SRB’s
Bedside Clinics in
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Foreword
Thangam Verghese Joshua

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This book is dedicated to
all my students
Sriram Bhat M, author of SRB’s *Bedside Clinics in Surgery* is known for his innovative works, writing books related to his profession, collecting all clinical and operative photographs. He has already authored *SRB’s Manual of Surgery; SRB’s Surgery for Nursing Students, SRB’s Surgery for Dental Students* and *Jaypee Gold Standard Mini Atlas Series: Surgical Diseases*.

This new innovation of his, *SRB’s Bedside Clinics in Surgery* is of different type with illustrations, clinical methods, X-rays, discussion on surgical pathology and basic surgical procedures. It is more of clinical and practical book by which undergraduate and surgical postgraduate students will be benefited. It will also be useful in the process of learning to any practitioner who still has the zeal to learn.

I am proud of the fact that a student of mine has reached such heights of excellence and I feel privileged to be given the honor of penning the foreword for this special book.

I wish him success in all his endeavors which I am sure will be an inspiration for every young aspiring surgeon.

**Thangam Verghese Joshua**  
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It is observed that students, especially undergraduates, often find difficult to prepare themselves for clinical examination after theory papers. They need to know basic clinical methods with relevant discussion of the specific cases; X-ray discussion; surgical specimens; instruments; basic operative procedures and principles. Keeping this in mind, this book SRB’s *Bedside Clinics in Surgery* has been brought out to go through quickly prior to clinical examinations. This is also useful to surgical residents and postgraduates, especially for instruments and surgical pathology, which are of great importance to them.

Many a times, students need to refer to SRB’s *Manual of Surgery, 3rd edition* (whenever required) and other specific books for detailed theory aspects of many topics. I hope this book will earn its value in its own way in student circle.

I thank everybody including publishers who are backbone of this title. Any criticisms are well accepted.

*Sriram Bhat M*
I am happy to bring out this new book of clinical and practical importance SRB’s *Bedside Clinics in Surgery*, first edition. This is due to constant help and support of many.

I thank our Chancellor Dr Ramdas M Pai, Pro-Chancellor Dr HS Ballal, Vice-Chancellor of MAHE Prof Rajashekar Warrier, our beloved Dean Prof CV Raghuveer, our Vice-Deans Prof Anand Kini and Prof Venkatraya Prabhlu for their academic support.

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My wife Dr Meera Karanth helped me day and night in editing this new book and without her help this could not have been possible. My beloved daughter Ananya helped me in drawing new diagrams artistically. I enjoy her love and affection towards me.

I remember my students Dr Ravi CR, Dr Ashwini Polnaya; Dr Ishwara Keerthi and Dr Sudesh for their special contributions.

I thank all my students especially postgraduates of Surgery Department who were helping regularly in bringing out this book.

Words are not sufficient to remember all my patients who are the main material for the book. I pray for their good health always.

I appreciate Shri Jitendar P Vij (Chairman and Managing Director), Mr Tarun Duneja (Director-Publishing) and all staff of the Jaypee Brothers Medical Publishers (P) Ltd, New Delhi, for doing appreciable work in their respective field of printing and publishing.

Sriram Bhat M
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Surgical Long Cases

Section 1
INTRODUCTION AND WRITING CASE SHEETS OF SURGICAL CASES
(BASIC PATTERN OF CASE SHEET WRITING)

A case sheet comprises a detailed history of a particular patient admitted to the hospital, has to be written carefully and neatly without any spelling mistakes.

Two important aspects of a case sheet are—
• Detailed history.
• Physical examination.

HISTORY

Particulars of the patient—
1. Name.
2. Age.
3. Sex.
4. Religion.
5. Occupation.
6. Address.
7. Date of admission.
8. Hospital number.

Chief Complaint

Should be mentioned in brief, and if multiple, in chronological order of appearance

• Pain in the right knee joint—15 days.
• Swelling in the right knee joint—7 days.
• Fever since 2 days.

All minor complaints should not be listed; only 2-3 appropriate complaints must be noted.

History of Present Illness

Write in detail about the complaints, along with mentioning other minor ailments also.

Begin with an opening statement such as the ‘patient was apparently normal’ (not perfectly or absolutely normal) before this episode of illness, e.g.

If the chief complaint is pain, then write in detail about the site, nature, duration, mode of onset, radiation, shifting of pain, aggravating and relieving factors, its relation to food/sleep/physical activities, whether associated with vomiting.

Then come to the next complaint, if it is swelling, mode of onset, whether there is recent increase in size, pain, its relation to activities, etc. Then the next complaint, if it is fever, mention in detail the type, time of onset, whether associated with chills, sweating.

Once the chief complaints are elaborated, only relevant questions in respect to symptoms pertaining to other systems should be asked and mentioned.

• GIT: history of haematemesis, melaena, heart burn, flatulence, weight loss, appetite, details of bowel habits, (frequency, nature, bleeding), jaundice.
• Respiratory system: H/O chest pain, cough, haemoptysis, breathlessness.
• Cardiovascular system: H/O chest pain, palpitation, breathlessness on exertion
• Urinary system: Details of urinary habits (frequency, dysuria, urgency, hesitancy), haematuria, burning micturition
• Neurological: H/O of head ache, vomiting, difficult speech, walk, weakness in limbs, etc.

Past History

• Do not simply mention ‘nothing significant’.
• History of any other major illness, pulmonary Koch’s been treated, epilepsy (treated or on treatment), hypertension, jaundice, diabetes, psychiatric illness, autoimmune disorder.
• History of surgery in the past, nature of illness, type of surgery, emergency/elective, type of anaesthesia used, mode of recovery, any complication, any blood transfusion given.

Personal History

Following aspects must be looked into—
• Dietary habits.
• Addiction (alcohol; drugs/cigarettes/tobacco, betel nut chewing).
• Sleep (disturbed or normal).
- Bowel habits, micturition (if not mentioned in the h/o presenting complaints).
- Socioeconomic status, marital status.
- Menstrual history in females (nature of the cycle, duration of flow, obstetric h/o, LMP, postmenopausal bleeding in old women).

**Family History**
Ask for history of any illness in the parents, siblings, spouse and children.

**Treatment History**
- History of treatment received for the present illness.
- History of receiving treatment for any other illness.

**History of Allergy to Drugs and Food**

**PHYSICAL EXAMINATION**
Done under three main categories—

**General Examination**
Level of consciousness, degree of cooperation, build, facies, nutrition decubitus, anaemia, jaundice, cyanosis, clubbing, oedema neck veins, lymph nodes.

Pulse—
Mention the rate, regularity, volume of blood flow, vessel wall, and palpate all the peripheral pulses (radial, brachial, temporal, dorsalis pedis).

Blood pressure—
Respiratory rate—
Temperature—
Pigmentation—

**Local Examination**
Site of disease has to be thoroughly examined in detail under 4 heading (inspection, palpation, percussion, auscultation), e.g.,
- Examination of inguinal region in hernia.
- Examination of breast in breast disease.

**Systemic Examination**
All other systems which has not been included in local examination has to be examined and written.

**Abdomen**

**Inspection:**
- Shape of abdomen (normal/obese scaphoid/distended).
- Position of umbilicus (central/deviated/pushed up or down).
- Movements of abdomen.
- Skin over the abdomen (scar/ pigmentation/venous engorgement).
- Hernial sites (look for expansile impulse on cough).
- External genitalia.

**Palpation:**
Done for—
- Swelling, if palpated, its relation to abdominal quadrants has to be mentioned, mobility, tenderness, consistency is noted.
- Tenderness both deep and superficial is elicited; any rebound tenderness with guarding and rigidity is noted.
- Liver, spleen, kidneys are palpated for enlargement, their consistency, tenderness, nodularity if any is noted.

**Percussion:**
- General note all over the abdomen.
- Shifting dullness.
- Free fluid thrill.
- Upper border of liver dullness.

**Auscultation:**
- Bowel sounds, nature intensity, abnormality is noted.
- Any added sounds-bruit.

**Perrectal Examination**

**Pervaginal Examination (in women)**
**Respiratory System**

**Inspection:** Shape, movement of chest, respiratory rate is noted.

**Palpation:** Position of trachea, tenderness over ribs and costochondral junction, vocal fremitus.

**Percussion**

**Auscultation:** Breath sounds, any crepitus/rhonchi, vocal resonance.

**Cardiovascular System**

**Inspection:** Shape of precordium, apex beat, any pulsation.

**Palpation:** Apex beat, parasternal heave, thrill.

**Auscultation:** 1st and 2nd heart sound in all the areas.

**Murmur**

**Examination of Nervous System**

- Higher functions: Consciousness, speech, alertness, cooperation noted.
- Gait examined.
- Cranial nerves examined.
- Motor system: Tone, power of upper and lower limb muscles must be mentioned.
- Sensory system: Pain, touch, temperature over arms, chest, back and lower limbs; vibrations and reflexes are checked.
- Cerebellar sign ± noted.

**Examination of Cranium and Spine**

**PROVISIONAL DIAGNOSIS**

A complete diagnosis has to be given.

e.g.—Carcinoma right breast with mobile axillary lymph nodes—T₂N₁M₀.

**INVESTIGATION SUGGESTED**

Base line investigations—

a. HB%, TC, DC, ESR, blood for sugar, blood urea, creatinine.

b. Urine routine.

c. Stool for routine (ova/cyst/parasite).

d. Chest X-ray.

e. ECG.

Special investigation—based on clinical findings and provisional diagnosis.

**DIFFERENTIAL DIAGNOSIS**

Can be mentioned in order of significance.

**IMPORTANT POINTS OF GENERAL PHYSICAL EXAMINATION**

**Anaemia**

It is qualitative or quantitative reduction in RBC or HB% in relation to standard age or sex.

It is assessed by presence of pallor at the lower palpebral conjunctiva, tip and dorsum of tongue, nail beds skin over palms and soles.

**Jaundice**

Yellowish discolouration of sclera, skin and mucous membrane due to excess bilirubin in blood.

Normal serum bilirubin—0.2mg% to 0.8mg%.

Jaundice is looked for in day light over sclera by asking the patient to look down and retracting
the upper eye lid, over soft palate and under surface of tongue, skin over palms and soles.

**Cyanosis**
Bluish discolouration of skin and mucus membrane due to increased amount of reduced Hb in circulation (> 5 gm%).

**Types**
- **Peripheral**: Periphery (tip of nose, tips of fingers, palms, soles, ear lobule) is blue due to sluggish circulation or vasoconstriction leading to more oxygen desaturation at capillary bed.
- **Central**: Excessive oxygen desaturation of central arterial blood (in severe VSD, tetrology of Fallot), looked for in the undersurface of tongue, and inner aspect of lips. Here periphery is also blue.

**Clubbing**
It is increase in anteroposterior and transverse curvature of nail leading to bulbous enlargement of the terminal phalanges. The angle between nail and nail bed is obliterated.

**Degrees of Clubbing**
1st: Increased fluctuation of nail bed (looked for at the base of the nail with two index fingers).

2nd: Fluctuation associated with increased anteroposterior and transverse curvatures.

3rd: Above changes associated with increased pulp tissue in terminal phalanges producing parrot beak or drum stick appearance.

4th: In addition to above changes there is hypertrophic osteoarthrophy (subperiosteal thickening of wrist and ankle bones).

**Oedema**
- Due to excessive of fluid collection in extravascular compartment.
- In ambulant patient, medial surface of tibia, 2.5 cm above the ankle is pressed for 5-10 seconds.
- Pitting on pressure becomes evident only when the circumference of limb increases by 10%.
- In non-ambulant patient, it is checked by pressing over the sacrum.

**Fig. 1.2:** Oedema should be looked for in both feet

**Lymph Nodes**

**Cervical Lymph Nodes**
- Level 1: *Submental group* in submental triangle; *submandibular group* in submandibular triangle—Palpated with pulp of fingers after flexing the neck to the same side.
- Level 2: *Upper jugular group*, situated along the upper third of the internal jugular from carotid bifurcation to base of skull.
- Level 3: *Middle jugular group*, situated along the middle third of internal jugular.
- Level 4: *Lower jugular group*, situated along the lower third of internal jugular.
  Level 2, 3, 4 are palpated along the jugular with the pulp of finger.
Level 5: *Posterior triangle group* palpated in posterior triangle, and also includes *supraclavicular group* which is palpated in supraclavicular fossa by asking the patient to shrug the shoulder.

Level 6: *Anterior compartment*, includes pericarotid, perirhizomatous, peritracheal nodes from hyoid bone above to suprasternal notch below and to medial border of sternomastoid laterally.

The number of nodes, consistency, mobility/fixity to underlying structures, tenderness, has to be noted.

**Axillary Group of Nodes**

*Pectoral group:* Situated behind the anterior fold of axilla, palpated with pulp of fingers of right hand for left side, with examiner’s fingers insinuated behind the pectoralis major, and with patient’s arm made to rest over the examiner’s forearm.

*Brachial group:* Lies on the lateral wall of axilla along the cephalic vein, left hand is used for left side, with palm directed laterally towards the upper end of humerus.

*Subscapular group:* Lies along the posterior fold of axilla, palpated standing behind the patient, keeping the arm in semi-flexed position.

*Central group:* This group is palpated in the apex of the axilla, left side with examiner’s right hand.

*Apical group:* This group is palpated higher than the above nodes.

**Inguinal Group**

Both horizontal and vertical group must be examined.

**Pulse**

- It is lateral expansion of arterial wall by a column of blood forced by the contraction of heart into the peripheral circulation.

- Radial artery is ideally and conveniently used to palpate for pulse against the lower end of radius above the wrist joint.

  Normal pulse rate: 60-100/minute; < 60/mt—bradycardia; > 100/mt—tachycardia.

  Not only rate-noting the rhythm is also important. Rhythm is appearance of successive pulse wave with time, regular if successive pulse beat appears at definite interval, irregular if it is not appearing at regular interval.

**Respiration**

Normal respiration is abdominothoracic, normal rate 18-20/min.

**Temperature**

*Normal body temperature:* 98-99 degree Fahrenheit.

*Pyrexia:* > 99° Fahrenheit

*Hyperpyrexia:* > 106° Fahrenheit.

*Pyrexia of unknown origin (PUO):* It is fever of > 101° Fahrenheit persisting for more than 2 weeks with cause remaining obscure in spite of intensive investigation.

**Blood Pressure**

Recorded is done in lying down supine position and sitting position, with sphygmomanometer cuff tied firmly around the left arm, one inch above the elbow joint. The cuff is inflated till the radial pulse disappears. The diaphragm of stethoscope is placed over the brachial artery. The pressure reading at which there is a clear tapping sound on deflating the cuff is the systolic blood pressure and the reading which corresponds to complete disappearance of sound is the diastolic pressure.

**Pigmentations**

Looked in face, oral cavity, tongue, palmar creases and general body skin.
HERNIA

Hernia is an important clinical topic for undergraduate as well as postgraduate students in surgery. It is a long case for undergraduate student and a short case for postgraduate students in surgery. It is one of the commonest surgical entities that surgeons come across and so detail knowledge of the subject is mandatory to both undergraduates and postgraduates.

Writing a case sheet for hernia is important as a long case.

METHOD OF WRITING A CASE SHEET FOR INGUINAL HERNIA

Patient’s name.
Age.
Sex.
Occupation.

Elderly people are more prone for hernia. Men with strain full occupation like manual labourer, sportsmen, weight lifters, etc. are more prone for hernia.

Chief Complaints
- Swelling in the groin, right or left or both sided for.... durations; or swelling in right/ left/both inguinoscrotal region for.... durations.
- Pain over the swelling for.... durations.

History
History of Present Illness

Swelling
- Duration of the swelling.
- Mode of onset of the swelling—spontaneous or on straining.
- Site of the first appearance of the swelling in the groin or in the scrotum.
- Progress and extent of the swelling, whether it limits only to the groin or extends to the scrotum.

- Any changes in the size and extent of the swelling on standing/walking/straining/lying down.
- Whether swelling is reducible on lying down/partially reducible or irreducible on lying down or needs any manoeuvre to reduce it. History of gurgling sound in the scrotum signifies enterocele.
- If swelling is irreducible, then whether it is painful or any abdominal distension vomiting should be asked.

Pain
- Site of pain—whether it is in the groin or in the scrotum.
- Duration of pain.
- Severity of the pain, type of pain—dull aching or severe pricking type.
- Aggravating or relieving factors. Aggravated by straining/walking/weight lifting; relieved by lying down.

History Relevant to Precipitating Factors
- Chronic cough, tuberculosis, bronchial asthma or other respiratory diseases.
- Constipation, altered bowel habits, tenesmus, bloody stool—in relation to anorectal stricture/carcinoma.

Past History
- Past history of hernia surgery—same side/opposite side. Type of surgery whether mesh used or repair done.
- History of appendicectomy earlier and if so detail about the surgery (can cause right direct hernia).
- Past history suggestive of irreducibility/obstruction and treatment for that conservative/surgical.
**Personal History**
- Smoking: duration, number per day, whether beedi or cigarette. Pan chewing/alcohol intake.
- Appetite and altered weight.

**Treatment History**
Any previous treatment given.

**General examination**
Examine for general built and nutritional status, pallor, clubbing, cyanosis, jaundice, lymphadenopathy, oedema feet, pulse and blood pressure.

**Local Examination**
Inguinoscrotal region should be examined in standing position as swelling commonly reduces and disappears in lying down position.

**Inspection**
Inspection in standing position—
- Mention the side of the swelling.
- Extent of the swelling is important. Incomplete indirect inguinal hernia and usually direct inguinal hernias are in inguinal region. Complete indirect inguinal hernia (rarely complete direct inguinal hernia) is inguinocrctal extending down into the bottom of the scrotum. Swelling extends from the proximal part of the inguinal canal towards the scrotum below.
- Both transverse and vertical dimensions of the size should be mentioned.
- Shape of the swelling is pyriform in indirect inguinal hernia and globular in direct inguinal hernia.
- Expansile impulse on coughing over the swelling is diagnostic. It is better seen than felt.
- Surface smooth/uneven.
- Margin—well-defined/ill-defined.
- Visible peristalsis over the swelling should be noted if present. It means it could be enterocoele.
- Scar/dilated veins/discolouration/redness over the swelling.
- On inspection, whether testis is seen separately from the swelling or covered by the swelling all over.

![Fig. 1.3: All hernias should be inspected initially on standing.](image)

**Figs 1.4A and B:** Expansile impulse on coughing is better seen than felt. It should be inspected with patient standing and examiner sitting beside the patient.
Palpation

- Temperature and tenderness over the swelling
- Whether get above the swelling is possible or not- purely scrotal swelling one can get above the swelling but in inguinoscrotal swelling one can not get above the swelling.
- Position and extent of the swelling.
- Size in vertical and transverse directions.
- Margin well defined or ill-defined.
- Surface smooth/lobular/tense.
- Consistency is soft and elastic in enterocele; doughy in omentocele.
- Location of the swelling—swelling is above and medial to pubic tubercle in inguinal hernia and below and lateral to pubic tubercle in femoral hernia.
- Reducibility of the swelling is checked by different methods.
  - Whether it is reducible spontaneously while lying down and gets reduced completely or partially.
  - In enterocele, it is difficult to reduce the first part but last part gets reduced easily. In omentocele it is difficult to reduce the last part but first part gets reduced easily.
  - Whether swelling needs any manipulation to get reduced like taxis. Taxis is gradual reduction of contents of the scrotum by gentle manipulation by flexion and rotation of the hip—taxis.
- Zieman’s test is done to find out over which finger cough impulse is felt and so which type of hernia it could be whether femoral/ direct inguinal or indirect inguinal.
- Deep ring occlusion test: When deep ring is occluded, if impulse on coughing is absent then it is indirect inguinal hernia; if impulse on coughing is still present then it is direct inguinal hernia.
- Finger invagination test: Size of the superficial ring is noted and site of the impulse felt is observed whether it is in the tip of the finger or on the pulp.
- Palpation of testis, epididymis and spermatic cord should be done without fail. Relation of swelling to testis also should be noted.
- Bulbar urethra is palpated by lifting the scrotum and feeling in the midline. (To look for thickening and button like depression-a feature of stricture urethra).
- Opposite inguinal region, opposite testis, epididymis and spermatic cord should be examined. Presence or absence of impulse on coughing on opposite side should be mentioned.

Fig. 1.5: Inguinal hernia is reduced in lying down position with elevation of scrotum and flexion and rotation of the hip—taxis.

Fig. 1.6: Bulbar urethra should be palpated by raising the scrotum in midline posteriorly. Any stricture urethra is felt as thickening/button like depression. Gonococcal urethritis and trauma are the commonest causes of stricture urethra. Bulbar urethra is the commonest site of stricture urethra.
**Percussion**

Without reducing contents of the swelling, percussion is done over the surface. If it is resonant, it is enterocele. If it is dull on percussion, then it is omentocele.

**Auscultation**

Bowel sounds may be heard over the swelling if it is enterocele.

**Perabdomen examination**

- Abdomen muscle tone should be checked by head raising test, leg raising test and Valsalva manoeuvre. It should be inspected for Malgaigne bulging and should be palpated to check whether the tone is adequate (firm) or inadequate (supple).
- Any scar over the abdomen (appendicectomy scar may cause right-sided direct inguinal hernia); ascites or mass per abdomen should be mentioned.

![Fig. 1.7A and B: Head raising and valsalva manoeuvre tests are needed to check the tone of abdominal muscle in hernia.](image1.png)

**Digital Examination of the Rectum**

Digital examination of the rectum (P/R) must be done in all hernia cases to look for prostate enlargement in elderly and rectal/anorectal strictures.

![Fig. 1.8: Clinically per-rectal examination is a must in hernia to look for prostate enlargement, and rectal stricture which are precipitating factors.](image2.png)

**Examination of Respiratory System**

Examination of respiratory system for altered breath sounds (rhonchi, bronchial breathing), effusion, etc. to find out any precipitating causes.

![Fig. 1.9: Respiratory system should be examined to find out the precipitating causes for hernia like bronchitis, tuberculosis or asthma.](image3.png)

**Other Systems**

Cardiovascular system, nervous system including spine and cranium for any neurological problems are examined for management of hernia.

**Diagnosis**

Diagnosis should be written complete with mentioning of side, type, whether complicated or not.

For example, left sided indirect incomplete uncomplicated inguinal hernia-enterocele.

**Investigations**

- All case sheets for long case should mention the investigations required for that particular case.
Relevant investigations required for inguinal hernia are chest X-ray, haematocrit, blood sugar, serum creatinine, ultrasound abdomen depending on the age/suspected cause of the hernia.

**Note:** Presentation of the case should be in order as mentioned above. One cannot alter the order of presentation like presenting percussion first and later palpation or likewise in a haphazard manner.

Students should strictly follow the proper order of presentation in clinical methods.

**Discussion**

In examination, discussion is usually in question and answers method. A provisional discussion often done after a presentation is given here.

**Why clinically it is inguinal hernia?**

Patient presented with swelling in the left groin, gradually increased in size which often descends into the scrotum and gets reduced on lying down. It increases on straining, coughing or walking. Expansile impulse on coughing is present and reduces on lying down or by taxis.

**Why it is indirect inguinal hernia?**

It is pyriform in shape. It descends obliquely in the groin. On occluding the internal ring in ring occlusion test, swelling does not appear later on coughing. On ring invagination test, impulse is felt at the tip of the invaginating finger. Zieman’s test confirms the impulse over the index finger.

**If it is direct inguinal hernia, then what are the differentiating features?**

Direct inguinal hernia is globular in shape. After occluding the deep ring, swelling still appears on coughing on the medial side of the inguinal region. Impulse is felt on the pulp of the finger in invagination test and over the middle finger in Zieman’s test.

**How expansile impulse on coughing is clinically demonstrated?**

Expansile impulse on coughing is also felt by placing the thumb in front, middle and index fingers behind the root of the scrotum and asking the patient to cough.

**When in a hernia impulse on coughing will not be there?**

Strangulated hernia will not show impulse on coughing.

**What is the meaning of the ‘get above the swelling’?**

Root of the scrotum is palpated between the thumb in front, index and middle fingers behind. In purely scrotal swelling like vaginal hydrocele, fingers and thumb meet each other well without any additional structure other than cord in between (one can get above the swelling). In case of inguinoscrotal swelling thumb and fingers do not meet each other properly because of the descent of hernial contents down (one cannot get above the swelling). It occurs in funicular and complete type of inguinal hernia not in bubonocele.

Expansile impulse on coughing is also felt by placing the thumb in front, middle and index fingers behind the root of the scrotum and asking the patient to cough.

Figs 1.10A and B: In inguinoscrotal swelling one cannot get above the swelling.
What is ring occlusion test?
It is the most important test in inguinal hernia. Deep/internal ring is located 1.25 cm above the mid-inguinal point. Mid-inguinal point is midpoint between the anterior superior iliac spine and pubic symphysis. (Note: Mid point of the inguinal ligament is center point between anterior superior iliac spine and pubic tubercle). Patient is asked to lie down to reduce the hernial contents. Thumb is placed over the mid-inguinal point. Patient is asked to cough. If there is expansile impulse on coughing on the medial side of the thumb, in spite after deep ring occlusion, it is then direct inguinal hernia. If there is no impulse on coughing then patient is asked to stand with thumb occluding the deep ring. Patient is once again asked to cough; impulse on the medial side of the occluded thumb is looked for to rule out the direct inguinal hernia. If there is no impulse even on standing, it is indirect inguinal hernia. The occluded thumb is removed and patient is asked to cough to show the swelling and impulse due to indirect inguinal hernia.

What is the prerequisite to do ring occlusion test?
Hernia should be reduced completely prior to do deep ring occlusion test. One cannot do deep ring occlusion test/invagination test/Zieman’s test if hernia is irreducible.

How is finger invagination test done?
Patient is asked to lie down. Contents are reduced completely. Using the little finger, scrotal skin is invaginated from below upwards near upper part of the testis. Finger is reached towards the superficial inguinal ring/external ring. Normally external ring does not admit the tip of the little finger. Finger is rotated inwards so that nail is towards the cord side. Patient is asked to cough. If the impulse is felt on the tip of the finger, then it is indirect inguinal hernia. If impulse is felt on the pulp then it is direct inguinal hernia. In case of complete inguinal hernia or funicular hernia external ring is patulous which can be very well-assessed by invagination test. Index finger can also be used for the test.

Invagination test should be done very gently, otherwise it will be very painful. It cannot be done in children.

Figs 1.12A and B: Ring or little finger is used to do invagination test.
How is Zieman's test done?
Reduce the hernial contents. Index ring is placed over the deep ring. Middle finger is placed over the superficial ring and ring finger over the femoral ring. Patient is asked to cough.

If impulse touches—
* Index finger it is indirect inguinal hernia
* Middle finger it is direct inguinal hernia
* Ring finger it is femoral hernia.

What are the boundaries of the inguinal canal?
**Boundaries**
**In front:** External oblique aponeurosis and conjoint muscle laterally.
**Behind:** Inferior epigastric artery, fascia transversalis and conjoint tendon medially.
**Above:** Conjoint muscle (Arched fibres of internal oblique).
**Below:** Inguinal ligament.

![Fig. 1.13A and B: Zieman's test—done on both sides. Three fingers are used to do Zieman's test.](image)

**How inguinal hernia is differentiated from femoral hernia?**
Inguinal hernia is above and medial to the pubic tubercle. Femoral hernia is below and lateral to the pubic tubercle.

![Fig. 1.14: Anatomy of the inguinal canal. IL—Inguinal Ligament. SIR—Superficial Inguinal Ring. DIR—Deep Inguinal Ring. CT—Conjoint Tendon. ASIS—Anterior Superior Iliac Spine. IEA—Inferior Epigastric Artery.](image)

**Fig. 1.14: Anatomy of the inguinal canal. IL—Inguinal Ligament. SIR—Superficial Inguinal Ring. DIR—Deep Inguinal Ring. CT—Conjoint Tendon. ASIS—Anterior Superior Iliac Spine. IEA—Inferior Epigastric Artery.**

**What is inguinal defence mechanism?**
It is the natural mechanism to maintain the strength of the inguinal canal. It is by
- Obliquity of the inguinal canal.
- Arched conjoined tendon.
- Shutter mechanism of internal oblique.
- Ball valve mechanism of the cremaster.
- Slit valve mechanism of the intercrural fibres of the superficial inguinal ring.
What are the differences between indirect inguinal and direct inguinal hernias?

<table>
<thead>
<tr>
<th>Indirect inguinal hernia</th>
<th>Direct inguinal hernia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can occur from childhood to adult.</td>
<td>Common in elderly.</td>
</tr>
<tr>
<td>Occurs in a pre-existing sac.</td>
<td>Always acquired.</td>
</tr>
<tr>
<td>Protrusion through the deep ring.</td>
<td>Herniation through posterior wall of the</td>
</tr>
<tr>
<td>Herniation occurs later.</td>
<td>inguinal canal.</td>
</tr>
<tr>
<td>Pyriform/oval in shape.</td>
<td>Globular/round in shape.</td>
</tr>
<tr>
<td>Descends obliquely and downwards.</td>
<td>Descends directly forwards as a bulge.</td>
</tr>
<tr>
<td>Can become complete by descending.</td>
<td>Descends down into the scrotum is rare.</td>
</tr>
<tr>
<td>down into the scrotum.</td>
<td></td>
</tr>
<tr>
<td>Neck of the sac is narrow and lateral to</td>
<td>Neck of the sac is wide and medial to</td>
</tr>
<tr>
<td>inferior epigastric artery.</td>
<td>inferior epigastric artery.</td>
</tr>
<tr>
<td>Sac is anterolateral to the cord.</td>
<td>Sac is posterior to the cord.</td>
</tr>
<tr>
<td>Ring occlusion test does not show any impulse</td>
<td>Test shows impulse even after occluding</td>
</tr>
<tr>
<td>after occluding the deep ring.</td>
<td>the deep ring.</td>
</tr>
<tr>
<td>Invagination test shows impulse on</td>
<td>Impulse is felt over the pulp of the</td>
</tr>
<tr>
<td>the tip of the little finger.</td>
<td>little finger.</td>
</tr>
<tr>
<td>Zieman’s test shows impulse on</td>
<td>Test shows impulse on the middle finger.</td>
</tr>
<tr>
<td>the index finger.</td>
<td></td>
</tr>
<tr>
<td>Commonly unilateral but can be bilateral.</td>
<td>Commonly bilateral.</td>
</tr>
<tr>
<td>Obstruction/strangulation are common.</td>
<td>Rare but can occur.</td>
</tr>
<tr>
<td>Sac should be opened during surgery.</td>
<td>Sac is not necessarily opened unless—</td>
</tr>
<tr>
<td></td>
<td>obstruction is present.</td>
</tr>
</tbody>
</table>

Fig. 1.15: Diagrammatic representations of direct and indirect sacs.

How clinically is enterocele and omentocele differentiated?

<table>
<thead>
<tr>
<th>In enterocele</th>
<th>In omentocele (epipocele)</th>
</tr>
</thead>
<tbody>
<tr>
<td>First part is difficult to reduce but last part is easier.</td>
<td>First part is easier to reduce but last part is difficult. Has a doughy feeling.</td>
</tr>
<tr>
<td>There will be gurgling sound on reduction.</td>
<td>Dull on percussion.</td>
</tr>
<tr>
<td>Resonant on percussion.</td>
<td>No peristalsis seen.</td>
</tr>
<tr>
<td>Peristalsis is seen.</td>
<td>Bowel sounds not heard.</td>
</tr>
<tr>
<td>Bowel sounds may be heard.</td>
<td></td>
</tr>
</tbody>
</table>
Fig. 1.16: Bilateral direct hernia. Note the medial location of the hernia. Direct hernia occurs through Hesselbach's triangle.

Fig. 1.17: Large bilateral direct hernias. Note, on right side it has descended into the scrotum to become complete. Usually direct hernia will not descend into the scrotum but long standing direct hernia can descend down and become complete.

Fig. 1.18: Direct sac on table during surgery.

Fig. 1.19: Irreducible hernia with bowel as well as omentum as contents. Note the change in colour of the bowel.

Figs 1.20A and B: Hernial sac with small bowel (enterocele) as content.
**What is Hesselbach’s triangle?**
It is bounded by inferior epigastric artery laterally, lateral border of rectus muscle medially and inguinal ligament below. Direct hernia protrudes out through this triangle.

**What is taxis?**
*Taxis* is a method used to reduce the complete inguinal hernia. Hip and knee are flexed and thigh is adducted. One hand held near the fundus of the sac in the bottom of the scrotum, other hand adjacent to external ring, contents are gently reduced towards the proximal side. Often patient himself does this technique in a better way. It is contraindicated in obstructed/strangulated hernia or femoral hernia or Maydl’s hernia. *Taxis* should be done very gently.

**How is tone of abdominal muscle checked and why?**
Abdominal muscle tone is checked by head rising (without supporting the elbows) or leg rising tests. It is initially inspected for any bulges in the abdominal wall which signifies *Malgaigne bulgings*. Later abdomen should also be palpated for muscle tone. Firmness signifies adequate tone whereas suppleness signifies poor muscle tone. Poor muscle tone indicates that patient needs hernioplasty using mesh. Abdominal muscle tone is also checked by Valsalva manoeuvre.

**Use five fingers of the hand to complete all tests for hernia**
- Thumb for deep ring occlusion test.
- Index, middle and ring fingers for Zieman’s test.
- Little finger for superficial ring invagination test.

**Rules of hernia examination**
- Never forget to check expansile impulse on coughing and reducibility.
- Never forget to examine opposite side.
Never forget to do perrectal examination.
Never forget to examine bulbar urethra.
Never forget to check abdominal muscle tone.

**What are the differential diagnoses for groin swelling?**
- Indirect/direct inguinal hernia.
- Hydrocele—vaginal/encysted.
- Femoral hernia.
- Lipoma of the cord.
- Inguinal lymphadenopathy.
- Groin abscess.

**Fig. 1.23:** Parts of hernia—neck, body and fundus.

**What is groin hernia?**
It is hernia occurring through a myopectineal orifice. It can be indirect inguinal hernia/direct inguinal hernia or femoral hernia.

**What is Fruchaud’s myopectineal orifice?**
It is an osseomyoaponeurotic tunnel. It is bounded—
- medially by lateral border of rectus sheath.
- above by the arched fibres of internal oblique and transverse abdominis muscle.
- laterally by the iliopsoas muscle.
- below by the pectin pubis and fascia covering it.

It is through this tunnel all groin hernias occur.

**What are the types of indirect inguinal hernia?**
It can be *incomplete* wherein sac does not reach to the bottom of the scrotum. It can be *complete* wherein sac descends completely up to the bottom of the scrotum. *Incomplete type* can be *bubonocele* where hernia limits to inguinal region without passing through the superficial inguinal ring or can be *funicular* where sac reaches up to the level of the upper part of the testis into the scrotum across the external ring.

**Figs 1.24A to C:** Types of indirect inguinal hernia. (A) Bubonocele (B) Funicular (C) Complete

**Fig. 1.25:** Complete inguinal hernia is one where hernia descends completely into the scrotum.
What are the newer classifications of groin hernias?

**Gilbert classification (1987)**

**Type I:** Hernia has got snug internal ring through which a peritoneal sac passes out as indirect sac.

**Type II:** Hernia has a moderately enlarged internal ring which admits one finger but lesser than two finger breadth. Once reduced it protrude during coughing or straining.

**Type III:** Hernia has got large internal ring with defect more than two fingerbreadth. Hernia descends into the scrotum or with sliding hernia. Once reduced it immediately protrudes out without any straining.

**Type IV:** It is direct hernia with large full blow out of the posterior wall of the inguinal canal. The internal ring is intact.

**Type V:** It is a direct hernia protruding out through punched out hole/defect in the transversalis fascia. The internal ring is intact.

**Type VI:** Pantaloon/double hernia.

**Type VII:** Femoral hernia.

Type VI and VII are Robbin’s modifications.

**Nyhus classification**

**Type I:** Indirect hernia with normal deep ring.

**Type II:** Indirect hernia with dilated (patulous) deep ring.

**Type III:** Posterior wall defect.
   a. Direct hernia, sliding hernia.
   b. Pantaloon hernia.
   c. Femoral hernia.

**Type IV:** Recurrent hernia.

**Bendavid classification**

**Type I:** Anterolateral defect (indirect).

**Type II:** Antero medial (direct).

**Type III:** Posteromedial (Femoral).

**Type IV:** Posterior prevascular hernia.

**Type V:** Anteroposterior defect (Inguino-femoral hernia).
What are the precipitating causes for inguinal hernia?
- Smoking.
- Obesity.
- Respiratory causes like bronchial asthma, tuberculosis, bronchitis.
- Ascites.
- Previous surgery like appendicectomy which causes direct inguinal hernia.
- Chronic constipation due to anorectal strictures. Rectal stricture may be due to chronic proctitis (amoebic), tuberculosis of anorectum, previous anorectal surgery, rectal carcinoma or stricture due lymphogranuloma venereum.
- Urinary problems like benign prostatic hyperplasia (BPH), urethral stricture.
- Straining.
- Multiple pregnancies.

How patient with hernia is evaluated for treatment?
- Routine investigations like haemoglobin, total count, blood urea, serum creatinine.
- Blood sugar
- Specific investigations like chest X-ray, U/S abdomen to confirm BPH.

What is the treatment?
- Initially precipitating causes should be treated. Asthma, tuberculosis and bronchiec-tasis are treated by proper drugs, broncho-dilators, respiratory physiotherapy.
- Later definitive surgical treatment is undertaken.
- Commonly used procedure at present is hernioplasty using prolene mesh. Modified Bassini’s repair is done in young individual with indirect hernia. Shouldice repair is also used in some centers.

What is modified Bassini’s repair?
It is strengthening of the posterior wall of the inguinal canal by approximation of the conjoint tendon to inguinal ligament using monofilament nonabsorbable suture material. Absorbable suture material like catgut should not be used as 50% of the tensile strength will be lost in

How local anaesthesia is given for inguinal hernia surgery?
Around 50-60 ml of xylocaine 0.5% is used. Plain xylocaine 0.5% or xylocaine 0.5% with adrenaline can be used. Plain xylocaine dose is 2 mg/kg body weight. Xylocaine with adrenaline is 7 mg/kg body weight.

Two methods are used—

a. Nerve block method (point block)
- 10 ml of xylocaine is infiltrated 2 cm above and medial to anterior superior iliac spine to block the iliohypogastric nerve.
- Midinguinal point is infiltrated with 10 ml xylocaine.
- Pubic tubercle place is infiltrated with 10 ml xylocaine.
- 10 ml of xylocaine is infiltrated just below the inguinal ligament lateral to femoral artery to block the genital branch of genitofemoral artery.
- Line of skin incision is infiltrated with 10 ml of xylocaine.
- Later neck of the hernial sac is infiltrated with 10 ml of xylocaine.

b. Field block method (Shouldice method)
- Skin of around 4 cm wide area is infiltrated into the subcutaneous plane as first layer from anterior superior iliac spine to pubic symphysis. Skin, subcutaneous and two layers of superficial fascia (Camper and Scarpa’s) are incised.
- Area deep to external oblique aponeurosis is infiltrated with 10 ml of xylocaine. External oblique aponeurosis is incised.
- Exposed inguinal canal and hernial sac is infiltrated with 10 ml of xylocaine to continue with the dissection.

What is the anaesthesia used for inguinal hernia repair?
General/spinal/epidural or local anaesthesia can be used to do inguinal hernia repair.
7 days. It takes 6 months to achieve more than 80% of tensile strength in repaired hernial wound, and so non-absorbable suture material has to be used here to maintain the same adequate tensile strength in these period. Multifilament suture material like silk may precipitate infection because of the crevices in the suture material and tensile strength is not as good as monofilament suture material. Commonly used suture material is either polypropylene (prolene (blue in colour)) or polyethylene (ethylon (black in colour)). Continuous sutures compromise the blood supply and interfere with proper healing; and strength will not be as adequate as interrupted sutures. So always interrupted sutures are used.

Earlier, commonest surgery done for groin inguinal hernia is modified Bassini’s repair. But now hernioplasty is the commonly done procedure for both direct and indirect sac. In direct hernia, sac is usually not opened but in indirect hernia, sac is always opened.

**What is herniotomy?**
Herniotomy is done for indirect sac, where the sac is dissected, neck of the sac is ligated and redundant sac is excised.

**What are the steps in inguinal hernia surgery? What are the different modifications?**

1. **Herniotomy**
   **Procedure**
   After cleaning and draping, skin is incised 1.25 cm above and parallel to the medial two/third of inguinal ligament. Two layers of superficial fascia (outer Camper’s fascia and inner Scarpa’s fascia) are incised. External oblique aponeurosis is incised. Upper leaf is reflected above and lower leaf is reflected downwards to visualise and expose the inguinal ligament. Ilioinguinal nerve is safeguarded. Cremasteric muscle is opened. Cord structures are dissected. Sac which is anterior and lateral to cord is identified and is pearly white in colour.
Dissection is usually started from the fundus and extended towards the neck which is identified by extraperitoneal fat. The neck is narrow and is lateral to the inferior epigastric artery. Sac is opened at the fundus. Finger is passed to release any adhesions. Sac is twisted so as to prevent the contents from coming back. It is transfixed using absorbable suture material (vicryl or chromic catgut 2-0) and is excised distally.

2. Modified Bassini’s herniorrhaphy
Conjoint tendon and inguinal ligament are approximated using interrupted nonabsorbable monofilament sutures [polypropylene (prolene, blue in color)]; medial most stitch is taken from the periosteum of pubic tubercle (called as key or Bassini’s stitch); external oblique is closed and other layers are closed. 1-0 polypropylene suture material is used for repair.

Lytle’s repair
Often internal ring is narrowed by placing interrupted sutures over the medial side of the ring to the transversalis fascia using either thread or silk (To narrow the ring and push the cord laterally).

Shouldice repair
Even though transversalis fascia is thin, it is a tough layer and so double breasting of this fascia using continuous sutures (with nonabsorbable material) strengthens the posterior wall of the inguinal wall.

It is a multilayered repair. It was originated at Shouldice clinic in Toronto where it was usually
Figs 1.31A to J: Steps in herniorrhaphy (modified Bassini’s repair) identification of sac, dissection of sac, opening of the sac, herniotomy, exposure of conjoint tendon and inguinal ligament, placing interrupted, approximating sutures between conjoint tendon and inguinal ligament and putting the knots of repair.
done under local anaesthesia. After doing herniotomy as in any other inguinal hernia, transversalis fascia is incised along the line of the wound from deep ring to pubic tubercle. Lower flap of fascia is sutured to posterior part of the upper flap. Upper flap is sutured to the inguinal ligament. It causes double-breasting of the transversalis fascia. Then conjoint tendon and inguinal ligament is further approximated by two layers of continuous sutures. External oblique aponeurosis is sutured in two layers (double-breasting) in front of the cord. Hence the original Shouldice repair is 6 layered procedure. First two layers of transversalis fascia, next two layers of conjoint tendon and last two layers of external oblique aponeurosis. Suture material used here is fine steel wire 34 gauge (in original Shouldice repair) or polypropylene or polyethylene. Recurrence rate is 1%.

**Berliner modified shouldice repair**: Involves double-breasting of the transversalis fascia like in Shouldice repair and single layer closure of the external oblique aponeurosis without any additional two-layered repair of conjoint tendon to inguinal ligament.

**Tanner’s slide operation**
To reduce the tension in the repair area, relaxing incision is placed over the lower rectus sheath so that conjoint tendon is allowed to slide downward.

*Fig. 1.32: Lytle’s repair*

**Darning (Abrahamson nylon darning)**
Continuous intervening network of non-absorbable sutures are placed between conjoint tendon and inguinal ligament to give good support to posterior wall inguinal wall.

*Fig. 1.33: Tanner’s slide operation—relaxing incision placed over the lower medial aspect of the rectus sheath to reduce the tension after modified Bassini’s repair.*

**Kuntz’operation**
In old people after taking consent, orchidectomy is done along with removal of full cord, testis and total closure of posterior inguinal wall by repair so as to reduce the recurrence.

**Removal of cord at inguinal region**
Cord is removed from the inguinal canal by ligating both at external and internal ring. But testis is retained (for psychological reason) and closure of inguinal canal by repair is done.

**Andrew’s operation**
Overlapping the external oblique aponeurosis.
Macvay operation (Cooper’s ligament repair)
Suturing the conjoined tendon to Cooper’s ligament.

Conservative treatment
1. Taxis: Patient lying in supine position, with flexion of hip and knee, and internal rotation of hip, contents are pushed with one hand directing with other hand
2. TRUSS: Rat-tailed sprung truss is used. Measurement is taken from the tip of greater trochanter to third piece of sacrum. Complications are discomfort, ulceration, strangulation, inflammation
It may be used in old people who are not fit for anaesthesia and surgery
Conservative treatment should be avoided in hernia as much as possible

What are the complications of the inguinal hernia surgery?

Complications of inguinal hernia surgery
- Haemorrhage, haematoma, haematocele.
- Infection 1-5%
- Postherniorrhaphy hydrocele, lymphocele
- Hyperaesthesia over the medial side of inguinal canal due to injury to ilioinguinal nerve
- Injury to iliohypogastric nerve, vas deferens, urinary bladder, intestine
- Recurrence
- Testicular atrophy, rarely oedema of the penis
- Osteitis pubis

What is hernioplasty?
It is strengthening of the posterior wall of the inguinal canal using synthetic material like prolene mesh, or Dacron. Earlier natural materials like tensor fascia lata, temporal fascia were being used. Now prolene mesh is commonly used. It is placed in front of the conjoint tendon between conjoint tendon and inguinal ligament. It is sutured using nonabsorbable suture material below to the inguinal ligament and above to the conjoint tendon. Prolene suture material is white in colour.

Size of the mesh should be 1.5 cm wider than the defect. Adequate haemostasis and prevention of infection is important. Mesh should overlap over pubic tubercle adequately.
Fig. 1.37: Mesh repair. Prolene mesh is reinforced between conjoint tendon and inguinal ligament.

What are the different types of hernioplasty?
Hernioplasty is becoming the prime treatment for inguinal hernia.

Different types are
- Onlay mesh repair by placing mesh in front.
- Inlay mesh repair by placing mesh deep to conjoint tendon.
- Lichtenstein tension free mesh repair (1993) with encircling the cord with mesh which is often done under local anaesthesia.
- Nyhus pre-peritoneal mesh repair. It is done through suprapubic horizontal incision. Mesh is placed in the preperitoneal space deep to the cord, conjoined tendon, and transversalis fascia. Below, it is folded deep to the iliopectineal ligament of Cooper and sutured to it using two or three interrupted non-absorbable sutures. It is sutured to transverse abdominis above and transversalis fascia from deep.
- Rives preperitoneal mesh repair is preperitoneal mesh repair through transinguinal approach. Here mesh is folded and sutured below to iliopectineal ligament, above to the transverse abdominis in deeper plane. Often transversalis fascia opened earlier is sutured back using non-absorbable suture material in front of the placed mesh.

Figs 1.38A to F: Hernial sac should be dissected up to the neck of the sac. It is then twisted and transfixed using catgut or vicryl and redundant sac is excised.
Figs 1.39A to G: Placement of prolene mesh in inguinal hernia repair. i.e Inlay-Lichtenstein mesh repair.

- Stoppa’s giant prosthesis reinforcement of visceral sac (GPRVS). It is done in large hernias, hernias in elderly, bilateral hernias, recurrent and re-recurrent hernias, hernia with very lax abdomen. Horizontal length (size) of the mesh is 2 cm less than distance between two anterior superior iliac spines and vertical length (size) is distance between the umbilicus and pubic symphysis. Large mesh is placed between peritoneum and lateral, inferior, anterior abdominal wall which stretches in the lower abdomen and pelvis. It is done through lower midline or

Fig. 1.40: Mesh after hernioplasty got infected with wound Dehiscence. It needs removal of mesh.
Pfannensteil incision. Usually such large mesh is placed without any anchorage.

- Gilbert mesh repair: after herniotomy, internal ring is plugged by cone-shaped piece of prolene mesh. Later onlay/inlay mesh repair of posterior wall of the inguinal canal is done.
- Transabdominal preperitoneal laparoscopic mesh repair (TAPP repair): becoming popular.
- Totally extraperitoneal laparoscopic mesh repair (TEP): becoming popular.

**Case**

A 65 years old male patient presents with bilateral direct inguinal hernia with features of prostatism with night frequency, burning micturition, and incomplete urination.

**How will you manage the case?**

Patient is having bilateral inguinal hernia with benign prostatic hyperplasia (BPH). Digital examination of the rectum (P/R) should be done. Patient is evaluated with ultrasound examination, serum acid phosphatase and PSA (Prostate specific antigen). Residual urine should be assessed. Normal value is 30 ml. More than 50 ml is abnormal. More than 200 ml signifies severe obstructive uropathy which needs surgical intervention.

**What surgery is done to this patient?**

TURP (Transurethral Resection of Prostate) with hernioplasty either Lichtenstein or preperitoneal mesh repair should be done. Both surgeries are done at single sitting usually under spinal anaesthesia.

**If TURP facility is not available what other options are there?**

Open prostatectomy, either transvesical or retropubic can be done, which also can be combined with hernioplasty. But many advocate hernioplasty 12 weeks after open prostatectomy. Incidence of open prostatectomy has drastically come down because of advent of TURP. It is done only in case of nonavailability of TURP or very large BPH.

**Fig. 1.41:** Left-sided complete inguinal hernia in a patient with Benign Prostatic Hyperplasia (BPH) who is on Foley's catheter. He needs trans urethral résection of prostate (TURP) with hernioplasty.

**Recurrent Hernia**

**What are the causes of recurrent hernia?**

- Infection—most common—50%.
- Haematoma in the wound.
- Early straining.
- Retained indirect sac, after repair of a direct sac (Pantaloon hernia).
- Smoking, constipation, obstructive uropathy, old age, nutritional deficiencies.
- Altered tension in repair site. Altered collagen synthesis.

**Fig. 1.42:** Recurrent hernia on table. Note the defect on the medial aspect.
Fig. 1.43: Sac in a case of recurrent hernia.

<table>
<thead>
<tr>
<th>Recurrence rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Bassini’s repair—10%</td>
</tr>
<tr>
<td>• Shouldice repair—1%</td>
</tr>
<tr>
<td>• Hernioplasty—1 to 3%</td>
</tr>
<tr>
<td>• Other methods—1 to 5%</td>
</tr>
</tbody>
</table>

What are the types of recurrent hernias?

**True or false recurrence**—based on type of recurrence—whether inguinal recurrence after inguinal hernia repair (true)/femoral hernia or obturator or other rare types after inguinal hernia repair (false). But presently hernia is classified grossly as groin hernias and so all recurrences are true recurrences.

How is patient with recurrent hernia investigated?

Patient is investigated by chest X-ray, pulmonary function tests, U/S abdomen for BPH, uroflowmetry, etc.

How such patient is treated?

Treatment is always by surgery—always by hernioplasty. Ideally preperitoneal mesh repair is done either Rives or Nyhus or giant prosthetic reinforcement of visceral sac (Stoppa’s GPRVS). Technically dissection is difficult because of the distorted anatomy of the inguinal canal and scarring. Orchidectomy may be added in old people only after taking formal consent.

What are the recent approaches for inguinal/groin hernias?

**Transabdominal preperitoneal mesh repair (TAPP)** using laparoscope. This is used in large indirect hernia or irreducible inguinal hernia. 10 mm umbilical port is used for laparoscope. 5 mm ports on pararectal point at the or above the level of the umbilicus one on each side so that to achieve adequate triangulation.

Contents of the hernia are reduced. Hernial sac is dissected in preperitoneal plane after making horizontal incision at the upper part of the sac opening. Vas, gonadal vessels, pubic bone, inferior epigastric vessels are identified. Once sac is dissected and excised, a prolene/vipro/ultrapro mesh of 15 × 10 cm sized is placed in preperitoneal space. It is fixed to pubic bone using tacks. Peritoneum is closed with continuous prolene sutures.

**Totally extra peritoneal repair (TEP repair) using laparoscope**—This technique is gaining more popularity than TAPP. Through subumbilical incision (10 mm) extraperitoneal space is reached. After CO₂ insufflation, another 5 mm port is inserted 4 cm below the first port in the midline. Third 5 mm port is inserted in the same line 4 cm below or in the right iliac fossa. Dissection is carried out downwards carefully, then medially up to the pubic tubercle, iliopsoas ligament, laterally to iliac vessels, inferior epigastric vessels. Once adequate space is dissected 15 × 15 cm mesh is placed and spread. Care should be taken not to have any folding in the mesh. Mesh may be sutured to iliopsoas ligament. Displacement of mesh is not common. Other side also can be done together.

Anatomical Considerations

Preperitoneal space is a potential space in front of the peritoneum and behind the transversalis fascia and anterior rectus muscle. Below in front of the urinary bladder it is called as space of Retzius (medially), laterally it is called as space of Bogros. Median umbilical fold is formed by urachus in the midline. Medial umbilical
ligament is formed by obliterated umbilical arteries. Lateral umbilical fold by inferior epigastric vessels. Three fossae are lying in relation to these folds—supravesical and medial fossae are medial to lateral umbilical fold which are sites of direct hernia whereas lateral fossa is lateral to lateral umbilical ligament is site of indirect hernia.

In 1956, Fruchaud described his myopontineal orifice bounded medially by the lateral border of rectus abdominis, laterally by iliopsoas, superiorly by conjoined tendon and inferiorly by pectin pubis. This area is the site of groin hernia which should be covered by mesh of adequate size to strengthen the defect and to prevent the recurrence. Iliopubic tract is analogue of the inguinal ligament extends from Cooper’s ligament to anterior superior iliac spine which divides endoscopic view of preperitoneal space into superior compartment (contains inferior
Difficulties and complications in TEP repair

- Difficulty in dissecting indirect sac cord/vas injury
- Inadvertent opening of the sac/ peritoneum and creation of pneumoperitoneum.
- Injuries to major structures like iliac vessels—0.5-1.0%
- Displacement of mesh or erosion into the structures like urinary bladder—rarely may occur.
- Nerve injury
- Formation of seroma/haematoma
- Infection
- Recurrence

Advantages of TEP repair

- Approach is totally extraperitoneal
- Small incision
- Proper placement of mesh in right space that is preperitoneal space
- Peritoneal cavity is intact and not opened

Indications for TEP

- Recurrent hernia
- Bilateral hernia
- Indirect/direct/femoral hernia

Contraindications for TEP

- Obstructed/strangulated inguinal hernias
- Ascites
- Bleeding disorders

Landmarks to be identified in TEP

- Pubic bone midline
- Inferior epigastric artery
- Cooper’s ligament
- Iliopubic tract
- Cord and vas deferens
- Psoas muscle and nerves in relation

Principles in TEP

- Head-down supine position
- Surgeon standing opposite side of hernia
- Camera person placed at opposite side of hernia
- Monitor at foot end
- Catheterise/empty the bladder properly prior to TEP
- Adequate wide space creation
- Careful dissection of cord and sac
- Ligate indirect sac
- Mesh should not be fixed laterally
- Size of mesh is 15 × 15 cm
- Two point fixations—one at pubic bone other at Cooper’s ligament by tacks/staplers

Triangle of doom is formed by gonadal vessels medially, iliopubic tract laterally and peritoneal reflection below. Genitofemoral nerve and lateral cutaneous nerve of thigh traverse this triangle. Injury to these nerves either by dissection or by tacks cause postoperative pain. Tacks/staplers should not be placed in this triangle.
INCISIONAL HERNIA

- Incisional hernia is a hernia occurring through a weak scar.
- Writing case sheets, taking detailed history is similar to inguinal hernia.

**Additional history to be collected in history of present illness**—

- Details of surgery patient has undergone earlier. After how long incisional hernia has occurred?
- History of wound infection, wound dehiscence, whether surgery done was an emergency or elective, and tension sutures placed or not.
- History of pain, irreducibility and details of precipitating factors to be asked.
- Other precipitating factors similar to inguinal hernia like smoking, urinary/respiratory/abdominal symptoms.

**Fig. 1.46:** Lower abdominal incisional hernia adherent to skin.

**Local Examination (Abdomen)**

**Inspection**

Scar, its extent and location, whether healed primarily or secondarily, skin over the scar and swelling is noted. Details of the swelling with expansile impulse on coughing and examination both in lying down and standing are done.

**Palpation**

Palpation is like for inguinal hernia. Size, extent, impulse on coughing must be confirmed; scar and skin should be palpated. The defect in the abdominal wall must be assessed. It is done after reducing the hernial content with patient in lying down position. Fingers are placed horizontally over the hernial defect and patient is asked to raise the head with arms folded over the chest (to contract the abdominal wall muscles) so that the defect is felt clearly. Its size, extent can be assessed well. Assessment can also be done by raising the legs instead of head.

*Gap cannot be assessed in an irreducible hernia.*

**Factors Responsible for Development of Incisional Hernia**

- Vertical incision has got higher chances of incisional hernia than horizontal incision.
- Layered closure of the abdomen has got higher chance than single layer.
- Continuous closure has got higher chances than interrupted closure.
- Use of absorbable suture material has got higher chances of hernia than nonabsorbable sutures.
- Emergency surgical wound has higher chances than elective surgical wound.
- Laparotomy for peritonitis, acute abdomen, and trauma can commonly cause incisional hernia.
- Drainage through the main laparotomy wound may precipitate formation of incisional hernia.
- Chronic cough, smoking, obstructive uropathy, constipation can precipitate incisional hernia.
- Diabetes, old age, malnutrition, malignancy, anaemia, hypoproteinaemia, jaundice, ascites, liver disease, uraemia, steroid therapy, immunosuppressive diseases are other precipitating factors.

**Type of defects in incisional hernia**

- Small defect
- Large and wide defect
- Very large defect
- Massive/diffuse
- Multiple defects
**Note:**
- Size of the defect is important to decide the type of surgical closure in incisional hernia.
- Midline hernia expels the content more outwards due to contraction of rectus muscles on both sides.

**Treatment Strategy for Incisional Hernia**
- When the defect is less than 3 cm, and if the patient is having adequate abdominal muscle tone then layer by layer anatomical repair is done using monofilament non-absorbable suture material like polypropylene/polyethylene with ideally interrupted sutures. Sac should be dissected, ligated and excised prior to repair. Peritoneum and posterior rectus sheath is apposed as first layer and anterior rectus sheath as second layer.
- Double breasting of the rectus sheath using interrupted nonabsorbable sutures using monofilament suture material. It is overlapping the rectus sheath in two layers with two rows of sutures.
- Mesh repair of the incisional hernia defect is always better and ideal with less chances of recurrence. Adequate sized mesh is placed either outer to peritoneum (inlay), or outer to musculoaponeurotic abdominal layer (onlay/overlay), or occasionally combined inlay and onlay mesh placement, both deep to peritoneum and outer to musculoaponeurotic layer. **Rive’s Stoppa’s mesh placement** for incisional hernia is placing mesh between posterior rectus sheath and rectus muscle. Commonly polypropylene mesh is used. Other materials used are Dacron, polytetrafluoroethylene (PTFE) mesh, polyglycolic mesh (vicryl mesh) or combined polypropylene and polyglycolic acid mesh (vipro mesh). Drain (suction drain) must be placed after surgery.
- Laparoscopic mesh repair is done for incisional hernia by placing a mesh under the defect laparoscopically in intraperitoneal plane. The only problem of this underlay placement is chances of adhesion and GI fistula formation but it is found to be safer. Laparoscopic preperitoneal mesh placement also done for smaller defects. Now dual mesh (PTFE) or four layered mesh are available. In this mesh is placed under the peritoneum deep to the defect after reducing the contents. Mesh is fixed with sutures and tacks. In four layer mesh, deepest 1st layer is absorbable cellulose which allows new peritoneum to creep underneath. Second layer is PDS mesh 3rd layer is polypropylene mesh last 4th layer is again PDS mesh. It is ideal but costly.
- **Keel’s operation** is done in large defect. Scar is excised and sac is dissected beyond the margin of the defect. Sac is never opened unless there is obstruction of the content. Sac in inverted using continuous/interrupted inverting nonabsorbable sutures, layer-by-layer until the defect margins are apposed together which is then again sutured with interrupted sutures. Keel is inverted beam of the ship.
- **Nuttall’s operation** is done for lower midline incisional hernia. Recti attachments are detached from the pubic bones and are crossed over to fix to opposite pubic bones so as to create a firm abdominal wall support by crossed recti muscles.

**Figs 1.47A and B:** (A) Keel’s operation is inverting rectus sheath layer by layer using nonabsorbable monofilament suture material so as to appose the defect. (Keel of a ship). (B) Nuttall’s operation—rectus muscle detached from its attachment from the pubic bone and sutured to opposite pubic bone.
Preoperative Preparations for Incisional Hernia Surgery
- Reduction in weight and control of obesity.
- Nutrition, control of anaemia.
- Treatment for diabetes, hypertension, cardiac diseases, respiratory problems.
- Treating the precipitating causes.
- Chest X-ray, U/S abdomen to be done.
- Massive incisional hernia after reduction might cause IVC compression, paralytic ileus and diaphragmatic elevation with respiratory embarrassment (abdominal compartment syndrome). It is prevented by prior increasing the capacity of peritoneal cavity by creating the pneumoperitoneum using CO₂ so as to increase the peritoneal pressure by 12-15 cm of H₂O, daily for 3-6 weeks. Later definitive surgery is done.

Different Types of Mesh Repair for Incisional Hernia
- **Outer to peritoneum is ideal method.** Large-sized mesh is placed in preperitoneum. It need not be fixed as abdominal pressure keeps it in position.
- **Under the peritoneum, directly over the content.** Now it is accepted but there are chances of adhesions/fistula formation. It is used in laparoscopic repair.
- **Overlay** mesh placed outer to musculoaponeurotic layer.
- **Combined inlay and overlay** with two layers of mesh.
- Rive’s Stoppa’s method of placing mesh between posterior rectus sheath and rectus muscle.

Postoperative management in incisional hernia
- Early ambulation
- Nasogastric aspiration
- Antibiotics, analgesics
- Fluid management
- Catheterisation
- Drain should be kept until drainage becomes minimal
- Abdominal binder is used to support abdominal wall during recovery period

Additional Problems in Large Incisional Hernia
- While reducing the bulky contents like bowel and omentum, inadequate intra-abdominal capacity leads to increased intra-abdominal pressure causing IVC compression, mesenteric oedema following stasis of splanchnic bed, paralytic ileus, diaphragmatic elevation and respiratory distress (abdominal compartment syndrome), urinary and bowel disturbances. Abdominal capacity can be raised by regular pneumoperitoneum over the period of 3-6 weeks.
- Lordosis and back pain may be presenting feature.
- Sac and contents may get adherent to the thin skin over the summit of the hernia leading to skin ulceration and occasionally fistula formation.
- Often might need resection of the adherent bowel segment.
- Large mesh placement is required.

What is paraumbilical hernia?
It is midline herniation above or below the umbilicus. It often attains large size and sags downwards. Neck may be narrow with omentum/small bowel as contents. Obstruction/strangulation tend to occur. It is commonly associated with obesity and multiple pregnancies. It is common in females. Swelling, impulse on coughing, dragging pain and reducibility are usual presentations. It is common with flabby, pendulous abdomen.
How is paraumbilical hernia treated?
It is treated by transverse elliptical incision, dissection and ligation of sac followed by closure of defect with interrupted nonabsorbable sutures when it is less than 4 cm size; mesh repair should be done using polypropylene mesh if the defect is large. Additional lipectomy (panniculectomy) may be done in case of pendulous abdomen.

What is Mayo’s operation?
It is done for umbilical and paraumbilical hernia. Once lower flap or umbilicus is raised above,
sac is identified, dissected and opened. After reducing the contents sac is transfixed using vicryl. Rectus sheath is repaired with double breasting using nonabsorbable sutures. Skin flap is closed often with a drain. Infection, recurrences are known complications.

**What is umbilical hernia?**
It is herniation through a weak umbilical cicatrix. It is common in infants and children. It is hemispherical in shape with defect felt during crying. It can cause obstruction and strangulation. 95% of umbilical hernias disappear in 2 years. If it persists beyond 2 tears, and if the defect is more than 2 cm in size or presence of complications are indications for surgery. It is operated through an infraumbilical incision; defect is closed with interrupted sutures after ligating the sac.

**What is Richter’s hernia?**
It is herniation of a portion of circumference of intestine usually small bowel leading into gangrenous change. But patient presents with features mimicking gastroenteritis without any signs of intestinal obstruction. Eventually it leads to perforation and peritonitis. It is common in femoral hernia. It is treated by resection and anastomosis and repair.

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**Fig. 1.49:** Paraumbilical hernia.

**Fig. 1.50:** Umbilical hernia

**Fig. 1.51:** Incision for umbilical hernia

**Fig. 1.52:** Richter’s hernia.
What is sliding hernia?
Posterior wall of the sac is formed by parietal peritoneum and also by sigmoid colon/caecum/urinary bladder. It occurs exclusively in males and common on left side. It attains large size and its content is usually small bowel. Posterior wall should not be separated from the sac. Sac is excised only partially and then is pushed into peritoneal cavity. Mesh repair is done afterwards.

What is pantaloon hernia?
Inguinal hernia containing both direct and indirect sacs is called as pantaloon hernia but it presents as direct hernia. It is also called as double hernia, saddle hernia or Romberg hernia. So in all cases of direct hernia, indirect sac should be looked for. Condition is one of the causes for recurrence.

What are the problems of strangulated hernia?
It is due to compromised blood supply of the contents of the hernia like bowel/omentum causing toxicity, tenderness at the site. There is no impulse on coughing, and is irreducible and tense. Features of intestinal obstruction are present if the content is bowel. Narrow neck and adhesions are the causes of strangulation. It is treated by emergency surgery. Exploration is done through groin incision. Contents are not allowed to spill or to get reduced. Toxic fluid is removed using suction. Bowel is checked for viability. If not viable resection and anastomosis is done. Groin is repaired by herniorrhaphy. Mesh is not used in strangulated hernia. Drain is kept to the wound. Adequate antibiotic coverage is a must.
Figs 1.56A and B: Strangulated enterocele with irreducibility, absence of impulse on coughing, signs of acute inflammation, tense and tender with features of intestinal obstruction. Bowel strangulation is obvious during surgery.

Fig. 1.57: Incision used for strangulated inguinal hernia. It is placed in the inguinal region extending into the scrotum downwards.

What is Maydl’s hernia? Here bowel loop in the form of ‘W’ lies in the hernial sac and centre of the portion of the W is strangulated. It may get reduced 'en-masse'. Strangulation of centre part is common.

What is ‘taxis’? Taxis is reducing hernia by flexing and medially rotating the hip. It is done in case of partially reducible or irreducible hernia. Patient himself does it properly. It is dangerous in case of obstructed hernia, Maydl’s hernia, femoral hernia, strangulated hernia and sliding hernia.

What are the clinical features of femoral hernia? Femoral hernia is herniation through the femoral ring over medial most part of the femoral canal.
Maydl’s ‘W’ hernia.

Anatomical locations of femoral and inguinal hernia. Inguinal hernia is above and medial to pubic tubercle. Femoral hernia is below and lateral to pubic tubercle. Also note the location of the obturator hernia below in Scarpa’s triangle.

Femoral ring is bounded by inguinal ligament, iliopectineal ligament, lacunar ligament and septum separating femoral vein. It is retort-shaped hernia, more prone for strangulation. It is common in females and it is bilateral in 20% cases. It is below and lateral to pubic tubercle whereas inguinal hernia is above and medial to pubic tubercle. Impulse on coughing, pain, reducibility are the usual features. It should be differentiated from inguinal hernia, lymph node mass, lipoma, psoas bursa, femoral aneurysm and saphena varix.

How is femoral hernia treated?
It is treated by surgical approach. Different approaches like Lockwood-low approach, McEvedy-High vertical approach (for strangulated femoral hernia), Lotheissen’s inguinal approach or suprapubic approach are used. After sac dissection and ligation, repair is done by approximating inguinal ligament to iliopectineal ligament or by approximating conjoint tendon to iliopectineal line (Lotheissen’s repair). Polypropylene mesh can be buttressed into the femoral canal to close the defect. A K Henry’s approach is suprapubic transverse extra peritoneal approach for bilateral femoral hernias. Laparoscopic mesh repair of femoral hernia is also a good method which is done using large mesh like TAPP/TEP.
**Fig. 1.62:** Diagramatic representation of location of inguinal, femoral and obturator hernias. Obturator hernia occurs through obturator canal, commonly presenting with features of intestinal obstruction. Often radiating pain to knee joint through geniculate branch of the obturator nerve called as Howship-Romberg sign may be the presentation. Obturator hernia is common in elderly females.

**Fig. 1.63:** Femoral hernia repair. Repair of femoral hernia is done either by approximating inguinal ligament to iliopectineal ligament or by approximating conjoint tendon to iliopectineal ligament or by plugging the mesh to femoral opening.

**Fig. 1.64:** Different approaches for femoral hernia. 1. Lockwood low approach is below the inguinal ligament parallel to it. 2. McEvedy high approach is vertical incision extending above and below the inguinal ligament. It is used in strangulated femoral hernia. 3. Lotheissen’s approach is inguinal approach through inguinal canal. 4. A K Henry’s approach is horizontal lower abdominal approach for bilateral femoral hernia repair with extraperitoneal approach.

**Fig. 1.65:** Right-sided hernia in a child. Only hemiotomy is done for inguinal hernia in children. Repair/mesh are not used. Hemiotomy is also done for hydrocele in children through inguinal approach. Hydrocele in children is due to patent processus vaginalis.
EXAMINATION OF A CASE OF ARTERIAL DISEASES

Arterial diseases can occur in lower limb commonly and also occasionally upper limb. Often both lower and upper limbs may get involved.

It is often classified as lower limb ischaemia and upper limb ischaemia. But wherever the disease detailed examination of both lower limb and upper limb vessels is required in all patients.

Name:
Age:
Sex:
Occupation:
Address:

Atherosclerosis occurs in old age usually. Thromboangiitis obliterans (Buerger’s disease) occurs in young males. Raynaud’s disease is common in young/middle-aged females.

Chief Complaints

- Pain in the limb right/left/both—its duration.
- Intermittent claudication—its duration.
- Blackish discoloration/ulceration.

History

History of Present Illness

Pain

- Site of pain, type of pain—severe burning/aching/deep persisting.
- Whether pain radiates or not.
- Intermittent claudication—duration, grade/distance how much patient can walk/whether pain subsides after stopping walk or after continuous walk/whether patient is able to walk in spite of pain/change in the claudication distance eventually/site of claudication—foot/leg/thigh/buttock.
- Presence of rest pain—its location/severity/whether patient has to hold the limb/foot/leg/toes to relieve pain little bit (probably by transmission of temperature from holding hand into the part) or to hang the leg down to relieve the pain or by applying the warmth.
- Pain, discomfort, colour changes when exposed to cold.

Ulceration

- Whether precipitated by trauma/spontaneously.
- Pain in the ulcer/type/duration/aggravating or relieving factors.
- Discharge-type—serous-purulent-bloody.
- Progression.

Gangrene

- Site of gangrene/its onset/progression/pain.
- History of difficulty in walking/altered gait.
- Mode of onset—in atherosclerosis/Buerger’s disease process is spontaneous and gradual. Gangrene due to embolism is sudden in onset, rapidly progressive.
- History of fever.
• History of impotence—its duration.
• History of tingling/numbness/weakness in the limbs.
• History of syncope/blackouts/loss of consciousness/blurred vision.
• History of chest pain/cough or cardiac related symptoms.
• History of abdominal pain/bloody diarrhoea/abdominal angina.
• History of paraesthesia over the skin.
• History suggestive of superficial thrombophlebitis like swelling/redness/pain along the line of superficial vein.

Past History and Treatment History
• Similar history earlier.
• History of drug intake earlier for similar conditions like vasodilators/drugs to increase the perfusion.
• History of earlier surgery like/sympathectomy/omentumoplasty/their results or effects.

Personal History
History of smoking—beedi or cigarettes/duration/number per day/stopped now or continuing/since when stopped smoking.

Family History
Any family history suggestive of atherosclerosis or vascular diseases.

General Examination
• Pulse-rate/rhythm/character/condition of vessel wall.
• Blood pressure of both arms and if possible of both lower limbs.
• Attitude of limbs.

Local Examination
Inspection
• Inspect both lower limbs keeping side-by-side as comparison is needed during clinical examination.
• Change in colour is very important sign of ischaemia.

• Colour proximal to gangrene area/ischaemic area (usually ischaemic area is pallor).
• Limb deformity.
• Gangrene of toe/foot/leg: Its extent, discharge from area, type of gangrene—dry or wet, line of demarcation-type/level/depth, colour of gangrenous area—black/purple/greenish black (in gas gangrene).
• Ulceration if any—its extent/discharge/size/shape/floor/surrounding area.
• Patchy ulcers proximal to gangrenous area—skip lesions which are usually black patchy lesions.
• Muscle wasting in the foot/leg/thigh should be observed. It should be compared and also should be measured using a tape from a fixed bony point keeping equal distance in both limbs.
• Features of ischaemia—shiny thin skin/loss of subcutaneous fat/hair loss—its extent/nail changes—brittle nail/transverse ridges in the nail.
• Plantar aspect of the foot for infective focus/abscess/callosities/skin changes/superficial ulcers in heel/malleoli/toes.
• Buerger’s postural test: Patient in supine position is asked to raise his legs one after other with knee keeping straight. In normal limb even after 90° elevation limb remains pink without any palor. Diseased limb after elevation shows marked palor (overfoot) with empty-guttered veins. The angle with which palor develops (between limb and ground) is called as Buerger’s vascular angle of insufficiency. In severe ischaemia, this angle will be less than 30°. If foot does not become palor or doubtful, then repeated ankle flexion and extension is done until it becomes palor empty-guttered veins on the dorsum of foot and after lowering the foot cyanotic congestion appears in the foot.
• Oedema in the foot/feet/legs.
• Status of the superficial veins—normally filled veins or pale/discoloured/guttered veins as seen in ischaemic limb.
- **Capillary filling time:** Initially elevated limbs are made to hang down the bed. Limb will remain normal pink in elevated as well as down position because of rapid capillary filling time. In ischaemia, limb becomes palor in elevation and only gradually becomes purple-red and then pink in more than 20 seconds. Purple pink colour is due to deoxygenated blood. Prolonged capillary time signifies severe ischaemia.

- **Venous refilling time:** Elevated limb when laid horizontal in the bed normal venous refilling occurs within 5 seconds. It is delayed in ischaemic limb.

### Palpation

- Temperature of the skin is important factor in ischaemic limb. Extent of cold and proximally where exactly limb/part become warmer also should be assessed.

- **Tenderness:** Site/extent/severity should be assessed.

- Gangrenous area to be palpated for extent/ whether it is dry and shriveled or whether it is wet and oedematous. Crepitus in gangrenous present or not should be checked.

- Limb above the gangrenous area should be palpated.

- **Capillary filling:** Tip of the nail or pulp of the finger or toe is pressed to blanch it and pressure is released (in 2 seconds) to make it to become pink. Time taken from blanched area to turn into pink is capillary filling time. It is prolonged in ischaemic limb.

- **Harvey’s venous refilling test:** Two fingers are placed over the vein. Pressure is elicited over the vein. Proximal finger is moved proximally for about 5 cm without releasing the pressure. Vein between the fingers gets emptied completely and becomes flat. Distal finger is released now to see the flow of the blood and its refilling is observed whether it is good or poor. It is poor in ischaemic limb.

- **Elevated arm stress test (EAST):** Both shoulders are abducted 90° with arms fully externally rotated. Patient will open and close the hands rapidly for 5 minutes. Normal individual can do this without any discomfort and pain. Patient with thoracic outlet syndrome develops pain, fatigue, paraesthesia of forearm with tingling and numbness of fingers. Patient will not be able to complete the test for 5 minutes. This test can also differentiate thoracic outlet syndrome from cervical disc prolapse disease.

- **Roos test:** Patient is asked elevate and abduct the shoulders 90° with external rotation of arms to keep it for 5 minutes. Patient feels fatigue in the diseased side.

- **Costoclavicular compression manoeuvre:** While feeling radial pulse of the patient, he is asked to place his shoulder backwards and downwards (exaggerated military position) causing absence/feeble radial pulse and while auscultating the supraclavicular region a bruit may be heard. This is due to compression of subclavian artery between clavicle and first rib.

- **Hyperabduction manoeuvre (Halsted test):** While palpating the radial pulse, arm on the diseased side is passively hyperabducted causing feeble or absence of radial pulse. This is due to compression of artery by pectoralis minor tendon (pectoralis minor syndrome). An axillary bruit may be heard on auscultation.

- **Adson’s test:** While feeling the radial pulse of the affected side of the patient, patient is asked to take deep breath and to turn his neck/head towards the same side so as to compress the thoracoaxillary channel. Pulse becomes feeble or absent in positive Adson’s test in thoracic outlet syndrome/scalenus anticus syndrome. While taking deep breath thoracic cage moves upwards and narrows the space causing aggravation of compression of subclavian artery by scalenus anterior muscle. Contraction of scalenus anterior further aggravates the feature (by turning neck towards same side).
Surgical Long Cases

Figs 1.67A and B: Adson’s test

- **Branham’s/Nicoladoni’s sign**: In arteriovenous fistula, pressure over the artery proximal to fistula will cause reduction in pulse-rate and size of the swelling with pulse pressure becoming normal and disappearance of bruit.
- **Allen’s test**: It is used in hand to find out the patency of radial and ulnar arteries. Both radial and ulnar arteries of the patient is felt and pressed firmly at the wrist. Patient clinches his hand firmly (often repeated clinching) and holds it tightly. After 1 minute, clinch is released to open the palm of the hand which looks pale. Pressure on the radial artery in wrist is released to see area of distribution of the radial artery. Normally, it becomes flushed with pink colour. If there is radial artery block area will remain white. Test is repeated again. This time pressure on the ulnar artery is released to check the patency of ulnar artery. Area will be pale and blanched after releasing in case of ulnar artery block. Otherwise in normal individual it becomes pink after release.
- **Cold and warm water test**: It is commonly done to confirm Raynaud’s phenomena. Patient is asked to dip hands in cold water to precipitate the vasospasm and Raynaud’s syndrome.
- **Crossed-leg test (Fuchsig’s test)**: Patient is asked to sit with the legs-crossed one above the other so that the popliteal fossa of one leg will lie against the knee of other leg. Oscillatory movements of foot can be observed synchronous with the popliteal artery pulsation. If the popliteal artery is blocked oscillatory movements will be absent.
- **Disappearing pulse syndrome**: Exercise the limb after feeling the pulse. Pulse will disappear once patient develops claudication. It is because of vasodilatation and increased vascular space occurring due to exercise wherein arterial tension can not be kept adequately and so pulse will disappear (unmasking the arterial obstruction).
- **Buerger’s postural test**: Patient lying down on his back is asked to raise the leg forward.

Figs 1.68A to D: Allen’s test
for two minutes. In normal individuals, limb (plantar aspect of foot) will remain pink even after raising to 90°. Ischaemic limb, when elevated shows marked pallor and empty veins. The angle in which pallor develops is called as Buerger’s angle of vascular insufficiency. Less than 30° angle indicates severe ischaemia. Ischaemic height of the heel in relation to the sternal angle where palor develops in heel signifies the severity of the disease. This height in centimeter is equal to the arterial pressure in the foot in mmHg. After that patient is asked to keep the legs below the bed to fill the vessels. Time taken to become leg pink colour is capillary filling time. Filling time more than 30 seconds suggests severe limb ischaemia.

- Guttering of vein while raising the leg for 15° is observed in ischaemic limb due to complete collapse of the veins whereas in normal individual veins are only partially collapsed while raising the leg.
- Reactive hyperaemia time test: Inflate the sphygmomanometer cuff around the limb up to 250 mmHg for 5 minutes to appear palor significantly. Release and assess the time of appearing of red flush in skin which signifies the reactive hyperaemia time. Normal time is 2 seconds. It is delayed in ischaemia.

**Palpation of Blood Vessels**

*Dorsalis pedis artery* is felt just lateral to the extensor hallucis longus tendon at the proximal end of first web space, felt against the navicular and middle cuneiform bones. It is absent in 10% cases.

*Posterior tibial artery* is felt against the calcaneus just behind the medial malleolus midway between it and tendo-Achilles.

*Anterior tibial artery* is felt in the midway anteriorly between the two malleoli against the
lower end of tibia just above the ankle joint lateral to extensor hallucis longus tendon.

Fig. 1.72: Palpation of anterior tibial artery

Popliteal artery is difficult to feel. It is palpated better in prone position with knee flexed about 90-130° to relax popliteal fascia. It is felt in the lower part of the fossa over the flat posterior surface of upper end of tibia. In upper end of the fossa, artery is not felt as bony area in intercondylar region is not present. It can also be felt in supine position with knee flexed 90-130° to relax the popliteal fossa so as to feel the pulsation against tibial condyles.

Femoral artery in the groin is felt just below the inguinal ligament midway between anterior superior iliac spine and pubic symphysis (midinguinal point). Often hip has to be flexed for about 10-15° to feel it properly.

Fig. 1.74: Palpation of femoral artery.

Radial artery is felt at the wrist on the lateral aspect against lower end of the front of radius.

Fig. 1.75: Palpation of radial artery

Ulnar artery is felt at the wrist on the medial end against lower end of the front of ulna.

Fig. 1.76: Palpation of ulnar artery.
**Brachial artery** is felt in front of the elbow just medial to biceps brachii tendon.

![Fig. 1.77: Palpation of brachial artery.](image)

**Axillary artery** is felt in lateral aspect of the axilla against upper end of the shaft of the humerus with raised and elevated arm.

![Fig. 1.78: Palpation of axillary artery.](image)

**Subclavian artery** is felt against first rib just above the middle of the clavicle in supraclavicular fossa while patient is lifting the shoulder to relax deep fascia.

![Fig. 1.79: Palpation of subclavian artery.](image)

**Common carotid artery** is felt medial to sternomastoid muscle at the level of thyroid cartilage against carotid tubercle (Chaissagne tubercle) of transverse process of 6th cervical vertebra (in carotid triangle).

![Fig. 1.80: Palpation of common carotid artery.](image)

**Facial artery** is felt against body of mandible at the insertion of masseter.

![Fig. 1.81: Palpation of facial artery.](image)

**Superficial temporal artery** is felt just in front of the tragus of the ear against zygomatic bone.

![Fig. 1.82: Palpation of superficial temporal artery.](image)
All pulsations should be written in a tabular form right and left side.

<table>
<thead>
<tr>
<th>Pulse</th>
<th>Right</th>
<th>Left</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dorsalis pedis</td>
<td>Should be mentioned as</td>
<td>Should be mentioned as</td>
</tr>
<tr>
<td>Posterior tibia</td>
<td>present/absent/feeble</td>
<td>present/absent/feeble</td>
</tr>
<tr>
<td>Anterior tibial</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Popliteal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Femoral</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radial</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ulnar</td>
<td></td>
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<tr>
<td>Brachial</td>
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<tr>
<td>Axillary</td>
<td></td>
<td></td>
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<tr>
<td>Subclavian</td>
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<tr>
<td>Carotid</td>
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<tr>
<td>Axillary</td>
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<td></td>
</tr>
<tr>
<td>Subclavian</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carotid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Superficial temporal</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Condition of the vessel wall, thrill and any tenderness on the artery should be mentioned. Ulcer if present should be examined for different features like tenderness/mobility/fixity/base/induration.

Limb muscle wasting assessment is important to find out the severity of the ischaemia. It is done by inspection of muscle bulk; prominent bony prominences; by measurement of the limb girth.

**Fig. 1.83A and B:** Measurement of girth is important to find out the wasting. It should be compared to opposite side and measured at a specific distance from a bony prominence.

**Fig. 1.84:** Muscle power should be checked against resistance to find out the grade.

**Fig. 1.85:** Wasting of muscles of right hand because of ischaemia. Note also colour difference between two hands.
girth (circumference is measured using a tape, 15 cm away from the bony point).

Muscle power is also should be checked and graded as—Grade 0—complete paralysis; Grade 1—flicker of contraction, no movement; Grade 2—movement with the elimination of gravity; Grade 3—movement against gravity, not against resistance; Grade 4—movement against partial resistance; Grade 5—normal movement against full resistance.

**Auscultation**

Auscultation over the artery for bruit is done using bell of the stethoscope placing gently over the artery. It signifies localised stenosis causing turbulence flow. Machinery bruit/murmur also heard in AV malformations/fistulas.

**Neurological Examination**

Muscle tone/power at ankle, knee and hip, sensory examination for touch, pain and temperature, reflexes at ankle and knee and plantar response should be checked when associated neurological conditions are suspected (like tabes dorsalis, syringomyelia, hemiplegia, transverse myelitis).

**Systemic Examination**

Abdomen should be examined for the presence of abdominal aortic aneurysms. It presents as pulsatile mass above the umbilicus, vertically placed, smooth, soft, nonmobile, not moving with respiration, resonant on percussion. Expansile pulsation is confirmed by placing the patient in knee-elbow position.

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**Figs 1.86A to C:** Auscultation over the major vessel like femoral/carotid for bruit is important. It signifies stenosis and turbulence flow of blood.

**Fig. 1.87:** Sensation should be checked for neurological deficit especially in upper limb (cervical rib).

**Fig. 1.88:** Examination of abdomen for aortic pulsation/aneurysm; old sympathectomy scar are important.
Cardiovascular system: CVS is essential part of the arterial system for any associated or causative causes to find out. There may be embolic focus in heart like fibrillation/endocarditis, etc.

Fig. 1.89: Cardiovascular system examination is also equally important for mitral stenosis/endocarditis, etc.

Other systems like skeletal and respiratory systems should be examined in detail.

Fig. 1.90: Palpation of abdominal aortic pulsation in epigastrum, above the umbilicus, midline.

Intermittent Claudication
Claudio means ‘I limp’ a Latin word. It is a crampy pain in the muscle seen in the limbs. Due to arterial occlusion, metabolites like lactic acid and substance P accumulate in the muscle and cause pain.

The site of pain depends on site of arterial occlusion.
• Commonest site is calf muscles.
• Pain in foot is due to block in lower tibial and plantar vessels.
• Pain in the calf is due to block in femoropopliteal site.
• Pain in the thigh is due to block in the superficial femoral artery.
• Pain in the buttock is due to block in the common iliac or aortoiliac segment, often associated with impotence and is called as Leriche’s syndrome.

Pain commonly develops when the muscles are exercising. Cause for pain is accumulation of substance ‘P’ and metabolites. During exercise increased perfusion and increased opening of collaterals wash the metabolites.

Boyd’s classification of claudication
Grade I: Patient complains of pain after walking, and distance in which pain develops is called as ‘claudication distance’. If patient continues to walk metabolites causing pain are washed away in the circulation due to increased blood flow in muscle and so pain subsides by opening of the collaterals
Grade II: Pain still persists on continuing walk; but can walk with effort
Grade III: Patient has to take rest to relieve the pain

Neurogenic claudication is pain in the leg during walking due neurological causes. It often mimics vascular claudication but arterial pulses are normal in this. It is common in spinal cord stenosis.

Claudication distance is distance at which claudication appears. It is better assessed using a treadmill.

Claudication is not that common in upper limb but can occur during writing or any upper limb exercise.
**Rest Pain**
It is continuous aching in calf or feet and toes or in the region depending on site obstruction. It is ‘cry of dying nerves’ due to ischaemia of the somatic nerves. It signifies severe decompensated ischaemia. Pain gets aggravated by elevation and is relieved in dependant position of the limb. Pain is more in the distal part like toes and feet. It gets aggravated with movements and pressure. Hyperaesthesia is common association with rest pain. Rest pain is more during night time as there is reduced heart-rate and blood pressure during night (sleeping time).

**Fontaine classification of limb ischaemia**

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No clinical symptoms</td>
</tr>
<tr>
<td>2</td>
<td>Intermittent claudication</td>
</tr>
<tr>
<td>2a</td>
<td>Well-compensated</td>
</tr>
<tr>
<td>2b</td>
<td>Poorly-compensated</td>
</tr>
<tr>
<td>3</td>
<td>Rest pain</td>
</tr>
<tr>
<td>4</td>
<td>Gangrene, ischaemic ulcer</td>
</tr>
</tbody>
</table>

**Critical Limb Ischaemia**
It is persistently recurring ischaemic rest pain or ulceration or gangrene of the foot or toes with an ankle systolic pressure < 50 mmHg or toe systolic pressure < 30 mmHg.

**Pregangrene**
It is the changes in tissue which indicates that blood supply is inadequate to keep the tissues alive and presents with rest pain, colour changes, oedema, hyperaesthesia with or without ischaemic ulceration.

**Gangrene**
It is macroscopic death of tissue in situ with or without putrefaction.

**Dry Gangrene**
It is dry, dessicated, mummified tissue caused by gradual slowing of blood stream. There is a line of demarcation and is localised.

**Wet Gangrene**
It is due to both arterial and venous block with superadded putrefaction and infection. It spreads proximally and there is no line of demarcation. It spreads faster.

Organs in which gangrene can develop are appendix, bowel, gall bladder, testis and pancreas.

**Necrosis**
It is microscopic cell death.

**Sequestrum**
Sequestrum is dead bone in situ.

**Slough**
Slough is dead soft tissue.

**Line of Demarcation**
It is a line between viable and dying tissue indicated by a band of hyperaemia. It also indicates that disease is well-localised. Final separation between healthy and gangrenous tissue occurs by development of a layer of granulation tissue in between. It is hyperaesthetic due to exposed nerve endings.

**Type of separation**
- Separation by aseptic ulceration—seen in dry gangrene.
- Separation by septic ulceration—seen in infected cases and wet gangrene.

**Features of ischaemia**

- Marked pallor, purple blue cyanosed appearance
- Thinning of skin
- Diminished hair
- Loss of subcutaneous fat
- Brittle nails, with transverse ridges
- Ulceration in digits
- Wasting of muscles
- Tenderness and temperature (cold)
Fig. 1.91: Ischaemic ulcers in both upper and lower limbs

Aortoiliac block causes claudication in both buttocks, thighs, and calves; absence of femoral and distal pulses; bruit over aortoiliac region. Impotence occurs due to defective perfusion through internal iliac arteries and so into the penis causing erectile dysfunction (Leriche’s syndrome).

Iliac artery obstruction causes claudication in thigh and calf; bruit over iliac arteries with absence of femoral and distal pulses.

Femoropopliteal obstruction causes claudication in calf with absence of distal pulses but with palpable femoral.

Distal obstruction shows absence of ankle pulses with palpable femoral and popliteal pulses.

INVESTIGATIONS FOR ARTERIAL DISEASES

- Blood tests: Hb%, blood sugar, lipid profile, peripheral smear, platelet count.
- Doppler to find out the site of block.
- Duplex scan: It is combination of B mode ultrasound and Doppler study. Difference in transmitted beam of the ultrasound and reflected beam is called as Doppler shift which is assessed and converted into audible signals. To study the site, extent, severity of block, and also about collaterals. Audible sound—with normal flow and sound is important. Turbulence is heard with stenosed partially blocked artery. Audible sound will be absent, if there is complete block. Using Doppler probe blood pressure at various levels can be assessed. Pulse wave tracing along the artery is also important.
- Plethysmography.
- Ankle-brachial pressure index (ABPI):
  Normally, it is 1. If it is less than 0.9, it means ischaemia is present. If it becomes 0.3 or below then it signifies severe ischaemia with gangrene. It may be normal at rest in early mild ischaemia but alters (reduces) during exercises.

Angiography

Retrograde transfemoral Seldinger angiography: It is commonly done. It is done only when femorals are felt. If femoral pulsation is not felt, then angiogram is done either transbrachially (left brachial artery), or transaortic.

Indications for angiogram

- TAO
- Atherosclerosis
- Raynaud’s phenomenon
- A-V fistulas
- Haemangiomas
- Thoracic outlet syndrome (e.g. cervical rib)
- Aneurysms,
- Neoplastic conditions

Other angiograms are carotid angiogram, celiac angiogram, superior mesenteric angiogram, coronary angiogram.

Femoral artery is cannulated with a guide wire. Through that Seldinger arterial catheter is passed proximally in retrograde direction and
water soluble iodine dye (Sodium diatrizoate) is injected. X-rays are taken to see the block, its extent in the affected limb. In TAO cork screw appearance is characteristic. Distal run off through collaterals is also important. If catheter is passed still proximally angiogram of opposite side is possible. Seldinger technique can also be used (to study) to do renal angiogram, renal artery stenosis, renal carcinomas, renal anomalies (vascular).

<table>
<thead>
<tr>
<th>Complications of retrograde angiogram</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Bleeding</td>
</tr>
<tr>
<td>• Dissection of vessel wall</td>
</tr>
<tr>
<td>• Haematoma formation</td>
</tr>
<tr>
<td>• Thrombosis</td>
</tr>
<tr>
<td>• Infection</td>
</tr>
<tr>
<td>• Anaphylaxis</td>
</tr>
</tbody>
</table>

*Direct aortic angiogram*, practiced earlier, is discouraged at present because of the risk of aortic dissection and paraplegia due to blockage of anterior spinal artery.

Digital Subtraction Angiography (DSA)

- Here vessel (artery) is delineated in a better way by eliminating other tissues through computer system. A-V fistulas, haemangiomas, lesion in circle of Willis, vascular tumours, other vascular anomalies are well-made out.
- Dye is injected either to an artery or vein. Injecting into a vein is technically easier but larger dose of dye is required. Injecting into an artery is technically difficult but small dose of dye is sufficient.
- Advantages: Only vascular system is visualised; other systems are eliminated by computer subtraction. Small lesion, its location and details are better observed with greater clarity.
- Disadvantages: Cost factor and availability.
- Complications: Anaphylaxis, bleeding, thrombosis.

U/S abdomen

To see abdominal aneurysm or nature of aorta and other vessels.

Figs 1.92A and B: DSA showing aortoiliac block left-sided. Second film is DSA after balloon angioplasty causing adequate dilatation of the left-sided aortoiliac segment.

DISEASES OF THE ARTERIES

1. Atherosclerosis:

<table>
<thead>
<tr>
<th>Risk factors for atherosclerosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Hypercholesterolaemia, hypertriglyceridaemia and hyperlipidaemia</td>
</tr>
<tr>
<td>• Cigarette smoking</td>
</tr>
<tr>
<td>• Hypertension</td>
</tr>
<tr>
<td>• Diabetes mellitus</td>
</tr>
<tr>
<td>• Age—elderly</td>
</tr>
<tr>
<td>• Common in males</td>
</tr>
<tr>
<td>• Sedentary life</td>
</tr>
<tr>
<td>• Family history</td>
</tr>
</tbody>
</table>

2. Thromboangiitis obliterans. TAO: (Buerger’s disease.)
3. Raynaud’s disease.
4. Conditions causing Raynaud’s phenomenon:
   Like Scleroderma, Rheumatoid arthritis, SLE, Granulomatosis, vasculitis of other causes.
5. Embolus.
6. Aneurysms.

Thromboangiitis Obliterans (TAO)
syn. Buerger’s disease - Leo Buerger, 1908 (Professor of Urology, 1879-1943).
It is a disease exclusively seen in males of young age group (Not seen in females due to genetic...
reason). It is seen only in smokers and tobacco users. Always starts in lower limb, may start on one side and later on the other side. Upper limb involvement occurs only after lower limb is diseased. It is a panvasculitis.

**Pathogenesis**

Smoke contains *carbon monoxide* and *nicotinic acid*

- Causes initially vasospasm and hyperplasia of intima
- Thrombosis and so obliteration of vessels occurs. Commonly medium sized vessels are involved.
  - Panarteritis is common.
  - Usually involvement is segmental.
  - Eventually artery, vein and nerve are together involved.
  - Nerve involvement causes rest pain.
  - Patient presents with features of ischaemia in the limb.
- Once blockage occurs, plenty of collaterals open up depending on the site of blockage either around knee joint or around buttock.

Once collaterals open up, through these collaterals, blood supply is maintained to the ischaemic area.

↓

It is called as *compensatory peripheral vascular disease.*

↓

If patient continues to smoke, disease progresses into the collaterals, blocking them eventually, leading to severe ischaemia and is called as *decompensatory peripheral vascular disease.*

↓

It is presently called as *critical limb ischaemia.* It causes rest pain, ulceration and gangrene.

<table>
<thead>
<tr>
<th>Smoking</th>
<th>= Number of cigarettes × Number of years smoked per day of smoking</th>
</tr>
</thead>
<tbody>
<tr>
<td>SI &gt; 300</td>
<td>is a risk factor</td>
</tr>
<tr>
<td>Pack Years</td>
<td>= Number of packets × Number of years cigarettes per day of smoking</td>
</tr>
<tr>
<td>PYI &gt; 40</td>
<td>is a Risk factor</td>
</tr>
</tbody>
</table>

**Shianoya’s criteria for Buerger’s disease**

- Tobacco use. Only in males
- Disease starts before 45 years
- Distal extremity involved first without embolic or atherosclerotic features
- Absence of diabetes mellitus or hyperlipidaemia
- With or without thrombophlebitis

**Investigations**

- Hb%. Blood sugar.
- Arterial Doppler and Duplex scan (Doppler + B mode U/S).
- Transfemoral retrograde angiogram through Seldinger technique—
  - Shows blockage—sites, extent, severity.
  - *Cork screw* appearance of the vessel due to dilatation of vasa vasorum.
  - Inverted tree/spider leg collaterals.
  - *Severe vasospasm causing corrugated/rippled artery.*
Figs 1.94A to H: Different types of ischaemic ulcers. Also note wasting, loss of hair, shininess and other features of ischaemia.
• **Distal run off** is amount of dye filling in the main vessel distal to the obstruction through collaterals. If distal run off is good then ischaemia is compensated. If distal run off is poor then ischaemia is decompensated.

• **Transbrachial angiogram:** If femorals are not felt, then transbrachial angiogram (Through left side brachial artery—left subclavian artery – and so to descending aorta) should be done.

• Ultrasound abdomen

• Vein, artery, nerve biopsies.

**Treatment**

Stop smoking. Opt for either smoke or limb but not both.

**Drugs**

- Vasodilators, e.g. nifedepine.
- Pentoxiphylline increases the flexibility of RBC’S and helps them reach the microcirculation in a better way so as to increase the oxygenation.
- Low dose of aspirin—antithrombin activity
- Prostacyclins, Ticlopidine, Praxilene.
- Clopidogrel 75 mg, atorvastatin 10 mg, parvostatin 40 mg
- Cilostazole 100 mg bid—is a phosphodiesterase inhibitor which improves circulation.

All drugs act at the collateral level than at the diseased vessel.

_Buerger’s exercise, Buerger’s position, heel raise, analgesics, care of feet (Chiropady), proper footwear are advised._

**Surgery**

1. **Lumbar sympathectomy** to increase the cutaneous perfusion so as to make the ulcer to heal.
2. **Omentoplasty** to revascularise the affected limb.
3. **Profundaplasty** is done for blockage in profunda femoris so as to open more collaterals across the knee joint. (It often makes better perfusion to the knee joint and flap of below knee amputation).

4. **Amputations are done** at different levels depending on site, severity and extent of vessel occlusion. Usually either below-knee or above—knee amputations are done.

5. **Ilizarov method** of bone lengthening helps in improving the rest pain and claudication by creating neosteogenesis and improving the overall blood supply to the limb.

6. **Gene therapy:** Intramuscular injection of vascular endothelial growth factor (VEGF) which is an endothelial cell mitogen which promotes angiogenesis.

**Fig. 1.95:** Below-knee amputation stump is still infected in a TAO patient. This patient might require an above-knee amputation.

**Fig. 1.96:** Below-knee amputation with long posterior flap.

**Raynaud’s Phenomenon**

It is an episodic vasospasm, i.e. arteriolar spasm. It leads to sequence of clinical features called as Raynaud’s syndrome.
Raynaud’s syndrome
It is sequence of clinical features due to arteriolar spasm.
1. **Local syncope**: It is due to vasospasm, causing white and cold palm and digits along with tingling and numbness.
2. **Local asphyxia**: It is due to accumulation of deoxygenated blood as the result of vasospasm causing bluish discoloration of palm and digits with burning sensation. (It is due to accumulated metabolites)
3. **Local recovery**: It is due to relief of spasm in the arteriole, leading to return of blood to the circulation causing flushing and pain in digits and palm. (Pain is due to increased tissue tension)
4. **Local gangrene**: If spasm persists more than ischaemic time (more than one hour in upper limb), then digits go for ulceration and gangrene. Does not occur regularly but is an occasional phenomenon in the cycle.

**Causes for Raynaud’s Phenomenon**
- **Raynaud’s disease**:
  - It is seen in females, usually bilateral.
  - It occurs in upper limb with normal peripheral pulses.
  - It is due to upper limb (hand) arteriolar spasm due to abnormal sensitivity to cold. Patient develops blanching, cyanosis and later flushing as Raynaud’s syndrome. Occasionally, if spasm persists it result in gangrene. Symptoms can be precipitated and observed by placing hands in cold water.
- **Working with vibrating tools**: Like pneumatic road drills, chain saws, wood cutting, and fishermen traveling in machine boats.
- **Collagen vascular diseases**: Like scleroderma, Rheumatoid diseases causing vasculitis (All autoimmune diseases).
- **Other causes**: Cervical rib, Buerger’s disease, Scalene syndrome.
  It is often associated with CREST syndrome. (Calcinosis cutis, Raynaud’s phenomenon, Esophageal defects, Sclerodactyly, Telangiectasia).

**Types of Raynaud’s Phenomenon**
Vasospastic.
Obliterative.
  Type is identified by angiogram of palm, Doppler, Duplex scan.
  Other investigations required are X-ray of the part, specific tests for autoimmune diseases.

**Treatment**
- Treat the cause.
- Avoid the precipitating cause.
- Vasodilators, Pentoxiphylline.
- Small dose of aspirin (100 mg daily).
- Cervical sympathectomy.

**Treatment of Arterial Diseases**

**Medical**

**General measures**
- Stop smoking.
- Reduction of weight.
- Change in life style.
- Exercise.
- Care of feet.
- Control of diabetes and hypertension.
- Buerger’s position and exercise—regular graded exercises upto the point of claudication improves the collateral circulation.

**Drugs**: Nifedepine, praxilene, pentoxiphylline, small dose of aspirin, prostacycline, dipyridamole, ticlopidine, atorvastatin, cilostazol 100 mg.

**Surgery**
1. **Transluminal balloon angioplasty/percutaneous transluminal balloon angioplasty (PTA)**: Through transfemoral Seldinger approach, initially angiogram is done. Then under guidance (fluoroscopic) stenosed area is approached. Balloon of the angioplasty catheter is inflated at stenosed area for one minute and repeated if required. Catheter is withdrawn. It is useful in cases of localised stenosed areas.
  **Complications**: Thrombosis, bleeding, sepsis.
2. **Atherectomy**: It is removal of atheroma from the wall of the artery either through open surgery or by percutaneous route of medium sized vessels.

3. **Thrombectomy**: It is removal of thrombus through an arteriotomy of larger vessels. It is done in aortoiliac, femoropopliteal region.

4. **Endarterectomy**: It is removal of thrombus along with diseased intima through an arteriotomy.

5. **Intraluminal stent** placement.

6. **Profundaplasty**: It is done when there is localised block in opening of profunda femoris (deep femoral). Profunda femoris is opened, thrombus if present, is removed. Opening is widened using either venous or synthetic (Dacron or PTFE) grafts. This procedure allows collaterals across the knee joint through profunda femoris and so gives good blood supply below-knee level and may prevent patient going in for above-knee amputation.

   (May be able to save knee joint with below-knee amputation with better prosthesis).

7. **Reverse saphenous vein graft**: In case of femoropopliteal block, saphenous vein is dissected out, reversed and sutured above to the femoral artery and below to popliteal segment so as to bypass the blood through reverse saphenous vein graft. Saphenous vein is reversed to nullify the action of valves so as to allow easy flow of blood.

8. **In-situ saphenous vein graft**: It is arterialisation of saphenous vein. Saphenous vein intact in same position is sutured above and below the blocked femoropopliteal region to bypass the blood across. Venous valves are removed through valvulotomy instrument so as to allow the blood to pass.
9. **Arterial/venous grafts:**

*Synthetic:*
- Dacron woven graft.
- Dacron knitted graft.
- PTFE—Poly tetra fluoroethylene graft.

*Natural:*
- Internal mammary artery.
- Long saphenous vein either reverse or *in situ.*
  Grafts of different length and size are available.

*Different procedures:*
- Aorto-femoral bypass graft.
- Ileo-femoral bypass graft.
- Femoro-femoral bypass graft.
- Femoro-popliteal graft.
- Femoro-distal graft.

*Problems with grafts:* Leak, infection, thrombosis, cost factor, availability, re-block.
Surgical Long Cases

10. **Cervical sympathectomy**

**Indications**
- Cervical rib with vascular manifestations—Useful
- Raynaud’s phenomenon—Useful
- Hyperhydrosis—Very useful
- Upper limb vasospasm due to other causes—Useful
- Acrocyanosis—Useful
- Causalgia—Very useful
- Sudeck’s osteodystrophy

**Approaches:**

a. **Supraclavicular approach:** Through an incision in supraclavicular region, sternomastoid, omohyoid, scalenus anterior muscles are divided. Phrenic nerve is displaced medially; subclavian artery is pushed downwards; suprapleural membrane is depressed, stellate ganglion is identified in the neck of the first rib. All rami communicating from second and third ganglia are divided and Kuntz nerve is also divided.

**Complications:** Bleeding, injury to subclavian artery and nerves, pneumothorax and haemopneumothorax, Horner’s syndrome with ptosis, miosis, anhydrosis, enophthalmos.

b. **Transthoracic approach (Hedley Atkins):** This gives better visibility and easier removal of rami, lower down compared to supraclavicular approach.

c. **Endoscopic sympathectomy** is the choice and popular approach at present. Advantages are better visibility with magnification, less trauma of access (wound), faster recovery, and precise.

11. **Lumbar sympathectomy**

**Indications:**
- Peripheral vascular disease like TAO.
- To promote healing of cutaneous ulcers.
- To change level of amputation and to make flaps to heal better after amputation.
- Causalgia of lower limb (it is common in upper limb).
- Hyperhydrosis.

**Principle:** It increases the cutaneous blood supply and so ulcer healing and healing of skin flaps in amputations is better. It will not improve intermittent claudication.

**Procedure:** Under general or spinal anaesthesia, ganglia are approached through a transverse incision in the loin at the level of umbilicus, through extraperitoneal approach, by dividing external oblique, and splitting internal oblique, and transverse abdominis muscles. Inferior vena cava on right side, aorta on left side are identified. Sympathetic chain is identified by its rami. L2, L3, L4, L5 Ganglia are removed. L2 is identified.
by its size (Larger) and more number of rami. L₁ is retained on one side in bilateral cases. It is under the crus of the diaphragm. L₄ is under iliac vessels. Sympathetic chain is deeply placed in front of the vertebra with firm tense cord like feeling with ganglia at different levels. After removal, chain should be sent for histology. Chain may be missed for genitofemoral nerve. Lymphatics and lymph nodes are also can be missed for sympathetic chain. Chain has got grey rami communicantes from spinal cord to the chain and ganglia; and white rami communicantes begins at ganglia and enters the peripheral nerves. If it is removed it will lead on to failure of ejaculation and so sterility.

Complications:
1. Injury to IVC or aorta.
2. Bleeding lumbar veins.
3. Spinal vessel spasm and so ischaemia of spinal cord and paraplegia.
4. Injury to bowel and ureter.
5. Wound infection and abscess formation.

Its effects are only temporary (3-4 wks). Long term results are doubtful. It can be combined with omentoplasty.

It can also be done along with below- knee amputation to increase the blood supply of skin flap so as to have better healing.

Limb will become warmer immediately after sympathectomy.

12. Chemical sympathectomy
It is done in lateral position using a long spinal needle under local anaesthesia. Position is confirmed by injecting dye under fluoroscopy. Later 5 ml of phenol in water or absolute alcohol (1: 16) is injected lateral to the vertebral bodies of second and fourth lumbar vertebrae. Care should be taken to see that the needle does not enter IVC or Aorta. Procedure is contraindicated in patients with bleeding disorders and in patients who are on anticoagulants.

Indications:
1. Peripheral vascular disease—To improve circulation.
2. For lymphoedema it helps by providing lymphatics and so to drain lymph from the limb.
3. It is also tried for revascularisation of pharynx, cranial cavity.

Omentum is supplied by omental vessels.

Coeliac artery ↓
Right gastric artery    Splenic artery ↓
Gastroduodenal artery  Left gastro-epiploic ↓ ↓ artery

Right gastro-epiploic artery → Omental vessels

Four layers of omentum have got omental arcades of vessels. Omentum is also rich in lymphatics. It has got adhesive property. By retaining one of the pedicles, omentum can be mobilised so as to reach the limb to maintain the circulation. It can also be mobilised up to the ankle. It promotes ulcer healing, reduces the pain, and controls the features of ischaemia. It can be used in upper limb ischaemia. But if patient continues to smoke, disease spreads to these omental vessels also. Often it can be used for both limbs.

Complications of omentoplasty:
• Abdominal sepsis.
• Incisional hernia, where omental pedicle is tunneled into the limb from the abdomen.
• Adhesions and intestinal obstruction.

Procedure:
Under general anaesthesia, abdomen is opened with upper midline incision. Omental vessels are identified. Omentum with its blood supply is carefully mobilised to get a adequate length. Lengthened, mobilised omentum is brought into the subcutaneous plane through abdominal wall, lateral to the lower part of rectus muscle. Later this pedicle is mobilised in the subcutaneous tunnel across the leg, burried in the deep fascia.
Figs 1.105A to G: Omentoplasty technique. Mobilization of greater omentum with its arterial arcade and bringing down to the limb up to the ankle.

Fig. 1.106: Incisional hernia in omentoplasty patient. Patient also has failure of omentoplasty and underwent above knee amputation because of gangrene.

Other treatment methods:
Amputations at different levels depending on extent of gangrene, site of block, amount of collaterals.

Fig. 1.107: Amputated 2nd toe (ray amputation)—healing well-done for toe gangrene. It was dry gangrene.

Subclavian Steal Syndrome
Following obstruction of the first part of subclavian artery, vertebral artery provides collateral circulation to the arm by reversing its blood flow. This causes cerebral ischaemia with syncopal attacks.
Visual disturbances, diminished blood pressure in the affected limb.
Fig. 1.108: Forefoot amputation – it is not an ideal procedure for vascular disease. In this patient wound is granulating well after amputation. It is probably due to good number of opened collaterals in the foot.

Symptoms will be aggravated by arm exercise.

Investigations: Duplex scan and angiogram. DSA is useful.

Treatment: Transluminal balloon angioplasty/endarterectomy or bypass graft.

Fig. 1.109: Subclavian steal syndrome.

Acute Arterial Occlusion

Causes
1. Trauma.
2. Embolism.

Traumatic Acute Arterial Occlusion

Causes
1. Thrombus due to trauma.
2. Subintimal haematoma.
3. Acute compartment syndrome.
4. During femoral or brachial arterial catheterisation, either diagnostic or therapeutic procedures.

Clinical features: H/o trauma, pain, swelling at the site, pallor, pulselessness, cold limb

Investigation: Duplex scan, angiogram.

Treatment: Wound is explored and tear in the artery is identified. It is sutured using non-absorbable monofilament material, polypropylene 6-0. Often venous or dacron graft is required for interposition.

Proper antibiotics and heparin are required to prevent thrombosis of the vessel. Later patient is advised to take oral warfarin for maintenance.

Compartment syndrome: Is common in anterior compartment leg and in front of forearm. Here because of the closed compartment, pressure increases following fracture, haematoma which compresses over the vessel. It leads to blockade of vessel causing acute ischaemia of the limb presenting with severe pain, pallor, pulselessness.

Treatment: Immediate decompression by longitudinal fasciotomy, is the treatment of choice, where in deep fascia is cut adequately to relieve the compression. Otherwise limb may go for severe ischaemia, gangrene and may land with amputation.

Associated fractures, haematoma, vessel tear has to be managed accordingly.

Embolism

It is due to a solid material which is floating and traveling in the blood stream, eventually blocking the vessel on its pathway.

Arterial emboli: Source—due to mural thrombus following—
- Myocardial infarction.
- Mitral stenosis.
- Atrial fibrillation.
- Aortic aneurysms.
• Cervical rib causing poststenotic dilatation of subclavian artery. 
  *Venous emboli* are due to DVT causing pulmonary embolism.
  – *Fat embolism.*  
  – *Air embolism.*

**Effects of Arterial Embolism**
• Brain: Blockage at middle cerebral artery causes hemiplegia, transient ischaemic attacks (TIA), visual disturbances.
• Blockage at central retinal artery causes amaurosis fugax, or permanent blindness.
• Blockage at mesenteric vessels causes intestinal gangrene.
• Blockage at renal artery lead to haematuria, loin pain.
• Blockage at limb vessels causes pain, pallor, pulseless, paraesthesia, paresis, ulceration, gangrene.
  Commonest site of arterial emboli is common femoral artery.

**Investigations for Arterial Embolism**
• Emergency Doppler, ECG and echocardiography, angiogram.
• Relevant tests for origin of emboli.

**Treatment**
1. *Embolectomy:* It is done as early as possible as an emergency operation. Under fluoroscopic guidance, *Fogarty catheter* (interventional radiology) is passed beyond the embolus and balloon is opened. Catheter is pulled out gently with embolus. Procedure has to be repeated until embolectomy is completed and bleeding occurs. Angiogram is repeated to confirm the free flow. Postoperatively initially heparin and later oral anticoagulant are used. Procedure is done under general anaesthesia.
  *Open arteriotomy and embolectomy* can be done *by direct approach* and later the arteriotomy has to be sutured. Postoperatively, anticoagulants, antibiotics should be given.
2. *Intraarterial thrombolysis using fibrinolysins:* After passing arterial catheter, angiogram is done and agents are injected intraarterially through the arterial catheter.

**Drugs used are:**
• Streptokinase (here lysis occurs in 48 hours).
• Urokinase.
• Tissue plasminogen activator (TPA)— Here lysis occurs in 24 hours.
• TPA pulse-spray method – here lysis occurs in 6 hours.

*Contraindications for thrombolysis:* Stroke, bleeding diathesis, pregnancy.
  Heparin should not be used concomitantly with fibrinolysins.

**Saddle Embolus**
It is an embolus blocking at *bifurcation of aorta.*

**Causes:**
• Mural thrombus after myocardial infarction.
• Mitral stenosis with atrial fibrillation.
• Aortic aneurysm.
  The embolus which blocks at aortic bifurcation is usually large.
Fig. 1.111: Fogarty catheter. It is 80 cm in length with 4 to 7 French size. It is used for embolectomy. Note the inflated balloon at the tip.

Fig. 1.112: Saddle embolus blocking the bifurcation of abdominal aorta.

Clinical features:
- Features of ischaemia in both lower limbs.
- Gangrene of both lower limbs.
- Associated infection and its features.

Investigations:
- Arterial Doppler.
- Aortic angiogram.
- U/S abdomen.

Treatment:
- Initially, heparin is given intravenously - 10,000 units and later 5,000 units/- subcutaneously 8th hourly.
- Embolectomy can be done using Fogarty catheter.
- Open arteriotomy and embolectomy can also be tried.
- Antibiotic prophylaxis has to be given to prevent infection.

Fat Embolism
It is commonly seen after fracture femur, tibia, or multiple fractures and occasionally following electro convulsive therapy, usually occurs in 24-72 hours.

It is due to aggregation of chylomicrons, derived from bone marrow, causing fat embolism. It is often a fatal condition.

Features:
- Cerebral: Drowsy, restless, disoriented, constricted pupils, pyrexia, coma.
- Pulmonary: Cyanosis, tachypnoea, right heart failure, froth in mouth and nostrils, fat droplets in sputum, eventually respiratory failure.
- Cutaneous: Petechial haemorrhages in the skin.
- Retinal artery emboli is the earliest sign to appear, causing striae haemorrhages, fluffy exudates confirmed on fundoscopic examination.
- Kidney: Blockage in renal arterioles results in fat droplets in urine.

Treatment: Oxygen, heparinisation, low molecular weight dextran, ventilator support and ICU management.

Air Embolism
Causes:
- Through venous access like IV cannula.
- During artificial pneumothorax.
- During surgeries of neck and axilla.
- Traumatic opening of major veins sucking air inside, causing embolism.
- During fallopian tube insufflation.
- During illegal abortion.
Amount of air required to cause air embolism is 50 ml.
When the air enters the right atrium, it gets churned up forming foam which enters the right ventricle and then blocking the pulmonary artery.

**Treatment:**
Patient has to be placed in Trendelenburg position. By passing a needle, the air has to be aspirated from the right ventricle. Often requires life saving open thoracotomy to aspirate the excess air causing the block.

**Therapeutic Embolisation**

**Indications:**
- Haemangiomas,
- AV fistulas,
- Malignancies like renal cell carcinoma, hepatoma,
- Craniovascular problems.
- To arrest haemorrhage from GIT, urinary and respiratory tract.

In bleeding duodenal ulcer or gastric ulcer, embolisation is used to occlude gastroduodenal artery or left gastric artery respectively. It also useful in bleeding oesophageal varices, secondaries in liver (mainly due to carcinoids), hepatoma.

**Materials used**
- Blood clot
- Human dura
- Gel foam
- Plastic microspheres
- Balloons
- Ethyl alcohol
- Quick setting plastics
- Wool
- Stainless coils.

**Aneurysms**
It is dilatations of localised segment of arterial system.
- **True** aneurysm contains all three layers of artery.
- **False** aneurysm contains single layer of fibrous tissue as wall of the sac and it usually occurs after trauma.

**Types**
- Fusiform
- Saccular
- Dissecting

**Causes**
- Atherosclerosis.
- Syphilis.
- Traumatic.
- Collagen diseases like Marfan’s syndrome.

**Mycotic Aneurysm**
It is a **misnomer**. It is not due to fungus but due to bacterial (commonly *Staphylococcus*,
Streptococcus) infection. Origin of bacteria may be from any site of infection in the body.

**Sites:**
- Aorta.
- Femoral.
- Popliteal.
- Subclavian.
- Cerebral, mesenteric, renal, splenic arteries
- Commonest is true, fusiform, atherosclerotic, aortic aneurysms.

**Differential diagnosis:**
1. Pyogenic abscess: Abscess has to be always confirmed by aspiration; especially in axilla, popliteal region, groin.
2. Vascular tumours.
5. A-V fistula.

**Investigations:**
Doppler study, duplex scan, angiogram, DSA. Tests relevant for the cause, like blood sugar, lipid profile, echocardiography.

**Treatment:**
- Reconstruction of artery using arterial grafts.
- Arterial endoaneurysmorrhaphy—MATA’S.
- Therapeutic embolisation,
- Clipping the vessel under guidance (e.g. cranial aneurysms).

**Abdominal Aneurysms**
*Abdominal aortic aneurysm* is the commonest aortic aneurysm. It has got 2% incidence.

**Causes:**
Atherosclerosis: 95%.
Others: Syphilis, dissecting, traumatic, collagen diseases.

**Classification I:**
- Infrarenal—Commonest 95%.
- Suprarenal 5%.

**Classification II**
1. Asymptomatic: Found incidentally either on clinical examination or on angiography or on ultrasound. Repair is required if diameter is over 5.5 cm on ultrasound.
2. Symptomatic without rupture: Present as back pain, abdominal pain, mass abdomen which is smooth, soft, nonmobile, not moving with respiration, vertically placed above the umbilical level, pulsatile both in supine as well as knee-elbow position with same intensity, resonant on percussion. GIT,
urinary, venous symptoms can also occur. Hypertension, diabetes, cardiac problems should be looked for and dealt with.

**Investigations:**
- Blood urea, serum creatinine.
- U/S, aortogram.
- DSA, CT scan, MRI.

**Treatment:**
If aneurysm is more than 5.5 cm then surgery is the choice.

**Options** are
- Open surgical aneurysm repair using PTFE or dacron graft.
- Endoluminal stent graft procedure using interventional radiology with Seldinger’s technique. Adequate amount of blood is required for surgery.

**Symptomatic Ruptured Aortic Aneurysm**
Risk of rupture is 1%, if diameter is within 5.5 cm in size. Risk increases to 20% once the diameter = 7 cm. It may be *anterior rupture* (20%) into the free peritoneal cavity causing severe shock and death very early; or *posterior rupture* (80%) with formation of retroperitoneal haematoma of large size causing severe back pain, hypotension, shock, absence of femoral pulses and with palpable mass in the abdomen.

**Management of ruptured aneurysm:**
- Immediate diagnosis by ultrasound.
- Resuscitation.
- Massive blood transfusions (10-15 bottles).
- *Emergency surgery is the only life saving procedure in these cases.*

Patient has to be shifted to the operation theatre. Abdomen is opened. *Vascular clamps or bull dog clamps* are applied to the aorta above and below the aneurysm. Adventitia is opened and the clot is removed. Aneurysm is excised and the *arterial graft* PTFE (*Polytetra fluoro-ethylene*), knitted dacron graft, or woven dacron graft is placed. The graft is sutured to the vessel above and below using monofilament, nonabsorbable suture material, polypropene 5-zero.

**Complications**
- Haemorrhge
- Colonic ischaemia
- Renal failure
- Sexual dysfunction
- Aorto-duodenal fistula
- Graft Leak, graft thrombosis, graft failure
- Aorto venacaval fistula
- Spinal cord ischaemia

*Fig. 1.116: Chest X-ray showing aortic aneurysm.*

*Fig. 1.117: Abdominal aortic aneurysm ultrasound picture.*
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Peripheral Aneurysms

Popliteal aneurysm
- Is commonest (70%).
- 65% are bilateral.
- 25% cases are associated with abdominal aortic aneurysm.
- 75% causes complications in 5 years.

Presentations
- Swelling in popliteal region which is smooth, soft, pulsatile, well localised, warm, and compressible, often with thrill and bruit. It may mimic a pyogenic abscess.
- Thrombosis and emboli from popliteal aneurysm can cause distal gangrene which may be spreading proximally and may lead to amputation.
- Rupture may cause torrential haemorrhage.

Investigations
- Duplex scan, angiogram.
- CT scan/CT angiogram.
- MRI/MR angiogram.

Treatment
- Repair with arterial graft using PTFE, dacron.
- Endoluminal stenting.
- Aneurysmorraphy.

Dissecting aneurysm: It is the dissection of media of the aorta after splitting through intima creating a channel in the media of the vessel wall.

Causes:
- Hypertension (It is associated in 80% of dissecting aneurysms).
- Cystic medial necrosis.
- Marfan’s syndrome and collagen diseases.
- Trauma.
- Weakening of the elastic layers of the media due to shear forces.

Features:
- It is always seen in thoracic aorta, common in ascending aorta. (70%).
- It is uncommon in other part of aorta or other vessels.
- It can occur in aortic arch or thoracic descending aorta.
- This dissected aortic channel gets lined by endothelium, often re-opens distally into the aorta causing double-barreled aorta which in fact prevents complications.
- It is commonly associated with aortic insufficiency.

Dissecting aneurysm is a misnomer. It is only aortic dissection.

Atherosclerosis is not a usual cause for dissecting aneurysm.

Classification (DeBakey’s):

Type I: Dissection begins in ascending aorta extends into descending thoracic aorta (70%).
Type II: Dissection origins and extends only up to the origin of the major vessels. It is safer type with less complications.

Type III: Dissection begins in the descending thoracic aorta beyond the origin of the left subclavian artery.

Dissecting aneurysm can be
• Acute.
• Chronic.
• Healed dissecting aneurysm which communicates distally again to aorta as double barreled aorta.

Complications:
Acute: Rupture into the pericardium or pleura - dangerous type.
Chronic: Blockage of coronary vessels, major vessels like carotid, subclavian arteries with aortic insufficiency.

Clinical features:
• Pain in the chest, back which is excruciating.
• Features of ischaemia due to blockage of different vessels.

Investigations:
• Chest X-ray shows mediastinal widening.
• Arterial Doppler.
• Angiogram.

Treatment: Antihypertensives.

Surgery: Using Dacron graft reconstruction of aorta has to be done with cardio-pulmonary bypass.

Indications for surgery:
• Progressive disease
• Significant ischaemia
• Impending rupture.

Acrocyanosis
It is persistent, painless cyanosis seen in fingers and often in legs with paraesthesia and chilblains affecting young females. It is chronic persistent arteriolar constriction with slow rate of blood flow. Trophic changes, ulcerations are not seen. Cyanosis which is persisting may aggravate by exposure to cold. It may be associated with endocrine dysfunction.

Treatment: Vasodilators, cervical sympathectomy (Effective).

Gangrene
It is macroscopic death of tissue in situ (in continuity with adjacent viable tissue) with or without putrefaction.

It can occur in—limbs, appendix, bowel, testes, gall bladder.

Fig. 1.120: Gangrene of toes and ischaemic changes in the foot.

Causes
Secondary to arterial obstruction like atherosclerosis, emboli, diabetes, TAO, Raynaud’s disease, ergots, etc.

Infective: Boil, carbuncle, gas gangrene, Fournier’s gangrene, cancrum oris.

Traumatic: Direct, indirect.

Physical: Burns, scalds, frostbite, chemicals, irradiation, electrical.

Venous gangrene.
Clinical Features

1. **Colour changes**: Pallor, greyish, purple, brownish black due to disintegration of haemoglobin to sulphide.
2. **Absence of pulse**, loss of sensation, loss of function,
3. **Line of demarcation** between viable and dead tissue by a band of hyperaemia and hyperaesthesia with development of a layer of granulation tissue.  
   *In dry gangrene* separation occurs by aseptic ulceration with minimum infection and gangrene is dry, and mummified.  
   *In moist gangrene* separation takes place by septic ulceration. Often demarcation is vague with *skip lesions* more proximally and so landing with higher level of amputations. Even after amputation skin flap may show *die back* process, leading to failure of taking up of flap of amputation and so require still higher level of amputation.
4. **Proximal ischaemic features may be present** with rest pain, colour changes, hyperaesthesia—pregangrene.

Types of Gangrene

**Dry gangrene** is due to slow gradual loss of blood supply to the part causing dry, desiccated, wrinkled, mummified part with proper line of demarcation.

**Wet gangrene** is due to infection with putrefaction, causing oedematous, swollen, discoloration, spreading proximally, with vague line of demarcation.

Investigations

- Hb%, blood sugar.
- Arterial Doppler, angiogram (Seldinger's technique).
- U/S abdomen to find out the status of aorta.

Figs 1.121 and B: Gangrene both in lower and upper limbs. Note all features of gangrene.

Treatment

**Limb saving methods:**

- Drugs: Antibiotics, vasodilators, pentoxifylline, praxilene, dipyridamole, small dose of aspirin, ticlopidine.
- Care of feet and toes:
  - The part has to be kept dry.
  - Any injury has to be avoided.
  - Proper footwear is advised (Microcellular rubber footwear, MCR).
- Measures for pain relief is taken.
- Nutrition supplementation is done.
- The limb should not be heated.
- Pressure areas has to be protected.
- Localised pus has to be removed.
- Cause has to be treated.
- Diabetes has to be controlled.
• Surgeries to improve the limb perfusion: Lumbar sympathectomy, omentoplasty, profundaplasty, femoropopliteal thrombectomy or endarterectomy, arterial graft bypass are done according to the need.

**Life saving procedures:**
Amputations may have to be done occasionally. **Level of amputation** has to be decided on skin changes, temperature, line of demarcation and Doppler study.
• **Below-knee amputation** is a better option as BK prosthesis can be fitted better and also the movements of knee joint are retained. There is no need of external support and limp is absent.
• In **above-knee amputation** range of movements is less, limp is present and often requires third (stick) support to walk.
• Different amputations done are **Ray amputation**, below-knee amputation (Burges’s amputation), Gritti-Stokes transgenial amputation, above-knee amputation.
  Lisfranc’s, Chopart’s, Symes’, Modified Symes’ amputations are not commonly used in ischaemic limb as flaps will not survive.

**Diabetic Foot and Diabetic Gangrene**
Foot is a complex structure with many layers of muscles, ligaments, joints, arches, fat, thick plantar fascia, vascular arches, neurological system which maintains weight bearing, gravity, normal walk (swing, and stance phases).

**Problems in Diabetic Foot**
• Callosities, ulceration.
• Abscess and cellulitis of foot.

**Pathogenesis of Diabetic Foot/Gangrene**
• High glucose level in tissues is a good culture media for bacteria. So infection is common.
• **Diabetic microangiopathy** causes blockade of microcirculation leading to hypoxia.
• **Diabetic neuropathy**: Due to sensory neuropathy, minor injuries are not noticed and so infection occurs. Due to motor neuropathy, dysfunction of muscles, arches of foot and joints, and loss of reflexes of foot occurs causing more prone for trauma, abscess, etc. Due to autonomic neuropathy, skin will be dry, causing defective skin barrier and so more prone for infection.
• **Diabetic atherosclerosis** itself reduces the blood supply and causes gangrene. Thrombosis can be precipitated by infection causing infective gangrene. Blockage occurs at plantar, tibial, and dorsalis pedis vessels.
• Increased glycosylated haemoglobin in blood causes defective oxygen dissociation leading to more hypoxia. At tissue level there will be increased glycosylated tissue proteins, which prevents proper oxygen utilisation and so aggravates hypoxia.

**Clinical Features**
• Pain in the foot.
• Ulceration.
• Absence of sensation.
• Absence of pulsations in the foot (Posterior tibial and dorsalis pedis arteries).
• Loss of joint movements.
• Abscess formation.
• Change in temperature and colour when gangrene sets in.

**Investigations**
• Blood sugar, urine ketone bodies.
• Blood urea and serum creatinine.
• X-ray of part to see osteomyelitis.
• Pus for culture and sensitivity.
• Doppler study of lower limb to assess arterial patency
• Angiogram to see proximal blockage
• U/S abdomen to see status of abdominal aorta.

**Treatment**

Foot can be saved only if there is good blood supply.

- Antibiotics—decided by pus C/S.
- Regular dressing.
- Drugs: Vasodilators, pentoxiphylline, dipyridamole, small dose of aspirin.
- Diabetes has to be controlled by insulin only.
- Diet control, control of obesity.
- Surgical debridement of wound.
- Amputations of the gangrenous area. If blood supply is not present, then below knee or above knee amputation may be required. Level of amputation has to be decided by skin and temperature changes or Doppler study.
- Care of feet in diabetic:
  - Any injury has to be avoided.
  - MCR foot wears must be used.
  - Feet has to be kept clean and dry, especially the toes and clefts.
  - Hyperkeratosis has to be avoided.

**Frostbite**

- It is due to exposure to cold wind or high altitude.
- It is common in old age during cold spells.
- Damage to vessel wall causes oedema, blistering, gangrene formation.
- Part is painless and waxy.
- *Treatment: Gradual warming is done.* Part should be wrapped with cottonwool and rested. Warm drinks, analgesics, paravertebral injections to sympathetic chain, hyperbaric oxygen are effective.
**WRITING A CASE SHEET FOR VARICOSE VEINS (LONG CASE)**

**Name:** Address: Age:

**Occupation:** Varicose veins are more common in people who stand for long hours like bus conductors, nurses, doctors, manual labourers, watchmen, traffic policemen, etc.

**Chief Complaints**
- Pain in the leg/thigh/foot with the duration of pain and side.
- Swelling/dilated veins in the leg and its duration.
- Pigmentation/ulceration in the leg with duration.

**History**

**History of Present Illness**

**Pain**
- Pain in the leg/foot/or thigh with duration. Origin of pain, its severity, nature of onset whether acute or insidious has to be asked.
- **Character of pain:** Dull aching or cramping should be asked. Whether pain gets aggravated by walking/standing should be noted. Dull aching pain along the line of the vein is typical and usually aggravates in the evening and gets relieved by lying down. Pain in calf of short duration, may be due to co-existing deep vein thrombosis (DVT).
- Pain also can be due to ulcer/periostitis/infection.

**Pigmentation**
- It is due to stasis and release of chemicals and usually occurs around ankle region.
- It is associated with itching and often ulceration.

**Ulcer**
- **History:** Mode of onset, duration, site of onset. Ulcer on the medial aspect of the ankle is due to long saphenous vein varicosity; on the lateral aspect is due to short saphenous vein varicosity.
- **Discharge from ulcer:** Its type, smell, quantity signifies the severity of the infection.
- Itching and bleeding in the ulcer bed are also important.

**History of trauma:** Often minor trauma precipitates ulcer formation in patients with varicose vein.

**History of swelling around the ankle.**

**History of pain/lump in the abdomen.**

**History of urinary/bowel symptoms.**

**History of similar complaints on the other leg—Varicose veins are often bilateral.**

**Past History**
- History suggestive of earlier deep vein thrombosis like pain, calf swelling and fever.
- History of immobilisation, hospitalisation.
- History of any previous surgery.

**Treatment History**
- History of previous surgery for varicose vein, drug intake like warfarin for DVT, injection therapy—sclerotherapy, wearing stockings/crepe bandages.

**Personal History**
- In females, history of pregnancy, delivery and postdelivery period, oral contraceptive intake.
- Smoking/alcohol/working pattern.

**Family History**

Family history relevant of varicose veins.
- Often varicose veins are familial, which are bilateral and severe, observed in young individuals. There are absent/defective valves in these patients.
Local Examination
Examination of lower limbs—symptomatic limb should be examined first.

Inspection
Examination of veins in standing position is the first method in varicose veins.

- Limb is looked for dilated long saphenous vein on the medial side and for short saphenous vein on posterior and lateral side. Other communicating veins are also looked for.
- Beginning of the varicosity in the foot, later its extent above also should be examined. Great saphenous vein tortuosity often extends into the thigh whereas short saphenous vein varicosity ends at popliteal region.
- Always limb is looked for skin changes, pigmentation, oedema, ankle flare, and ulcer. Cough impulse at saphenous opening (Morrissey’s) may be significant.
- Extent, size, shape, margin, edge and discharge in an ulcer should be noted.

Palpation
- Ulcer, if present should be described with tenderness, induration, warmness, mobility, fixity to the underlying bone, etc.

Brodie-Trendelenburg test
Vein is emptied by elevating the limb and milking the vein in lying down position; a tourniquet is tied just below the sapheno-femoral junction (or saphenofemoral junction can be occluded using a thumb). Saphenous opening is located 3.5 cm below and lateral to the pubic tubercle. Pubic tubercle is palpated along the adductor longus tendon which is identified by adducting the thigh against resistance. Patient is asked to stand quickly. When tourniquet or thumb is released, rapid filling from above signifies sapheno femoral incompetence. This is Trendelenburg test I.

In Trendelenburg test II, vein is emptied again in lying down position and tourniquet is applied at sapheno-femoral junction. After standing without releasing the tourniquet, the limb is observed. Filling of blood from below upwards rapidly can be observed within 30-60 seconds. It signifies perforator incompetence.
Figs 1.126A and B: Long saphenous vein varicosity. Note the prominent of veins and blow outs. Note the diagrammatic representation of varicose veins.

Figs 1.127A to C: Emptying of the superficial varicose vein is important in all tourniquet tests for varicose veins. It is done in lying down position with elevating and milking the vein. Emptying is not done in modified Perthes’ test. Note the marking of the saphenofemoral junction before applying the tourniquet.
Figs 1.128A and B: Note the site of applying the tourniquet at sapheno-femoral junction. It is 3.5 cm below and lateral to pubic tubercle.

Fig. 1.129: Tourniquet test. After emptying the vein by elevating the leg and milking, tourniquet is applied. Patient is asked to stand, tourniquet is released immediately and saphenous vein is observed. Rapid filling of vein from above signifies LSV varicosity with sapheno-femoral incompetence.

- Three/multiple (Oschner’s Mahoner’s test) tourniquet test: To find out the site of incompetent perforator, three tourniquets are tied after emptying the vein—
  1. At sapheno-femoral junction.
  2. Above knee level.
  3. Another below knee level.
  4. Additional tourniquets often may be applied at below-knee and above ankle level.

Patient is asked to stand; filling of veins and site of filling is looked for. Then tourniquets are released from below upwards to look again for incompetent perforators. Individual perforators may be tested by repeating the procedure.
- **Schwartz test**: In standing position, when lower part of the vein in leg is tapped, impulse is felt at the saphenous junction or at the upper end of the visible part of the vein. It signifies continuous column of blood and valves between two fingers are incompetent due to valvular incompetence. It signifies continuous column of blood and also signifies. Positive test is usually found in gross venous varicosity.

- **Pratt’s test**: Esmarch bandage is applied to the leg from below upwards with a tourniquet tied at saphenofemoral junction. The bandage is released after that to see the ‘blow outs’ as perforators.

- **Fegan’s test**: Line of varicose vein is marked. On standing, the site where the perforators enter the deep fascia bulges and these points are also marked. In lying down, button like depressions (crescentric gaps) in the deep fascia are felt at the marked out points which confirms the perforator site.

- **Ian-Aird test**: On standing, proximal segment of long saphenous vein is emptied with two fingers. Pressure from proximal finger is released to see the rapid filling from above which confirms saphenofemoral incompetence.

- **Perthes’ test**: The affected lower limb is wrapped with elastic bandage and the patient is asked to walk around and exercise. Development of severe crampy pain in the calf signifies DVT.

- **Modified Perthes’ test**: Tourniquet is tied just below the sapheno femoral junction without emptying the vein. Patient is asked to do a brisk walk which precipitates bursting pain in the calf and also makes superficial veins more prominent. It signifies DVT.

  *DVT is contraindicated for any surgical intervention of superficial varicose veins. It is also contraindicated for sclerosant therapy.*

- **Homan’s test** is dorsiflexion of the foot to elicit pain in the calf and Mose’s sign is squeezing the relaxed calf muscles sidewards to elicit pain. Both tests signify deep vein thrombosis (DVT).
Point to be remembered is that in case of acute DVT, Homan’s/Mose’s tests should not be done as it will precipitate the dislodgement of the clot and embolism.

- **Bone thickening** in the shin (tibia and ankle) is important which signifies periostitis.
- Measurement limb length and girth is needed especially in arterio-venous malformation with varicose veins and also to find out deformities.

**Auscultation**

Auscultation of the vein for bruit/venous hum.

**Other Examinations**

Examination of peripheral pulses are important (dorsalis pedis/anterior tibial/posterior tibial/popliteal/femoral).

Regional lymph nodes Vertical inguinal nodes and external iliac nodes (above and medial aspect of the inguinal ligament) are palpated.

Ankle Joint movements (plantar and dorsiflexion) are checked for any restriction.

Examination of the other limb both in standing and lying down position should not be forgotten.

Abdomen should be examined for any mass which might be compressing the inferior vena cava (IVC) or iliac veins causing varicose veins.

Examination of other systems also should be done.

### INVESTIGATIONS FOR VARICOSE VEINS

**Specific Investigations**

1. **Venous Doppler**: With the patient standing; the Doppler probe is placed at sapheno-femoral junction and later wherever required. Basically by hearing the changes in sound, venous flow, venous patency, and venous reflux can be very well-identified.

### Venous Doppler in varicose veins

- To find out DVT - very important
- To find out sapheno-femoral, sapheno-popliteal incompetence
- To find out perforator incompetence

2. **Duplex scan** is a highly reliable U/S Doppler imaging technique (Here high resolution B mode ultrasound imaging and Doppler ultrasound is used) which along with direct visualisation of veins, gives the functional and anatomical information, and also colour map. Examination is done in standing and lying down position and also with valsalva maneuver. Hand held Doppler probe is placed over the site and visualised for any block and reversal of flow. DVT is very well-identified by this method.

3. **Venography**

- **Ascending venography** was a very common investigation done earlier to Doppler period. A tourniquet is tied above the malleoli and the vein of dorsal venous arch of foot
Deep vein thrombosis is contraindicated for varicose vein surgery.

**Fig. 1.132:** Doppler showing DVT in leg. Deep vein thrombosis is contraindicated for varicose vein surgery.

**Fig. 1.133:** U/S showing IVC thrombosis.

is cannulated. Water soluble dye injected, flows into the deep veins (because of the applied tourniquet). X-rays are taken below and above knee level.

Any block in deep veins, its extent, perforator status can be made out by this.

*Note:* In the presence of Duplex scan ascending venography is not necessary investigation.

If DVT is present, surgery or sclerotherapy are contraindicated.

- **Descending venogram** is done when ascending venogram is not possible and also to visualise incompetent veins. Here contrast material is injected into the femoral vein through a cannula in standing position. X-ray pictures are taken to visualize deep veins and incompetent veins.

4. Plethysmography.

5. Ambulatory venous pressure.

6. **Arm-foot venous pressure** (Foot pressure is not more than 4 mmHg above the arm pressure).

7. **U/S abdomen**, peripheral smear, platelet count, and other relevant investigations are done depending on the cause of the varicose veins. If venous ulcer is present, then the discharge is collected for culture and sensitivity, biopsy from ulcer edge is taken to rule out Marjolin’s ulcer, plain X-ray of the part is taken to find out periostitis.

**Routine Investigations**

- Haematocrit, blood urea, serum creatinine, blood sugar.
- Chest X-ray, ECG.

It is done mainly to prepare the patient for surgery—for anaesthesia purpose.

**TREATMENT FOR VARICOSE VEINS**

**Conservative Treatment**

1. Elastic crepe bandage application from below upwards or use of pressure stockings to the limb.
2. Diosmin therapy which increases the venous tone.
3. Elevation of the limb.

**Injection sclerotherapy (Fegan’s technique)**

By injecting sclerosants into the vein, complete sclerosis of the venous walls can be achieved.

**Indications**

- Uncomplicated perforator incompetence
- In the management smaller varices
- Recurrent varices
- Short saphenous vein-uncomplicated

**Sclerosants**

- Sodium tetradecyl sulphate 3% (STDS)
- Sodium morrhuate
- Ethanolamine oleate
- Polidocanol
Mechanisms of action of sclerosant
- Causes aseptic inflammation leading to thrombosis
- Causes perivenous fibrosis leading to block
- Causes approximation of intima leading to obliteration

After emptying a 23 gauge needle is inserted into the vein with the patient sitting down, with the legs kept horizontal. 0.5 ml of sclerosant is injected into the vein and immediately compression is applied on the vein (to prevent the entry of blood which may cause thrombosis, which later gets re-canalised and further worsens the condition) so as to allow the development of sclerosis and proper endothelial apposition.

Usually injection is started at the ankle region and then preceded upwards along the length of veins at different points. Later pressure bandage is applied for three weeks. Often injection may have to be repeated after a week.

Microsclerotherapy: Very dilute solution of sclerosing agent like STDS, Polidocanal is injected into the thread veins and reticular veins followed by application of compression bandage (30 G needle). Dermal flare will disappear well by this method.

Contraindications
1. Sapheno-femoral incompetence.
2. Varicose veins with venous ulcer.
3. DVT.

Advantages
1. It can be done as an out patient procedure.
2. It does not require anaesthesia.

Disadvantage: Inadvertent subcutaneous injection can cause skin necrosis or abscess formation.

Foam sclerotherapy: STD 3% is taken in a syringe and is passed rapidly into another syringe which contains air to form foam. This can be injected into larger area of the vein and also long saphenous or short saphenous veins. Air gets absorbed and endothelial destruction and sclerosis occurs.

Echosclerotherapy: Sclerotherapy is done under ultrasound duplex image guidance.

Surgery
a. Trendelenburg operation: It is juxta-femoral flush ligation of long saphenous vein (i.e. flush with femoral vein), after ligating named (superficial circumflex, superficial external pudendal, superficial epigastric vein) and unnamed tributaries. All tributaries should be ligated otherwise recurrence occurs and retained stump of the vein becomes tortuous and dilated (saphena varix).

Fig. 1.135: Incision for Trendelenburg operation is on below and medial aspect of the inguinal ligament at the level of the sapheno-femoral junction. Long saphenous vein is identified and ligated flush with femoral vein.

Fig. 1.134: Note the typical ankle flare—dilated dermal and reticular veins. Microsclerotherapy is useful to these veins.
b. **Stripping of vein:** Using Myer’s stripper vein is stripped off. Stripping from below upwards is technically easier. Immediate application of crepe bandage reduces the chance of bleeding and haematoma formation.

**Complication:** Injury to saphenous nerve causing *saphenous neuralgia*. Stripping is not usually done for the veins in the lower part of the leg.

**Fig. 1.138:** Diagrammatic representation of stripping vein.
c. **Subfascial ligation of Cockett and Dodd**
   Perforators are marked out by Fegan’s method. Perforators are ligated deep to the deep fascia through incisions in antero-medial side of the leg.

d. **Ligation of short saphenous vein** at sapheno-popliteal junction. Stripping of the short saphenous vein is better. It is done using a rigid stripper.

e. **Removal of superficial varicose veins by hook phlebectomy.**

f. **Linton’s approach** is vertical skin incision approach in the calf to do perforator ligation subfascially.

**Contraindication for surgery:** Deep vein thrombosis (DVT).

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**Newer Methods Available for Treating Varicose Vein**

- **Radiofrequency ablation (RFA) method** *(VNUS closure method)* (VNUS medical technologies Inc; Sunnyvale, CA, USA) (by Goldman 2000): This procedure is done under general or regional anaesthesia. A RFA catheter is passed into long/short saphenous vein near sapheno-femoral or sapheno-popliteal junction under guidance. 85°C temperature is used for longer period of time to cause endothelial damage, collagen denaturation and venous constriction. Phlebectomy is done while withdrawing the catheter.

  - **TRIVEX method**—By subcutaneous illumination, a large quantity of fluid is injected percutaneously to identify the superficial veins. Superficial veins are removed using suction.

  - **Subfascial endoscopic perforator ligation surgery (SEPS)**—is becoming popular.

  - **Endo-venous laser ablation (EVLA):** It is done as an OP procedure or as day-care surgery. Patient lies supine with diseased leg flexed, hip externally rotated and knee flexed. With aseptic precaution, under U/S guidance LSV is cannulated above the knee and a guide wire is passed beyond SFJ and 5-French catheter is passed over guide wire and tip is placed 1 cm distal to the junction. 200 ml of 0.1% lignocaine is infiltrated along the length of the LSV. Laser fibre is inserted up to the tip of the catheter and catheter is withdrawn for 2 cm and laser fibre protrudes for 2 cm. Laser fibre is fired step by step using diode laser one second withdrawal in 2 seconds. Once procedure is over catheter is removed and pressure bandage is applied for 2 weeks. Heat produced (729°C at tip) by the laser produces steam bubbles with thermal damage of endothelium leading into occlusion of the vein.

**Complications of varicose vein surgery**

- Infection
- Haematoma formation
- DVT
- Saphenous neuralgia
- Recurrence
- Pain along the stripped vein area
Complications of varicose veins
- Haemorrhage: Venous haemorrhage can occur from the ruptured varicose veins or sloughed varicose veins, often torrential, but can be controlled very well by elevation and pressure bandage
- Eczema and dermatitis
- Periostitis causing thickening of periosteum
- Venous ulcer
- Marjolin’s ulcer
- Lipodermatosclerosis
- Ankylosis of the ankle joint
- Talipes equino varus
- Deep venous thrombosis
- Calcification

Discussion
What are the usual presentations of varicose veins?
- It is more common in females (10:1). It is much more common in females with a family history.
- Often it is familial.
- Familial varicose veins begin in younger age group and are seen bilaterally, involve all veins including deep veins.
- Visible dilated veins in the leg with pain, distress, nocturnal cramps, feeling of heaviness, pruritus.
- Pedal oedema, pigmentation, dermatitis, ulceration, tenderness, restricted ankle joint movement.
- Bleeding, thickening of tibia occurs due to periostitis.
- Positive cough impulse at the saphenofemoral junction.

What are the aetiologies for varicose veins?
Varicosities are more common in lower limb. Because of erect posture long column of blood has to be supported which can lead to weakness and incompetence of valves leading to varicosities.

a. Primary varicosities are due to—
   - Congenital incompetence or absence of valves.
   - Weakness or wasting of muscles.
   - Stretching of deep fascia.

b. Secondary varicosities are due to—
   - Recurrent thrombophlebitis.
   - Occupational—standing for long hours.
   - Obstruction to venous return like abdominal tumour, retroperitoneal fibrosis, lymphadenopathy.
   - Pregnancy (due to progesterone hormone).
   - A-V malformations—congenital or acquired.
   - IVC/Iliac vein thrombosis.

What is the definition of the varicose veins?
It is dilated, tortuous and elongated superficial vein with reversal of blood flow due to incompetence of valves.

What are the sites where varicosities can occur?

Sites where varicosities can occur
- Lower limb
- Pampiniform plexus of veins-varicocele
- Vulva
- Sites of portosystemic anastomosis (piles)

Venous Ulcer
It is the complication of varicose veins or deep vein thrombosis.

Fig. 1.142: Venous ulcer—typical site around the ankle.
Pathogenesis of Venous Ulcer

Varicose veins or DVT which are recanalised, eventually causes chronic venous hypertension around ankle.

↓

Causes hemosiderin deposition in the subcutaneous plane from lysed RBC’s, Eczema

↓

Dermatitis and lipodermatosclerosis

↓

Fibrosis—Anoxia

↓

Ulceration

• Area where venous ulcer commonly develops is around and above the medial malleoli because of presence of large number of perforators which transmit pressure changes directly into superficial system. This area is called as Gaiter’s zone. It can be seen on both malleoli.
• Ulcer is often large, nonhealing, tender, recurrent with secondary infection. Vertical group of inguinal lymph nodes are usually enlarged and tender.
• Often it leads to scarring, ankylosis, Marjolin’s ulcer formation. Slough from the ulcer bed may give way causing venous haemorrhage.
• Periostitis is common which also prevents ulcer from healing.
• Due to regular walking on toes so as to get relief from pain causes contraction and extra-articular fibrosis of Achilles tendon. Proper exercise is the remedy – talipes equino varus.

Investigations

• Discharge from the ulcer for C/S.
• X-ray of the area to look for periostitis.
• Biopsy from the ulcer edge to rule out Marjolin’s ulcer.

Treatment

Bisgaard method of treating venous ulcer

• Elevation
• Massage of the indurated area and entire calf
• Passive and active exercise

• Pressure bandage (crepe bandage). Multilayered (four) pressure bandage with pressure of 45 mmHg is also very useful. This optimum pressure promotes the ulcer healing without injuring the leg.
• Care of ulcer by regular cleaning with povidone iodine, H₂O₂.
• Dressing with EUSOL. (EUSOL is Edinburgh university solution of lime containing boric acid, hypochlorite, and calcium hydroxide).
• Antibiotics depending on C/S of the discharge.
• Once ulcer bed granulates well, split skin graft (SSG, Thiersch graft) is placed.
• Specific treatment for varicose veins should be undertaken—Trendelenburg’s operation, stripping of veins, perforator ligation.

Note:

50% of venous ulcer occurs as a result of recanalisation of DVT, and the leg is commonly called as post phlebitic limb (leg). It presents with all complications of venous diseases like eczema, ulceration, lipodermatosclerosis, and venous ulcers.

Here surgery for superficial varicose veins is contraindicated. Venous valve repair (Kistner’s valvuloplasty) or drugs like Stanazolol which reduces the fibrous tissue in turn increases the oxygenation are beneficial.
What are the types of varicose veins?
1. Long saphenous vein varicosity.
2. Short saphenous vein varicosity.
3. Varicose veins due to perforator incompetence.

Complications of venous ulcers
- Haemorrhage
- Marjolin’s ulcer
- Infection
- Talipes equino varus
- Periostitis is common over the tibia
- Disability
- Calcification
- DVT

Fig. 1.144: Stockings should be worn for 3 months after therapy. It should be worn from toes to knee joint.

Figs 1.143A and B: Typical site of venous ulcer. When ulcer granulates well-split skin grafting is done. Definitive treatment for varicose veins should be done.

Figs 1.145A and B: Tortuous, elongated dilated long saphenous vein.

Figs 1.146A and B: Photo of short saphenous vein varicosity and its diagrammatic location.
4. **Thread veins (dermal flares)**: Are small varices in the skin usually around ankle which look like dilated, red or purple network of veins. <3 mm in size.
5. **Reticular varices**: Are slightly larger than thread veins located in subcutaneous region. >3 mm in size.
6. Combinations of any of above.

**What is lipodermatosclerosis? What are the theories of the problems of varicose veins?**
Fibrin deposition, scarring and tissue hypoxia due to chronic venous hypertension around ankle joint is called as *lipodermatosclerosis*. It is irreversible change in the soft tissue which eventually leads into ulceration.

<table>
<thead>
<tr>
<th>Two theories</th>
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<tr>
<td>1. Fibrin cuff theory</td>
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<tr>
<td>2. White cell trapping theory</td>
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Incompetence of venous valves ↓
Stasis of blood ↓
Chronic ambulatory venous hypertension (Pressure up to 80-100 mmHg) ↓
Defective microcirculation ↓
RBC’s diffuses into tissue planes ↓
Lysis of RBC’s ↓
Release of haemosiderin, pigmentation ↓
Dermatitis ↓
Capillary endothelial damage ↓
Prevention of diffusion and exchange of nutrients ↓
Severe anoxia ↓
Chronic venous ulceration. (*Fibrin cuff theory*).

Inappropriate activation of trapped leucocytes release proteolytic enzymes which cause cell destruction and ulceration—*White cell trapping theory*.

**What are different types of perforators?**
- Ankle perforators (May or kuster).
- Lower leg perforators I, II, III (of Cockett).
- Gastrocnemius perforators (of Boyd).
- Mid thigh perforators (Dodd).
- Hunter’s perforator in the thigh.

**What is CEAP classification?**
It is the classification used for lower extremity venous diseases.

| C—Clinical signs (grade 0-6); (A) for asymptomatic or (S) for symptomatic presentation. |
| E—Aetiological classification (congenital, primary, secondary) |
| A—Anatomic distribution (Superficial, deep or perforator) |
| P—Patho-physiologic dysfunction (reflux or obstructive) |

**Grading of clinical signs**
0—no visible or palpable signs of venous diseases
1—Telangietases, reticular veins or malleolar flare
2—Varicose veins
3—Oedema without skin changes
4—Skin changes due to venous diseases like pigmentation, eczema or lipodermatosclerosis.
5—Skin changes as above with healed ulceration
6—Skin changes as above with active ulceration

**Physiology of Venous Blood Flow in Lower Limb**
Veins are thin walled vessels with collapsible walls that assume an elliptical configuration in collapsed state and circular configuration in the filled state.
Venous valves are abundant in the distal lower extremity and the number of valves decreases proximally, with no valves in superior and inferior vena cava.

**Venous Return**

1. Arterial pressure across the capillary increases the pumping action of vein.
2. *Calf musculovenous pump*: During contraction phase of walking, pressure in the calf muscles increases to 200-300 mmHg. This pumps the blood towards the heart. During relaxation phase of walking, pressure in the calf falls and so it allows blood to flow from superficial to deep veins through perforators. Normally while walking, pressure in the superficial system at the level of ankle is 20 mmHg.
3. During walking, foot pump mechanism propels blood from plantar veins into the leg.

**Factors responsible for venous return:**
- Negative pressure in thorax
- Peripheral pump—calf muscle
- Vis-a–tergo of adjoining muscle
- Nonrefluxing valves in course of veins

**Deep Vein Thrombosis (DVT)**

**Aetiology**

*Virchow’s triad:*
- Stasis.
- Hypercoagulability.
- Vein wall injury.

**Causes**

1. Following childbirth.
2. Trauma.
3. Muscular violence.
4. Immobility.
5. Debilitating illness, obesity, bed rest, pregnancy, puerperium, oral contraceptives, and estrogens.

6. *Postoperative thrombosis*: Common after the age of 40 years. Incidence following surgeries is 30%. In 30% of cases both legs are affected. Usually seen after prostate surgery, hip surgery, major abdominal surgeries, gynaec surgeries, cancer surgeries. Bedridden for more than 3 days in the postoperative period increases the risk of DVT.

7. *Spontaneous thrombosis* is common in visceral neoplasm like carcinoma pancreas or carcinoma stomach. It is often migrating type.

8. Thrombus may start in a venous tributary which eventually may extend into the main vein causing DVT.

9. Axillary vein thrombosis can occur spontaneously, following compression by cervical rib, by various causes of thoracic inlet syndrome, or arm being in the hyper abduction state for prolonged period (e.g painting the ceiling), after axillary lymph node block dissection, after radiotherapy to axilla, occasionally as a complication of venous cannulation.


11. Deficiencies of antithrombin III, protein C, protein S.

**Sites**


**Phlegmasia alba dolens:**
It is DVT of *femoral vein* (deep femoral vein commonly) causing painful congestion and oedema of leg, with lymphangitis, which further increases the oedema and worsens the situation. *(White leg).*

**Phlegmasia caerulea dolens:**
It is extensive DVT of iliac and pelvic veins causing blue leg with either venous gangrene or areas of infarction.
Clinical Features
1. Fever—earliest and common symptom.
2. Pain and swelling in the calf and thigh (often). Commonly associated with fever. Pain is often so severe that the patient finds difficult to flex (or move) the leg.
3. Leg is tense, tender, warm, pale or bluish with stretched and shiny skin.
4. Positive Homan’s sign: Passive forceful dorsiflexion of the foot with extended knee will cause tenderness in the calf.
5. Mose’s sign: Gentle squeezing of lower part of the calf from side to side is painful. Gentleness is very important otherwise it may dislodge a thrombus to form an embolus.
6. Neuhof’s sign: Thickening and deep tenderness is elicited while palpating deep in calf muscles.
7. Most often, DVT is asymptomatic and presents suddenly with features of pulmonary embolism like chest pain, breathlessness and haemoptysis.

Investigations
1. Venous Doppler.
2. Duplex scanning.
3. Venogram.
4. Radioactive I^{125} fibrinogen study.
5. Haemogram with platelet count.

Treatment
1. Rest, elevation of limb, bandaging the whole limb with crepe bandage.
3. For fixed thrombus: Initially high dose of heparin of 25,000 units/day for 7 days has to be given. Later patient is advised to continue with warfarin for 6 months. Low molecular heparin can also be used. Dose is controlled by assessing Activated Partial Thromboplastin Time (APTT). Duration of heparin treatment is usually for 5 days.
4. For free thrombus: Fibrinolysins-Streptokinase or urokinase or tissue plasminogen activator are used to dissolve thrombus (It should not be given when patient is on heparin).
5. Venous thrombectomy is done using Fogarty venous balloon catheter.
6. Thrombotic emboli is prevented from reaching the heart by filtering it at IVC level using Kim ray Greenfield filter, suture sieve plication, staple plication, vena caval ligation, Mobin Uddin umbrella filter.
7. Palma operation: In iliofemoral thrombosis, common femoral vein below the block is communicated to opposite femoral vein through opposite long saphenous vein.
8. May-Husni operation: When blockage is in popliteal vein, popliteal vein below the block is anastomosed to long saphenous vein (end to end) so as to by pass the blood across popliteal block.

Prevention of DVT
1. Care has to be taken to see for proper positioning of legs with no pressure on the calf muscles.
2. Pressure bandage to the legs has to be applied during major surgeries, laparoscopic surgeries. During postoperative period, elevation, massaging, pressure bandage, early ambulation, maintaining hydration are essential measures.

3. Low dose heparin is given in suspected cases, in major surgeries and continued during postoperative period till the patient is ambulated. 5000 units is given subcutaneously 2 hours before surgery.

4. Various measures like graduated static compression, elastic stockings, electrical stimulation of calf muscles, pneumatic compression are used to prevent sluggish flow of blood.

5. Intravenous dextran 70, 500 ml during surgery and another 500 ml postoperative period in 24 hours can also be used to prevent DVT.

### Effects and sequelae of DVT
- Pulmonary embolism.
- Infection.
- Venous gangrene.
- Partial recanalisation, chronic venous hypertension around the ankle region causing venous ulcers.
- Recurrent DVT.
- Propagation of thrombus proximally.

### Anticoagulants

#### Heparin
- It is a natural anticoagulant, a mucopolysaccharide.
- It prevents clotting of blood both in vivo and in vitro by acting on all three stages of coagulation. It prolongs clotting time and activated thromboplastin time in specific (by 1.5–2.0 times the control).
- Heparin also causes hyperkalaemia.
- Commercial heparin is derived from lung and intestinal mucosa of pigs and cattle.
- The onset of action is immediate after administration and lasts for 4 hours.
- It is metabolised in the liver by heparinase.
- It does not cross placental barrier and not secreted in breast milk.

#### Indications
- As prophylaxis in major surgeries, postoperative period, puerperium.
- As therapy in DVT.

#### Dose
- For prophylaxis: 5,000 units/SC ly. 8th hourly.
- For therapy: 10,000 units/IV ly. 6th or 8th hourly. Later change to subcutaneous dose.
- In severe cases, 5000 units to 20,000 units is given daily through IV infusion at a rate of 1000 units per hour. Daily dose should not exceed 25,000 units.

Note: Heparin should not be given intramuscularly and should not be combined with streptokinase or urokinase.

Heparin is not given orally.

Heparin administration should always be monitored with APTT.

#### Complications
Allergy, bleeding, thrombocytopenia.

#### Low Molecular Weight Heparin (LMWH)
It is a commercially prepared heparin with a molecular weight of 4000 to 6500.

#### Advantages
- They are absorbed more completely.
- Have a longer duration of action.
- Have a better anticoagulant effect.
- Less interaction with platelets.
- Less antigenic.
- Usage is easier and acceptable.

#### Disadvantages: They are expensive.
Presently LMWH are becoming very popular. Enoxaparin, dalteparin, parnaparin, reviparin.

#### Heparin Antagonist
50 mg of 1% protamine sulphate solution is given slow intravenous.
Oral Anticoagulants
They are given orally and are slow acting.

Types
1. **Coumarin derivatives**: Bishydroxycoumarin (Dicoumarol)—First coumarin drug derived from sweet clover.
   *Warfarin sodium*: Commonest oral anticoagulant used.
2. **Indandione derivative**:
   - Phenindione.
   - Anisindione.

Mode of Action of Oral Anticoagulant Therapy
- By suppressing synthesis of prothrombin, factors VII, IX, and X.
- By inhibiting carboxylation of glutamic acid through vitamin K.

Features
- Oral anticoagulant does not have *in vitro* action.
- They are slow acting, and long acting.
- Control of oral anticoagulant therapy is by *monitoring prothrombin time*.
- PT comes to normal only 7 days after cessation of the drug.
- They cross placental barrier and known to cause teratogenicity when given in 1st trimester.
- *They are secreted in breast milk.*

**Indication**
- In DVT, for maintenance therapy after cessation of heparin.
- After valve replacement surgery.

**Side Effects**
1. **Bleeding**: It may require blood transfusion to control.
2. Cutaneous gangrene.
3. Fetal haemorrhage and teratogenicity.
4. Alopecia, urticaria, dermatitis.
5. *Drug interactions*: With NSAIDs, cimetidine, omeprazole, metronidazole, cotrimoxazole, erythromycins, barbiturates, rifampicin, griseofulvin.

**Warfarin Sodium**
Warfarin Sodium (*W*iskonian *A*lumni *R*esearch Foundation + coum*AR*IN derivative) is the commonest drug used. It has got lesser side effects. It has got cumulative action and so given in tapering dose.

Dose is 5 mg once a day.

It should be discontinued 7 days before any surgery like tooth extraction and prothrombin time should return to normal level. During surgery if excess bleeding occurs, blood transfusion may be given.
WRITING A CASE SHEET IN A CASE OF BREAST LUMP

**History Taking**

**Chief Complaints**
- Swelling in the right/left breast/both breasts; its time duration.
- Pain in the breast with duration.
- Ulceration in the breast with duration.
- Discharge from nipple.
- Ulceration over the breast/swelling.
- Swelling in the axilla/neck.

**History of Present Illness**

**Swelling:** Duration, its progression whether slowly increasing in size or rapidly increasing has to be asked for. Swellings of short duration are most probably due to carcinoma. But most often, after noticing the swelling the patient immediately consults a doctor for opinion and so duration may not be clearly obtained. Swelling in the opposite breast is also important. In 2% of cases, breast carcinomas are bilateral; and fibrocystadenosis is commonly bilateral.

**Pain:** In the breast, it is often called as mastalgia. It is common in fibrocystadenosis and acute mastitis. There will be associated fever in mastitis. Carcinoma breast is painless to begin with but eventually becomes painful following infiltration or development of tumour necrosis or skin ulceration/fungation. Pain in fibroadenosis is more prior to menstruation (cyclical), and may disappear during pregnancy and after menopause. Duration of pain, type, timing, site and relation to menstruation has to be noted.

**Nipple discharge:** Duration of discharge, its type whether serous/purulent/bloody/serosanguinous/milky/greenish has to be asked for and noted. Bloody discharge is often seen in duct papilloma, carcinoma. Serous and greenish discharge is seen in fibroadenosis.

**History of changes in nipple:** Like retraction (depression), deviation, destruction, displacement, discoloration, duplication and discharge is noted. Recent history of changes signifies carcinoma. Often retraction may be congenital, since birth.

**History of alteration in size and symmetry of the breasts with duration.**

**History related to swelling in the axilla/neck and their details like duration, progress, pain, ulceration, etc. is noted.**

**History related to respiratory problems** has to be asked like chest pain/breathlessness/cough/haemoptysis—signifies the secondaries in lung from carcinoma breast.

**History of abdominal pain,** loss of appetite, decreased weight, jaundice, abdominal distension which signifies liver secondaries has to be asked for.

**History related to bone secondaries:** Like bone pain, low back pain, altered sensation like sense of position and vibration, lower limb weakness, features of paraplegia, loss of control over urination and defaecation is asked for.

**History of convulsions,** loss of consciousness, vomiting, limb weakness, headache, visual disturbances, behavioural changes (psychological like features) and localisation changes.

**Past History**

**Past history of any surgeries** of breast (recurrence can occur after excision of fibroadenoma, conservative breast surgery may cause recurrent carcinoma breast) or drug therapies like for fibroadenosis.

**Menstrual History, Obstetric History and Family History**

This is important in breast diseases. Family history of carcinoma of breast (in mother, grandmother,
aunt, cousins, 1st and 2nd degree relatives), ovarian tumour or other tumours has to be noted. Breast carcinoma can be familial. Often multiple tumours can occur. History of menarche, menstrual cycles, number of pregnancies, breast feeding, lactation, menopause, last child birth and usage of contraceptives/postmenopausal HRT are very important.

**Personal History and Treatment History**
History of smoking, alcohol intake, dietary habits is noted. History of any drug intake at present is important.

**General Examination**
Like for any other long case, patient should be examined for palor, jaundice, oedema feet, clubbing. Pulse and blood pressure should be checked.

**Local Examination of Breasts**

*Inspection*
For proper inspection, both breasts should be exposed properly including axillae. Initially examination is carried out with the patient sitting with 45° semi recumbent position. Later examination is done in lying down position. During inspection, the clinician should stand in front and later on the side of the patient. Usually normal breast should be first examined.

**Fig. 1.148:** Accessory nipple is not an uncommon condition.

**Figs 1.149A and B:** Examination of breast is done in sitting position with arms beside.

**Figs 1.150A and B:** Examination with both arms raised above the shoulder and with leaning forward.
Inspect both breasts: Note the size, shape and symmetry. Asymmetry can be seen in breast lumps. Inspect both breasts while leaning forward to see whether both breasts fall forward or not. In carcinoma, if the breast is fixed to underlying chest wall, it will not fall forward. Both breasts should be inspected while the arms are raised upwards to see whether breast is/breasts are adherent to chest wall.

Inspection of nipple: Look for symmetry/asymmetry, pushed up/down, displacement, retraction, size/shape of nipple, discharge/ulceration in the nipple, discolouration, duplication, cracks/fissures. Many of these changes occur in carcinoma. Fissuring and cracks can occur in breast feeding mothers during lactation. Nipple retraction may be due to infiltration of lactiferous duct by carcinoma.

Areola should be inspected for any changes in color, size, ulceration, eczema/eczema like changes. Both areolas should be inspected. Areola is pink in colour in young girls, dark coloured in adults, brownish during pregnancy and lactation. Ulceration of nipple can occur in carcinoma and Paget’s disease of breast, a localised type of carcinoma breast. It should be differentiated from eczema. Eczema is commonly bilateral without any nodule underneath, associated with itching and vesicles, with normal nipple. It is common during lactation. Paget’s disease of breast is unilateral, without vesicles and itching, with a hard lump underneath, often with destruction of nipple.

Skin over the breast is inspected for retraction, pigmentation, redness/shining, dimpling, puckering, Peau d’orange, nodules, ulceration, fungation, and scar. Any dilated veins over the skin and cancer-en-cuirasse is looked for. Involvement of the ligament of Cooper causes dimpling and puckering of skin over the breast. Oedema of skin is due to blockade of cutaneous lymphatics causing burial of sweat glands and hair follicles giving the appearance of orange peel (Peau d’orange). When ulcer is present, its position, size, shape, margin, floor, edge should be noted. Cancer-en-cuirasse is extensive involvement of the skin over the breast and chest wall with multiple nodules and ulceration by the carcinoma. It looks like armor coat.

Swelling in the breast is an important finding to be inspected. Its location in relation to the
quadrants of the breast, extent, size, shape, margin, surface, skin over it should be examined.

**Palpation**

Normal breast should be palpated first. Palpation should be done by the palmar aspect of the fingers. During palpation one should look for raise in temperature over the breast (observed in mastitis but also can occur in vascular tumours like medullary carcinoma and sarcoma), tenderness, nature of the swelling—its size, shape, extent, surface, margin, consistency (carcinoma is hard/stony hard and irregular), fixity to breast tissue (swelling will not have independent/differential mobility), fixity to skin (by pinching the skin), fixity to pectoral fascia (by tethering), fixity to pectoralis major muscle/serratus anterior muscle/latisimus dorsi muscle. Palpate ulcer—look for tenderness, its edge and base for induration, bleeding on palpation. Nipple and areola should be palpated for tenderness, eversion, induration and discharge.

Examination of ipsilateral, regional axillary lymph nodes. Anterior/pectoral, central/medial, posterior, lateral, apical lymph nodes should be examined.

Supraclavicular lymph nodes should be examined.

Opposite axillary nodes are also examined. It may get involved through retrograde spread from internal mammary nodes or through cutaneous lymphatics.

Examination of arms for venous oedema or lymphoedema. Venous oedema may be due to axillary vein compression by nodal mass. Lymphoedema may be due to lymphatic block following nodal involvement. Lymphoedema is mainly distal. It is gradual in onset and progressive. Venous oedema is sudden in onset, with bluish discoloration over the skin, uniform in both distal and proximal aspect of the upper limb (forearm and arm).

Examination for mediastinal node involvement—it is done by percussion. Initially percuss for liver dullness. Then percussion is done one space above from lateral to medial, to widened mediastinal border. Mediastinal nodes are common in middle mediastinum.

Examination of respiratory system for secondaries—altered breath sounds, features of consolidation or pleural effusion are looked for.

Examination of abdomen—to look for palpable nodular liver, Krukenberg ovaries in menstruating age group, and ascites. It is completed with digital examination of rectum (P/R), and per vaginal examination.
Always examine abdomen for liver enlargement, ascites or Krukenberg's tumour (in premenopausal age).

Examination of pelvis, spine, long bones for any swelling/tenderness/pathological fracture/restricted movements of spine, hips, etc.

Examination of central nervous system to look for any neurological deficits following metastatic disease in the brain.

**Diagnosis**

Complete diagnosis with side and staging should be given/written in case sheet. TNM staging is used.

Example: Carcinoma left breast stage II-T1, N1, M0.

**Discussion**

Breast is examined in different positions to elicit different clinical features.

- Sitting position with arms by the side
- 45° semirecumbent position is very much convenient
- Sitting position with leaning forward
- Sitting position with arms over the waist
- Sitting position with arms rising above the shoulder—to see fixity to chest wall and changes in nipple.
- Lying down position for self-examination

Breast self examination (BSE) has got a major role in early detection of the carcinoma breast.

Ideally done once a month, just after the menstruation, as during this time breasts are less engorged. In postmenopausal age group it is done regularly at monthly intervals (fixed day of the month).

- Examine both breasts.
- American cancer society recommends monthly BSE after 20 years of age.
- Remind the patient that 90% of breast lumps are not cancer.
- Better way is in lying down position with arm raised with a mattress support behind.
- Palpation is done over all quadrants of the breast using the fingers.
- If any doubtful swelling is palpable, consult the surgeon.
- Nursing mother should perform BSE just after feeding the baby.

**Assessment of Nipple Deviation**

Nipple changes are assessed by inspection, palpation and measurement. Displacement of nipple is assessed by measuring distance between mid-clavicular point to the nipple. This reveals any upward/downward displacement of nipple. Outward/inward displacement is assessed by measuring the distance of nipple from mid-line.
Quadrants of breast

- Quadrants of breast are marked by drawing two lines, vertical and horizontal along the nipple.
- Upper outer quadrant (includes axillary tail also)—commonest site for carcinoma
- Lower outer quadrant
- Upper inner quadrant
- Lower inner quadrant—close to mediastinum
- Central quadrant—nipple and areola region

Fixity of the lump to breast tissue is checked by holding the breast tissue in one hand and moving the lump in other hand. If lump is fixed to breast tissue, then breast tissue moves along the lump.

Skin tethering can be demonstrated by moving the lump one side. It is due to inward puckering of the skin following involvement of the elastic Cooper’s ligament which becomes inelastic. Dimpling of skin appears which can be demonstrated by raising the arms above the shoulder level. When skin tethering occurs lump can be moved in the arc anywhere without moving the overlying skin where as lump cannot be moved at all without moving the skin in skin fixation.

Fixity to pectoralis major muscle is checked in sitting position. Patient is asked to keep her hands on her waist. Lump is moved along the direction of the muscle and also perpendicular to the direction of the muscle. Patient is asked to hold the hands tight and pressed over the waist to contract the pectoralis major muscle (action of the muscle is flexion of the shoulder) which is confirmed by feeling the taut muscle. Lump is again moved along the direction and perpendicular to the direction of the muscle. Mobility will be restricted, if lump is adherent to the pectoralis major muscle. It becomes T3 stage.

Figs 1.157A and B: Quadrants of breast. Carcinoma is more common in upper outer quadrant as more breast tissue is located in this quadrant.

Fig. 1.158: Peau d’orange appearance of skin in carcinoma breast. It is due to blockade of dermal lymphatics.
Fixity to latissimus dorsi muscle is checked in sitting position with examiner by the side of the patient. Latissimus dorsi is an extensor of the shoulder joint. Initially mobility of the lump is checked and then arm is extended against resistance with elbow flexed 90° to contract the latissimus dorsi. If now mobility of the lump is restricted, then it confirms that lump is fixed to latissimus dorsi muscle.

Fixity to serratus anterior muscle is checked by checking the mobility of the lump before and after contracting the serratus anterior. Contraction of serratus anterior is achieved by pushing the outstretched both hands against resistance over the wall and checking for restriction of mobility of the lump. It signifies involvement of chest wall—T4.

Chest wall fixity can be assessed by absence/presence of mobility of the mass; and breast with mass will not fall forward if it is fixed to underlying chest wall; and on raising the arm above shoulder breast with mass will not raise upward. Chest wall fixity means fixity to ribs and intercostals muscles.

**Palpation of axillary lymph nodes** is an important step in examination of carcinoma breast.
Anterior/pectoral group of nodes are commonly involved nodes. Patient will be in sitting position. Raise the patient’s arm high and inspect the axilla. Place the patient’s forearm over examiner’s forearm. Palpate the relaxed axilla over pectoralis major muscle for any lymph nodes. Examiner will use his left hand to examine the nodes (of right axilla) and his right hand will be over patient’s left shoulder to support.

Interpectoral nodes (Rotter’s) are also palpated similarly by insinuating the fingers between the two pectori. It signifies retrograde spread of the tumour. It is often difficult to palpate.

Central/medial group of nodes are palpated in similar way like pectoral nodes but hand in
the axilla is directed medially over the lateral chest wall and with gentle rolling movements. Lateral/humeral group of nodes are palpated with examiner’s right hand (for right axilla) with left hand placed over same side shoulder.

![Fig. 1.165: Examination of lateral group of lymph nodes.](image1)

Posterior/subscapular nodes are palpated with patient in sitting position and examiner standing behind the patient. By raising the arm and forearm of the patient from opposite side the posterior axillary fold is palpated between thumb and fingers.

![Fig. 1.166: Examination of posterior group of lymph nodes.](image2)

Apical nodes are palpated (for right axilla) with left hand of the examiner placing high in the axilla with right hand supporting over the shoulder and supraclavicular region of the same side of the axilla. It is often difficult to palpate.

![Fig. 1.167: Examination of apical group of lymph nodes.](image3)

Supraclavicular nodes are palpated using fingers over supraclavicular fossa by standing behind the patient who is asked to shrug the shoulder.

![Fig. 1.168: Examination of supraclavicular group of lymph nodes.](image4)

Axillary nodes on opposite side are also examined. Opposite axilla can be examined by examiner standing on the same side by leaning over the patient or can be examined by standing on the opposite side. Its involvement signifies stage IV disease. It is confirmed by FNAC.
Levels of the axillary nodes

Level I: Below and lateral to the pectoralis minor muscle—anterior, lateral, posterior

Level II: Behind the pectoralis minor muscle—central

Level III: Above and medial to pectoralis minor muscle—apical

Fig. 1.169: Surgical levels of lymph nodes in the axilla draining from breast.

Axillary tail of the Spence is the extension of the upper outer quadrant of breast across foramen Langer deep to deep fascia. Foramen Langer is an opening in deep fascia over outer aspect of the breast which allows part of breast tissue to extend under deep fascia, otherwise rest all breast tissue is in subcutaneous plane. Axillary tail is located adjacent to outer border of the pectoralis major muscle. When it is involved by carcinoma it should be differentiated by pectoral node enlargement. Axillary tail will move along with main breast tissue whereas pectoral node will not move when breast is moved but it has got independent mobility. Axillary tail often extends over the lateral edge of the pectoralis major muscle up to axilla.

Fixed enlarged axillary nodes can cause lymphoedema due to lymphatic block; venous thrombosis and venous oedema due to venous block; and severe excruciating pain along the distribution of the median and ulnar nerves (rare in radial nerve) with often significant sensory and motor deficits due to tumour infiltration of the cords of brachial plexus (medial cord often lateral cord).

Fig. 1.170: Axillary tail of Spence.

Note:
- Spread restricted to Level I nodes carries better prognosis
- Spread to Level II has poor prognosis
- Spread to Level III indicates worst prognosis

Cystic swellings of the breast

- Blood good cyst.
- Breast abscess.
- Hydatid cyst.
- Galactocele.
- Serocystic disease of Brodie
- Cystic necrosis in carcinoma breast.
- Lymph cyst.
- Haematoma in breast.

Mastitis

- Mastitis of infancy (Witches milk) is due to maternal hormone in infant blood. It usually subsides but may cause suppuration.
- Mastitis of puberty is common in boys, is invariably unilateral with tender, swollen and inflamed breast.
- Mastitis of mumps is usually unilateral and can occur in both sexes.
- Bacterial mastitis is seen in adult women commonly lactating and is due to *Staphylococci* infection.
- Subareolar mastitis is due to infection of gland of Montgomery or due to areolar furuncle.
Differences between Paget’s disease and eczema of nipple

<table>
<thead>
<tr>
<th>Paget’s disease (Jame’s Paget-1874)</th>
<th>Eczema</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Unilateral</td>
<td>Bilateral</td>
</tr>
<tr>
<td>• Edges are distinct</td>
<td>Edges are indistinct</td>
</tr>
<tr>
<td>• Itching absent</td>
<td>Itching present</td>
</tr>
<tr>
<td>• Seen in menopausal women</td>
<td>Occurs during the time of lactation</td>
</tr>
<tr>
<td>• Vesicles absent</td>
<td>Vesicles present</td>
</tr>
<tr>
<td>• Nipple is usually destroyed</td>
<td>Nipple is usually intact</td>
</tr>
<tr>
<td>• Underlying lump is usually present</td>
<td>No underlying lump</td>
</tr>
</tbody>
</table>

Discharges from the nipple

**Blood**
- Carcinoma
- Ectasia
- Papilloma

**Serous**
- Fibrocystic disease
- Ectasia

**Greenish**
- Ectasia
- Fibrocystic disease

**Purulent**
- Infection
- Sometimes malignancy

**Milk**
- Lactation (Physiological discharge)
- Galactorrhoea

**Serosanguinous**
- Carcinoma
- Infection

In Paget’s disease, there will be a hard nodule just underneath the areola, which later ulcerates and also causes destruction of nipple. Histologically it contains large, ovoid, clear Paget’s cells with malignant features.

**Causes of lymphoedema in carcinoma breast**
- Involvement and fixation of the axillary nodes level I, II and III
- After levels I, II and III dissection
- After radiotherapy to axilla
- Recurrent axillary disease

Figs 1.171A and B: Paget’s disease of the breast.

Fig. 1.172A: Subareolar carcinoma with destruction of nipple-areolar complex.
SRB's Bedside Clinics in Surgery

Treatment of lymphoedema of arm
- Elevation of limb
- Elastic stockings
- Pneumatic compression
- Drugs like diuretics and benzopyrones

Features of lobular carcinoma in situ
- Predominantly premenopausal
- Need not be detected by mammography
- It is an incidental pathological entity
- Multifocal and bilateral
- Clinically, it do not form a lump
- Does predispose to invasive cancer
- 50% cancers can develop in the contralateral breast

Fig. 1.174: Carcinoma breast over the commonest site—upper outer quadrant—more visible on raising the arm.

Fig. 1.172B: Carcinoma breast with rib secondaries.

Fig. 1.175: Carcinoma breast with extensive skin involvement.

Fig. 1.173: Ulcerated carcinoma breast with Peau' d'orange. Note the lymph node enlargement.

Fig. 1.176: Recurrent carcinoma of breast. Note the recurrent tumour nodules.
Staging of Carcinoma Breast (Manchester and TNM Staging)

**Manchester Staging**
1. Tumour in the breast, not involving pectoral or deeper plane. Skin involvement if present, it is lesser than the size of tumour. Lymph nodes are not palpable.
2. Same as stage I but with *mobile, discrete lymph nodes palpable in the ipsilateral axilla*.
3. Tumour fixed to pectoral muscle or skin involvement more than the tumour size or ipsilateral axillary lymph nodes adherent to each other.
4. Tumour fixed to the chest wall, ‘cancer-en-cuirasse’, skin involvement wider than that of the breast or ipsilateral or contralateral side supraclavicular lymph nodes or opposite breast or opposite axillary lymph nodes or spread to bone, lung, liver or inflammatory carcinoma of breast.

**TNM Staging**

*Tumour*
1. T₁—Tumour size <2 cm in greatest diameter (T₁a—0.1-0.5 cm, T₁b—0.5-1.0 cm, T₁c—1-2 cm).
2. T₂—Size 2-5 cm.
3. T₃—Size >5 cm.
4. T₄—Tumour fixed to chest wall or skin (T₄a—fixed to chest wall, T₄b—fixed to skin, T₄c—T₄a+T₄b, T₄d—inflammatory carcinoma breast).

*Node*
- N₀—No nodes.
- N₁—Axillary nodes mobile.
- N₂—Axillary nodes fixed to one another and other structures.
- N₃—Supraclavicular nodes. Oedema of arm and internal mammary lymph nodes.

*Metastasis*
- Mo—No metastasis.
- M₁—Distant metastases.

**The Columbia Classification (Haagsen, Cooley and Stout)**

*Grave signs*
- Oedema of skin: Stage A—only tumour. No grave signs.
- Skin ulceration: Stage B—tumour + axillary lymph nodes < 2.5 cm.
- Fixity to chest wall: Stage C—tumour + any one of five grave signs.
- Axillary lymph nodes >2.5 cm: Stage D—two more Grave signs.
- Fixed axillary lymph nodes: Supraclavicular lymph node involvement.

**Stage A** — No skin oedema, ulceration, or fixation to chest wall. Axillary nodes are not clinically involved.

**Stage B** — Clinically involved axillary nodes less than 2.5 cm in diameter. Not fixed.

**Stage C** — Grave signs of comparatively advanced carcinoma. Oedema of skin, skin ulceration, fixation to chest wall. Massive axillary involvement with nodes > 2.5 cm in diameter. Axillary fixation.

**Stage D** — Advanced carcinoma including two or more signs in stage C. In addition satellite nodules, supraclavicular nodes. Inflammatory cancer, arm oedema or distant metastasis.
Causes of massive enlargement of breast
- Benign hypertrophy usually bilateral.
- Giant fibroadenoma.
- Serocystic disease of Brodie.
- Sarcoma.
- Carcinoma often when extensively involved.
- Filariasis of breast.

Changes that can occur in nipple
- Destruction
- Depression (retraction).
- Discoloration.
- Displacement.
- Deviation.
- Discharge.
- Duplication

Causes of hard swellings in the breast
- Carcinoma breast.
- Antibioma breast.
- Traumatic fat necrosis.
- Calcified haematoma.
- Fibroadenoma—hard variety.

How carcinoma breast is suspected?
Any lump in the breast can be malignant unless proved otherwise. But one has to remember that every breast lump need not be always malignant. Duration, progression, nodal status, hard consistency, often irregular surface and late features like fixity, ulceration/fungation and distant spread are the features to consider carcinoma breast.

Differential diagnosis for carcinoma breast
- Fibroadenosis.
- Traumatic fat necrosis
- Tuberculosis of breast.
- Bloodgood cyst
- Filariasis breast.
- Mastitis.
- Antibioma.
- Galactocele
- Mondor’s disease.
- Cystosarcoma phylliodes.
Figs 1.180A and B: Fungating carcinoma breast. Note the extension of fungation into the chest wall.

What are the investigations done for breast lump?

Investigations in carcinoma breast—

1. **Mammography**
   - It is plain X-ray of soft tissue of breast using low voltage and high amperage X-rays. Two films are taken.
   - *Cranio caudal* from above downward.
   - *Mediolateral* from side to side.

   Dose of radiation is 0.1 Gy, a low dose. So it is a safe and effective procedure.

   **Findings**
   - Microcalcifications signify malignancy
   - Soft tissue shadow may be smooth and regular in benign conditions or irregular in carcinomas
   - Size and location of mass lesion is assessed with nipple and skin change (thickness).
   - Spiculations
   - Mammary duct distortion

  Breast imaging reporting and data system (BI-RADS) has got its own categories, assessment and recommendations.
Digital mammography is computerised electronic image of the breast with enhanced magnified pictures. Digital spot-view mammography allows faster and more accurate stereo tactic biopsy.

**Indications**
- For screening purpose it is done after 40 years. Early screening is indicated when there is family H/o carcinoma breast or histological risk factor. Mammography before 25 yr of age is usually not done unless there is a lump or a strong family history.
- In obese patients.
- To find out spread or de novo tumour in the opposite breast.
- Mastalgias.
- Mammography guided biopsy can be done.
- Evaluation and follow up in benign breast disease with malignant potential.
- Follow up mammography after conservative breast surgery.

Mammography is usually not done before the age of 25 yr, unless there is a strong family history or any suspicious lump.

*Xeromammography* is same as above, but here a photoconductor is used to produce a final image on a Selenium paper rather than on X-ray film.

**Advantages:**
- Edge enhancement effect, therefore useful in dense breasts.

**Disadvantage:**
- Exposure to high radiation dose and selenium plate is needed.

The condition when lump is clinically not palpable but mammogram shows identifiable carcinoma is ideal for breast conservative surgery like quadrantectomy QUART therapy.

**2. Ultrasound of breast**
- To look for whether the lesion is solid or cystic, margin of the lesion, internal echoes, retro-tumour acoustic shadowing, compressibility, dimensions.
- Irregular margin, irregular internal echoes, irregular posterior shadowing, non-compressibility, ratio between antero-posterior to width (lateral/horizontal) dimensions more than 1 are the features of carcinoma.

Doppler will show high frequency signals with continuous flow.
- Benign lesions are smooth, rounded with well-defined margins with weak internal echoes and compressibility.
- Disadvantage is lesions less than 1 cm may not be identified.
- FNAC can be done under U/S guidance.
- It is cheaper, easily available and there is no risk of radiation.
- It is preferred method of screening in pregnancy and early lactation.

**3. FNAC**

FNAC is very useful in diagnosing the carcinoma breast. FNAC is also done under U/S guidance. But negative results are difficult to interpret because it may be due to sampling errors and so requires further diagnostic methods. FNAC of opposite breast, lymph nodes, opposite axillary lymph nodes are also often required. It is done with 23 gauge needle using FNAC aspiration special syringe. With the lump held firmly, the

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**Figs 1.184A and B:** FNAC of breast lump
needle is passed into the lump and with negative pressure continuous aspiration is done until adequate material comes through the needle. Needle with syringe is removed without negative pressure. Material is collected on a slide; a smear is made using 100% alcohol. Cytology is studied after staining it under microscopy.

Advantages:
FNAC is least painful, can be done on OP basis, reliable and cheaper. Malignant deposits will not occur along FNAC track (only contraindication for FNAC is testicular tumour).

FNAC is Fine Needle Non-Aspirating Cytology.

Reliability of FNAC and mammography

<table>
<thead>
<tr>
<th></th>
<th>FNAC</th>
<th>Mammography</th>
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<tbody>
<tr>
<td>Sensitivity</td>
<td>90-98%</td>
<td>90%</td>
</tr>
<tr>
<td>(true positivity)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Specificity</td>
<td>98-100%</td>
<td>90%</td>
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<tr>
<td>(without false positive)</td>
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<td></td>
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<tr>
<td>False negative</td>
<td>2-10%</td>
<td>10%</td>
</tr>
<tr>
<td>False positive</td>
<td>Near 1-5%</td>
<td>10%</td>
</tr>
</tbody>
</table>

4. **Frozen section biopsy**
If FNAC fails even after two trials or in cases of negative FNAC, then on table frozen section biopsy is done for diagnosis. It is often difficult to differentiate between severe atypia and carcinoma by frozen section and so its validity and use is under debate. In such situation excision biopsy is better. While doing excision biopsy incision is placed in such a way that it can be included in eventual mastectomy. **Trucut biopsy** is also used nowadays in many centers.

5. **Chest X-ray:** To look for pleural effusion, cannon ball secondaries in lungs, mediastinal lymph nodes, secondaries in rib. **CT chest** is more reliable method to see lung secondaries.

6. **Ultra sound abdomen:** To look for liver secondaries, ascites, and ‘Krukenberg’ tumour.

7. **X-ray spine or MRI spine/pelvis** shows osteolytic secondaries in the bone like vertebra and pelvic bones.

8. **Radioisotope bone scan** to look for secondaries in bone in advanced cases. It is not done routinely in early carcinoma of breast.

<table>
<thead>
<tr>
<th>Indications for whole body bone scan in carcinoma breast</th>
</tr>
</thead>
<tbody>
<tr>
<td>• T3, T4 advanced disease</td>
</tr>
<tr>
<td>• Advanced nodal disease</td>
</tr>
<tr>
<td>• Bone pain, bone swelling, pathological fracture</td>
</tr>
<tr>
<td>• Chest/liver secondaries</td>
</tr>
</tbody>
</table>

9. **Estrogen receptor study**
- They are estrogen sensitive receptors, which are cytosolic glycoprotein present in the breast and tumour tissue. It is an important indicator of prognosis of carcinoma breast.
- Tissue for receptor study is sent in low temperature in ice flasks. It is assessed by quantitative analysis. (Frozen –70°C).
- If value is more than 10 units (Femto mols) per ng gram tissue it is called as **ER +ve status**. If value is 5-9 it is borderline and if it is less than 5 femtomoles per nanogram tissue it is called as **ER –ve status**.

In **ER +ve status**
- Prognosis is good.
- Hormone therapy including Tamoxifen is very beneficial.
- Response to treatment is better.

In **ER –ve status**
- Prognosis is poor.
- Hormone therapy is not very beneficial (but used) as compared to ER +ve patients.
- Response to treatment is not good.

ER positivity is common in post-menopausal women (60%) compared to premenopausal women (30%).

Progesterone receptor (PR status) study and Her 2 neu receptor status are other studies done at present to plan the therapy and assess the prognosis.

10. **Study of discharge from the nipple**
Nipple discharge is usually unilateral in carcinoma breast. **Ductal lavage** may be useful
in some patients. Micro-catheter of 1 cm length is introduced gently into the ductal opening. 10 ml saline is infused through the catheter. Fluid is withdrawn into the syringe and cytological analysis is done.

11. MRI of breast and MRI of spine (in case of suspected spine secondaries)
   - To differentiate scar from recurrence.
   - To image breasts of women with implants.
   - To evaluate the axilla and recurrent disease.
   - Both pre contrast and post contrast MRI are done. T1 and T2 weighed images are taken
   - Irregular mass with spiculations, changes in skin and nipple, lymphoedema are the findings in carcinoma breast.

12. Edge biopsy: Done only when there is skin involvement—ulceration and fungation. Diathermy should be avoided in incision biopsy as it may distort the histology of tumour and study of hormone receptor status may not be possible.

13. Tumour markers are used mainly during follow up period. CA 15/3 is commonly done when needed.

14. Sentinel node biopsy (SLNB): The first axillary (SLN) node draining the breast (by direct drainage) is designated as the sentinel node. SLN is first node involved by tumour cells and presence or absence of its histological involvement, when assessed will give a predictive idea about the further spread of tumour to other nodes. Involvement of other nodes without SLN is less than 3% and so if SLNB is negative nodal dissection can be avoided but regular follow up is needed. SLNB is done in all cases of early breast cancers, T1 and T2 without clinically palpable node. It is not done in clinically palpable axillary node as there is already distortion of lymphatic flow due to tumour. It is also not done in multifocal and multicentric tumours, as there is involvement of many lymphatic trunks from different places of breast, chances of false negative is high. Sentinel node is localised by pre-operative (within 12 hours) or peroperative injection of patent blue (Isosulfan vital blue dye) or 99m Tc radioisotope labeled colloid albumin near the tumour (peritumour area). Marker will pass through the sentinel node which can be detected visually as blue staining or with a hand held gamma camera; and is biopsed with a small incision directly over it. If there is no involvement of sentinel node by tumour, then further axillary dissection is not required as skip lesions (skipping sentinel node) occur only in less than 3% cases.

   Note: Facility for SLNB is not available in many centers.

   SLNB is done in—
   - Carcinoma breast.
   - Carcinoma penis.
   - Malignant melanoma.

![Fig. 1.185: Sentinel lymph node biopsy (SLNB) of breast. Note: Spread by skipping the sentinel node is less than 3%](image)

Axillary sampling is often done with an adequate axillary incision. 10-15 nodes are removed for sampling. It is not commonly practiced now. (Minimum 10 nodes should be removed—level I nodes).

15. CT scan of chest, abdomen and brain whenever needed. CT is said to be more useful to detect secondaries in these regions.

16. Triple assessment:
   Includes—
   2. Radiological imaging.
   3. Cytological or histological analysis.
17. **Ductography**
This is a contrast study of ducts of breast in case of unilateral nipple discharge. Fine cannula is passed under vision carefully through the duct opening into the duct and 0.2 ml of dilute water-soluble contrast media is injected into the duct. Craniocaudal and mediolateral X-ray films are taken. Contrast irregular filling defect may be observed.

18. **Thermography** is not very sensitive test (50%). Malignant tumours are hypervascular and so transmitted temperature is detected through different thermographic methods.

**What is the treatment for early breast cancer?**

In early breast cancer, aim of the treatment is to achieve cure, to conserve breast form and function, to prevent recurrence and distant spread.

In early cancer, breast conservative surgery like quadrantectomy, axillary dissection (levels I and II) and postoperative radiotherapy (to the breast) is used which prevents the disfigurement and psychological trauma of mastectomy to the patient.

**Principles of conservative breast surgery**

- Curvilinear nonradial incisions (Do not place radial incisions, as if there is a need to convert into total mastectomy, then incision plan may be difficult).
- Separate incision for axillary dissection.

**Breast conservative surgery**

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Lump &lt; 4 cm</td>
<td>• Tumor &gt; 4 cm</td>
</tr>
<tr>
<td>• Clinically negative axillary nodes</td>
<td>• Positive axillary nodes &gt; N1</td>
</tr>
<tr>
<td>• Mammographically detected lesion</td>
<td>• Tumour margin is not free of tumour after breast conservative surgery</td>
</tr>
<tr>
<td>• Well differentiated tumour with low S phase</td>
<td>• Poorly differentiated tumour</td>
</tr>
<tr>
<td>• Adequate sized breast to allow proper RT to breast</td>
<td>• Multicentric tumour</td>
</tr>
<tr>
<td>• Breast of adequate size and volume</td>
<td>• Earlier breast irradiation</td>
</tr>
<tr>
<td>• Feasibility of axillary dissection and radiotherapy to intact breast</td>
<td>• Tumour/breast size ratio is more</td>
</tr>
<tr>
<td></td>
<td>• Tumour beneath the nipple</td>
</tr>
<tr>
<td></td>
<td>• Intraductal carcinoma extensive</td>
</tr>
</tbody>
</table>

Figs 1.186A and B: Curvilinear incision should be placed in conservative breast surgeries. Never place wrong radial incisions. If conversion to total mastectomy is needed placement of incision will be difficult if radial incision is placed. In conservative breast surgery for axillary dissection separate incision in the axilla should be placed.
• Try to avoid undermining of the skin flap
• Confirm tumour clearance by frozen section. It may be often difficult and so tumour is cut and only margin which is close and doubtful is advocated for frozen section.
• Radiotherapy is a must to breast and chest wall region (locally)

**What is QUART therapy?**
It is quadrantectomy, axillary dissection of level I and II nodes with separate axillary incision and postoperative radiotherapy to breast (5000 cGy) and axilla (1000 cGy). First it is started by Umberto Veronesi from Milan.

**What is skin sparing mastectomy (SSM)?**
- It is like a key-hole surgery of breast
- Skin sparing/limited skin excision (5-10%) will not alter/affect the recurrence rate.
- **Indications are**— central tumour/multicentral/extensive intraductal/T1/not feasible for conservation.
- Excision of nipple—areola complex with very limited skin removal.
• Marginal skin excision over the tumour/biopsy site.
• Total glandular mastectomy.
• Axillary dissection using either same (extension of SSM incision) or separate incision in the axilla.

When total mastectomy is done in early breast cancer?
• When tumour is more than 4 cm.
• Multicentric tumour.
• Poorly differentiated tumour.
• Tumour margin is not clear of tumour after breast conservative surgery.

How axillary nodes are treated when clinically not palpable?
Sentinel lymph node biopsy (SLNB) is done. If node is positive for tumour, then axillary dissection is done. But facility for SLNB is not available in most of the centers and so axillary dissection is done. Usually level I and II nodes - below the axillary vein are dissected.

What are axillary dissection/axillary clearance?
It is removal of axillary nodes with fat, fascia of the axilla. Different levels of nodes are removed.

What are the problems with axillary dissection?
• Injury/thrombosis of axillary vein
• Seroma—50%.
• Shoulder dysfunction 10%.
• Pain (30%) and numbness (70%).
• Flap necrosis/infection.
• Lymphoedema(15%) and its problems
• Axillary hyperesthesia (0.5-1%).
• Winged scapula.

<table>
<thead>
<tr>
<th>Why axillary dissection is done?</th>
<th>Which levels?</th>
<th>Technical principles</th>
</tr>
</thead>
<tbody>
<tr>
<td>• For staging</td>
<td>• Level I- 60%</td>
<td>• Any incision but caudal hair-line incision is preferred</td>
</tr>
<tr>
<td>• To assess the prognosis-</td>
<td>• Level I, II- 20-25%</td>
<td>• Safeguard nerve to serratus anterior/thoraco-dorsal nerve</td>
</tr>
<tr>
<td>number of nodes/size of the node</td>
<td>• Level I,II,III- 15-20%</td>
<td>• Retain medial and lateral pectoral nerves when done with the mastectomy</td>
</tr>
<tr>
<td>• As a treatment-regional</td>
<td>• Level I and II dissection –Low axillary dissection – less chances of lymphoedema</td>
<td></td>
</tr>
<tr>
<td>control of the disease</td>
<td></td>
<td>• Drain should be kept to the area</td>
</tr>
<tr>
<td>• To plan adjuvant therapy</td>
<td></td>
<td>• After surgery specimen should be dissected for all lymph nodes properly, labeled and sent for histological study. Usual number of nodes in axilla are 20-32. So minimum of 10 nodes should be dissected, identified and sent for study. Nodes can be easily identified if fat dissolving agents are used over them.</td>
</tr>
<tr>
<td>irradiation/chemo/hormone</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Adjuvant therapy after surgery in early breast cancer

- Radiotherapy
- Chemotherapy—CMF, CAF regime commonly used. Taxanes are also used.
- Endocrine manipulation—
  - Ablation
  - Tamoxifen (receptor antagonist)- 20 mg/day for 5 years
  - Aromatase inhibitors- blocks estrogen production. –Letrozole 2.5 mg OD-
  - LHRH agonists- Goserelin 3.6 mg/28 day’s cycle for 2 years.
- Monoclonal antibodies (Trastuzumab/herceptin)

**Fig. 1.188:** Post mastectomy lymphoedema. Note the mastectomy scar.

**Drugs Used for Chemotherapy**

**Anthracycline regimes**

<table>
<thead>
<tr>
<th>CMF regime</th>
<th>CAF regime</th>
<th>MMM regime</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cyclophosphamide 600 mg/sq m</td>
<td>Cyclophosphamide</td>
<td>Methotrexate.</td>
</tr>
<tr>
<td>Methotrexate 40 mg/sq m</td>
<td>Adriamycin 50 mg/sq m</td>
<td>Mitomycin C.</td>
</tr>
<tr>
<td>5-Fluorouracil 500 mg/sq m</td>
<td>5-Fluorouracil</td>
<td>Mitozantrone.</td>
</tr>
</tbody>
</table>

CMF is commonly used.
All regimes are given in monthly cycles/3 weekly for 6 months.
Toxic effects are: Alopecia, bone marrow suppression, cystitis, megaloblastic anaemia, GIT disturbances, and nephritis.

**Fig. 1.189:** Alopecia after chemotherapy to carcinoma breast.

**Taxanes**

They are newer chemotherapeutic drugs which act by G2/M phase of cell cycle. It is commonly used in metastatic carcinoma of breast. Drugs are *paclitaxel and docetaxel*. Taxanes have no cross resistance with anthracyclines and so can be used sequentially or concurrently with anthracyclines.

**Indications for chemotherapy—**

- All node positive patients
- Node negative patients but having other poor prognostic factors

**Fig. 1.188:** Post mastectomy lymphoedema. Note the mastectomy scar.

**Fig. 1.189:** Alopecia after chemotherapy to carcinoma breast.

**What are different types of surgeries for carcinoma breast?**

1. **Simple (total) mastectomy:** Along with the tumour, entire breast, areola, nipple, skin over the breast, including axillary tail are removed. There is no...
Surgical Long Cases

axillary dissection. Often the patient is later subjected to radiotherapy (external) to axilla.

2. **Simple mastectomy with axillary clearance:**
   Commonly used procedure. Total mastectomy is done along with removal of axillary fat, fascia and lymph nodes.

3. **Modified radical mastectomy (MRM)**
   a. **Patey’s operation:** Commonly done. Here along with tumour, entire breast, overlying skin, nipple, areola, fat, fascia and level I, II and III lymph nodes of axilla are removed. Pectoralis minor is divided from its origin or removed completely, (so as to have good access to the upper part of axilla and also to clear the interpectoral nodes of Rotter, which are commonly involved) but pectoralis major is retained so as to have better cosmetic result.
   
   b. **Scanlon’s operation:** Is a modified Patey’s operation wherein instead of removing pectoralis minor, it is incised to approach the affected Level III lymph nodes.
   
   c. **Auchincloss operation:** Here pectoralis minor muscle is left intact and level III lymph nodes are not removed.

---

**Fig. 1.190:** Stewart incision for mastectomy.

**Fig. 1.191:** Gray incision for mastectomy in carcinoma breast which extends to opposite side.

**Fig. 1.192:** Greenough’s incision for mastectomy.

**Fig. 1.193:** Other incision often used for total mastectomy—horizontal incision.
4. **Halsted Radical Mastectomy.** (Complete Halsted) (RM):

In radical mastectomy (Halsted):
- **Structures removed are:**
  - Tumour
  - Entire breast, nipple, areola, skin over the tumour with margin
  - Pectoralis major and minor muscles
  - Fat, fascia, lymph nodes of axilla
  - Few digitations of serratus anterior.

- **Structures retained are**
  - Axillary vein,
  - Bells nerve (nerve to serratus anterior)
  - Cephalic vein.

*Not commonly done at present.*

Complications are lymphoedema and eventual lymphangiosarcoma (after 3 to many years later) of the limb.

![Fig. 1.194: Kocher’s incision for mastectomy.](image)

![Fig. 1.195: Orr incision for mastectomy.](image)

![Fig. 1.196: Rodman’s incision for mastectomy.](image)

![Fig. 1.197: Note the original Halsted and modified Halsted incision.](image)

![Fig. 1.198: Other incision used for radical and often modified radical mastectomy. Note the extension of the incision into the anterior axillary fold.](image)
5. **Conservative breast surgeries**: Tumour is removed with a rim of 1 cm of normal tissue. It may be
a. Wide excision.
b. Lumpectomy.
c. Quadrantectomy as part of *Quart Therapy*- Entire segment of the involved breast is removed along with axillary dissection (done through a separate incision in the axilla, level I and either level II or level III removal) and radiotherapy.

6. **Toilet mastectomy**: In locally advanced tumour, tumour with breast tissue and whatever possible is removed to prevent further fungation. But its use and significance is under question.

7. **Extended Radical Mastectomies**: It includes Radical mastectomy + removal of internal mammary lymph nodes of same side with or without opposite side. It is not done at present.

**What is Patey's modified radical mastectomy?**
It is total mastectomy along with clearance of all levels of axillary nodes and removal of pectoralis minor muscle. It is enblock dissection of breast and axilla. An elliptical incision is made from medial aspect of the second and third intercostals space enclosing the nipple, areola and tumour extending laterally into the axilla along the anterior axillary fold. Upper and lower skin flaps are raised. Breast with tumour is raised from the medial aspect of the pectoral major muscle. Dissection is proceeded laterally with ligating pectoral vessels. Once dissection reaches axilla, lateral border of pectoralis major muscle is cleared with level I nodes. Pectoralis minor is divided from coracoid process to clear level II nodes. Medial and lateral pectoral nerves should be preserved (otherwise atrophy of pectoralis major muscle occurs). Later from the apex of axilla level III nodes are cleared. Nerve to serratus anterior, nerve to latissimus dorsi, intercostobrachial nerve, axillary vein, cephalic vein and pectoralis major muscle are preserved. Wound is closed with a suction drain.

**How mastectomy specimen is sent and for what all examinations?**
- Specimen is sent in formalin for histology.
- It is sent in saline in low temperature for ER/PR/Her 2 neu status study (histochemistry).
Tumour grading, tumour clearance, nodal involvement—its number and capsular breach are assessed histopathologically.

**What is tamoxifen?**
- It is an antiestrogen. It blocks cytosolic estrogen receptors.
- Dose is 20 mg daily for 5 years.

**Adverse effects:**
- *Tamoxifen flare*—flushing, tachycardia, sweating.
- Occasionally it causes bone pain associated with hypercalcaemia, particularly in patients with bone metastasis.
- It increases the incidence of endometrial cancer.

**Advantages:**
- It reduces the recurrence rate by 25%.
- It improves the prognosis.
- It is used presently in all age group, ER +ve and ER –ve patients; even though it is more...
effective in ER + ve patients and perimenopausal age group.
- Cheap, easily available, less toxic effects, very effective.
- It is equally effective in carcinoma male breast.

Note: It is also used for certain benign diseases of breast (ANDI, Cyclic mastalgia), desmoid tumour, and male infertility.

Selective Estrogen antagonists
- Do not cause endometrial hyperplasia or endometrial carcinoma.
- Drugs include Raloxifen, Tormefin.

Locally advanced carcinoma of breast (LACB)
- It means locally advanced tumour with muscle/chest wall involvement, extensive skin involvement or fixed axillary nodes. It will be T3, T4a, T4b, T4c or T4d or N2 or N3.
- It is investigated by FNAC of tumour, mammography of opposite breast, chest CT, CT abdomen or whole body bone scan.
- Treatment of LACB is always palliative by simple mastectomy, chemotherapy and hormone therapy using tamoxifen.
- Palliation is to control pain, to prevent fungation or bleeding.
- In inoperable fixed tumour initial chemotherapy is given. Later, after 3-4 cycles of chemotherapy, when tumour size reduces and becomes operable, total mastectomy is done.
- Postoperative radiotherapy is given to breast field and axilla.
- Usually axillary dissection is not necessary in LACB.
- Only chemotherapy and radiotherapy to breast and axilla (without palliative mastectomy) also can be used in LACB.
- There is no role of breast conservative surgery for LACB.
- 5 year survival is 40% and 10 year survival is less than 25%.
- Inflammatory carcinoma is T4d LACB. It is also called as mastitis carcinomatosis or lactating carcinoma of breast. It is 2% common. It is observed in younger age group usually pregnancy or lactating period. There will be extensive skin involvement with pain. It often mimics mastitis of lactation. FNAC or incision biopsy concludes diagnosis. It is treated by initial chemotherapy or radiotherapy; later if tumour reduces in size then total mastectomy with axillary clearance can be done. But most often it is inoperable. After surgery, chemotherapy and tamoxifen is given. 5 year survival for inflammatory carcinoma of breast is 25-30%.

What is letrozole?
- It is a non-steroidal competitive inhibitor of the enzyme ‘aromatase’. This enzyme converts adrenal androgens to estrogen (aromatization). So it is an aromatase inhibitor.
- Other aromatase inhibitors are anastrozole and exemestane.
- Letrozole is used as an adjuvant endocrine therapy in post-menopausal women with hormone sensitive breast cancer. (In pre-menopausal women this will cause rise in gonadotrophins and ovarian aromatase is not well suppressed). It can also be used in metastatic and recurrent cases. It slows down and stops the growth of estrogen sensitive breast tumours. It reduces estrogen level by 98%. Its half-life is 45 hours. It decreases the bone density.
- Dosage of letrozole is 2.5 mg once daily.
- It is given for 5 years or for 2 years following 3 years of tamoxifen.
- Side effects of letrozole are vaginal dryness, night sweats, hot flushes, vaginal bleeding, cardiovascular problems and osteoporosis.

Note
- Tamoxifen interferes with oestrogen receptors
- Letrozole interferes with oestrogen production
- Transtuzumab (Herceptin) interferes with HER-2 neureceptors
What is trastuzumab? (Herceptin)

- It is a monoclonal antibody that blocks HER-2/neu receptors thereby preventing growth of cancer cells. It is a new drug. It is presently marketed as herceptin. It is ErbB2 inhibitor.
- It has very little effect on HER-2/neu negative cancers.
- It is useful only in HER-2/neu positive cancers. It is currently approved by FDA for use only in metastatic disease. It is given as intravenous infusion.
- Studies have shown that substantiate improvement in disease free and overall survival can occur.
- It has got cardiac side effects.

What is metastatic carcinoma of breast?

It is blood spread into different places like bone, lungs and pleura, liver, soft tissues, brain and adrenals. It is evaluated by FNAC/incision biopsy, chest CT, LFT, U/S abdomen, CT abdomen, whole body bone scanning, CT brain, tissue study for ER/PR/HER-2 neu receptor status.

Treatment concept in metastatic carcinoma of breast

- To improve quality of life.
- To relieve pain of secondaries like bone, lungs.
- To relieve neurological problems like convulsions, space occupying cranial problems.
- Other symptomatic relief.

Treatment strategy in metastatic carcinoma of breast

- Chemotherapy—CMF, CAF, Taxanes in combination.
- High dose of chemotherapy using cyclophosphamide, cisplatin, Carmustine, melphalan is tried in view to get high response rate of 55-70% along with bone marrow transplant. But toxic effects are often life threatening.
- Haemopoietic growth factor also used along with chemotherapy to enhance the cell kill with less bone marrow toxicity. It also may allow multiple high dose chemotherapy to increase the response rate.
- Radiotherapy is used in bone metastasis, brain secondaries, to prevent paraplegia in spine involvement, and advanced axillary nodes.
- Hormone therapy has got important role.
- Blockage of over expression of epidermal growth factor (EGF)/transforming growth factor alpha (TGF-alpha) which are related to ErbB1/ErbB2 receptors in relation to aggressive carcinoma factor.
- Palliative surgeries done are total/toilet mastectomy, fixation of bones in case of pathological fractures, lung resection in case of localized secondaries, bilateral oophorectomy.
- Trastuzumab (herceptin) is monoclonal antibody used in cancers with good results. It blocks the Her-2/neu and erbB2 receptors.

Surgical endocrine ablations

- Bilateral oophorectomy (Beatson—1896).
- Bilateral adrenalectomy.
- Pituitary ablation.

Hormone Therapy in Carcinoma Breast

Includes:

- Estrogen receptor antagonists - Tamoxifen.
- Ovarian ablation by surgery (Bilateral oophorectomy) or by radiation.
- LHRH agonists. (Medical Oophorectomy). Goserelin causes reversible ovarian ablation by suppressing gonadotrophin release. It acts at hypothalmo-pituitary axis via tachyphylaxis causing reversible chemical castration (ovarian ablation). 3.6 mg/28 days cycle for 2 years.
- Oral aromatase inhibitors for post menopausal women. Letrozole and anastrozole are recent aromatase inhibitors available.
- Adrenalectomy or pituitary ablation.
- Progesterone receptor antagonist.
- Androgens. – Inj Testosterone propionate 100mg IM three times a week.
- Aminoglutethimide - blocks the synthesis of steroids by inhibiting conversion of cholesterol to pregnenolone - medical adrenalectomy.
- Progestogens, e.g. medroxyprogesterone acetate.
### Hormone therapy for carcinoma breast.

**In pre-menopausal women:**
- Tamoxifen—antiestrogen.
- Ovarian ablation by surgery/by Goserelin/by radiation
- Progestogens—Medroxyprogesterone 400 mg
- Androgens—Fluoxymestrone

**In post-menopausal women:**
- Tamoxifen
- Aromatase inhibitor like letrozole 2.5 mg OD
- Progestogens
- Androgens
- Medical adrenalectomy using aminoglutethimide (Mitotane) as major source of oestrogen after menopause is adrenal gland. Cortisone supplement is also needed to prevent feedback rise of ACTH which may block effect of aminoglutethimide.

### Indications
- Patient who undergoes conservative breast surgery—breast is irradiated after surgery using external radiotherapy.
- After simple mastectomy—external irradiation is given to axilla.
- Patients with higher risk of local relapse after surgery:—a) Invasive carcinoma. b) Extensive in situ carcinoma. c) Patients under 35 years. d) With multifocal disease.
- In bone secondaries—to palliate pain and swelling. If there is pathological fracture in the bone, internal fixation has to be done along with external irradiation.
- Inflammatory carcinoma of breast.
- In atrophic scirrhous carcinoma of breast, as a curative radiotherapy.
- As preoperative radiotherapy— to reduce the tumour size and to downstage the tumour, so that the operability is better.
- In conditions where there are more than 4 positive axillary nodes, pectoral fascia involvement, positive surgical margins, extranodal spread or axillary status not known/not assessed.

### Radiotherapy in Carcinoma Breast
- RT reduces the local recurrence of tumour and in the axillary region; and improves the quality of life.
- But survival benefit?—Not proved.

<table>
<thead>
<tr>
<th>Drug</th>
<th>Mechanism of action</th>
<th>Dose</th>
<th>Adverse effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tamoxifen</td>
<td>Antiestrogen</td>
<td>20 mg</td>
<td>Nausea, weight gain, hot flushes, vaginal bleeding, bone pain, amenorrhoea</td>
</tr>
<tr>
<td>Medroxyprogesterone</td>
<td>Progestogen</td>
<td>400 mg</td>
<td>Nausea, flushing, vaginal bleeding</td>
</tr>
<tr>
<td>Amino glutethimide</td>
<td>Aromatase inhibitor</td>
<td>250 mg QID</td>
<td>Rash, dizziness, lethargy, Cushing facies</td>
</tr>
<tr>
<td>Arimidex, Letrozole, anatrozole</td>
<td>Aromatase inhibitors</td>
<td>1mg QID, 2.5g OD orally</td>
<td>Lethargy, GI upset</td>
</tr>
<tr>
<td>Zoladex (Goserelin)</td>
<td>LHRH agonist</td>
<td>3.6 mg monthly</td>
<td>Amenorrhoea, nausea. It is expensive.</td>
</tr>
<tr>
<td>Diethyl stilboestrol</td>
<td>Ostrogen</td>
<td>15 mg daily</td>
<td>Fluid retention, vomiting, thrombosis hypercalcaemia.</td>
</tr>
<tr>
<td>Fluoxymestrone</td>
<td>Androgen</td>
<td>30 mg daily</td>
<td>Masculinization, nausea</td>
</tr>
</tbody>
</table>
External radiotherapy is given to breast, axilla, and internal mammary and supraclavicular area. Total dosage is 5000 cGY units. 200 cGY units daily 5 days a week for 6 weeks.

<table>
<thead>
<tr>
<th>Radiotherapy in carcinoma breast</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>To chest wall</strong></td>
</tr>
<tr>
<td>• T3 tumour &gt; 5 cm</td>
</tr>
<tr>
<td>• Residual disease-LABC</td>
</tr>
<tr>
<td>• Positive margin/close surgical margin of &lt; 2 cm</td>
</tr>
<tr>
<td>• After conservative surgery</td>
</tr>
<tr>
<td>• Higher risk group</td>
</tr>
<tr>
<td>• Inflammatory carcinoma</td>
</tr>
<tr>
<td><strong>To axilla</strong></td>
</tr>
<tr>
<td>• 4 or more nodes +ve</td>
</tr>
<tr>
<td>• Extranodal spread</td>
</tr>
<tr>
<td>• Axillary status not known/not assessed</td>
</tr>
<tr>
<td><strong>RT is a MUST after conservation of breast</strong></td>
</tr>
<tr>
<td>• Local as well as to axilla</td>
</tr>
<tr>
<td>• Tangential fields 50 Gy/25 fractions/5 weeks</td>
</tr>
<tr>
<td>• Another 10 Gy to tumour bed</td>
</tr>
</tbody>
</table>

**Common sites of distant spread in carcinoma breast**
- Bones—70% (lumbar vertebrae, pelvic bones, long bones).
- Lungs and pleura—20-30%
- Soft tissues—5-15%
- Liver—10-12%
- Brain—2-5%
- Adrenals—2-5%

**What are the aetiologies for carcinoma breast?**

*Aetiology:*
- Carcinoma breast is more common in developed western countries. In African-American women, it is more aggressive. It is less common in Japan.
- It is second most common carcinoma in females. Incidence is 19-34%. Median age is 47 years.
- It is more common after middle age, but do can occur at any age group after 20.
- It is familial in 2-5% cases.
- Carcinoma in one breast increases the risk of developing carcinoma on opposite breast by 3-4 times. Incidence of bilateral carcinoma is 2%.
- Diet low with phytoestrogens and high alcohol intake.
- It is common in nulliparous woman. Early child bearing and breast feeding reduces the incidence of malignancy. Breast carcinoma is directly related to oestrogen level increase. Early menarche and late menopause has got higher risk probably due to increased oestrogen level.
- It is more common in obese patient.
- Breast cancer relative risk is qualified as Relative Risk (RR). RR 2.0 means risk is twice the normal population. If RR is 0.5 means risk is 50% less than normal population.
- In males, occasionally gynaecomastia turns into carcinoma.
- Benign breast diseases with atypia, hyperplasia and epitheliosis have got higher risk in a patient with family history of carcinoma breast.
- Mutation of tumour suppressor genes BRCA 1 and BRCA 2 has got high risk of carcinoma breast. BRCA 1 has got more risk (35-45%). It is located in long arm of chromosome 17. It is also associated with ovarian carcinoma. BRCA2 is located in long arm of chromosome 13. It is also associated carcinoma male breast. Occasionally mutation of BRCA3 and p53 suppressor gene is also involved.
- Cowden’s syndrome and Li-Fraumen’s syndromes are associated with carcinoma breast.
- Presently carcinoma breast is considered as systemic disease. *Halsted concept* of spread is *sequential spread*. Breast—axillary lymph node—systemic spread. *Fischer concept* is early...
to begin with itself, only then there is distant blood spread because of micrometastasis without nodal disease. Only tumour lesser than 1 cm size can be sequential.

- Prior diagnosis of uterine/ovarian/colonic cancers.

**Incidence in carcinoma breast**
- 30% of all female cancers
- 20% of cancer related deaths in females
- 2-4% bilateral
- 2-5% hereditary
- Lump in the breast-commonest presentation (75%).
- 10% presents with pain
- 35-45% with mutation of BRCA1 gene
- 70% blood spread occurs to bones

**What is duct carcinoma in-situ? (DCIS)**
It is intraductal carcinoma without any invasion to the basement membrane. It is 5-20% common.
It can be:
- Solid.
- Comedo with necrosis is high grade with increased chances of micro invasion.
- Cribriform.
- Papillary.
- Micropapillary.
- It is associated with high expression of C-erb2 gene (80%).
- Nipple discharge and often-small swelling are main presentations.
- U/S assisted FNAC and mammography are the needed investigations.

**Risk of lymph node spread in DCIS** is less than 4%. So axillary dissection is not necessary. Sentinel Lymph Node Biopsy and proceed is the preferred method (if facility is available).

<table>
<thead>
<tr>
<th>Nottingham Prognostic Index (NPI)</th>
<th>Tumour size in cm</th>
<th>Lymph node stage</th>
<th>Tumour grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPI score &lt; 3.4</td>
<td>Good prognosis</td>
<td>80% survival</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(15 years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NPI score 3.4-5.4</td>
<td>Moderate prognosis</td>
<td>40% survival.</td>
<td></td>
</tr>
<tr>
<td>NPI score &gt; 5.4</td>
<td>Poor prognosis</td>
<td>15% survival.</td>
<td></td>
</tr>
</tbody>
</table>

**Which is the commonest pathological type of carcinoma breast?**
Scirrhous type of carcinoma breast is the commonest pathological type of carcinoma breast. It is whitish, hard, and gritty/cartilaginous in consistency without any capsule.

**What is medullary carcinoma of breast?**
It is also called as encephaloid carcinoma because of its soft consistency. It contains malignant cells with lymphocytic infiltration. It has got better prognosis than scirrhous carcinoma of breast because of more lymphocytes.

**Which has got worst prognosis and which has got best prognosis?**
Inflammatory carcinoma has got worst prognosis. Atrophic carcinoma (in post-menopausal women) has got best prognosis.

<table>
<thead>
<tr>
<th>Van Nuy’s prognostic index for DCIS:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Score</strong></td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
</tbody>
</table>

Score 3-4: Conservative breast surgery (wide local excision)
Score 5-7: Conservative surgery + Radiotherapy
Score 8-9: Total mastectomy
How is carcinoma breast classified?

Classifications

I. Ductal carcinoma.
   Lobular carcinoma.

II. (a) In situ carcinoma
   • DCIS (Ductal carcinoma in situ).
   • LCIS (Lobular carcinoma in situ).

   (b) Invasive.
   • Invasive ductal carcinoma.
   • Invasive lobular carcinoma. It is commonly multifocal and often bilateral.

III. Unilateral.
     Bilateral. 2-5% common.

IV. Unifocal.
    Multifocal.

IV. Multifocal—tumour tissues within the same quadrant.
    Multicentric—tumour tissues within the breast but in different quadrant.

What are the prognostic factors for carcinoma breast?

• Spread to axillary nodes is the most important prognostic indicator. More than 2 in number of nodes and nodal size more than 2.5 cm carries poor prognosis. More than 4 nodes/level III (apical nodes) involvement has got worst prognosis (5 year survival is 30%) and also decides for radiotherapy to axilla.
• Age: Younger the age worse the prognosis.
• Sex: Carcinoma male breast has got worse prognosis compared to female breast, because of early spread in carcinoma male breast.
• Stage I and II has got better prognosis.
• Atrophic scirrhous has got best prognosis.
• Medullary carcinoma has got better prognosis than scirrhous carcinoma because of lymphocytic infiltration.
• Invasive carcinoma has got worse prognosis.
• Inflammatory carcinoma breast has worst prognosis.
• ER +ve tumours has got better prognosis.
• Differentiation also decides prognosis.
• Presence of elastic fibers in histology has got better prognosis.

• Tumour grade, growth factor and oncogene factors. ErbB2 – Her-2/neu positive has got poor prognosis. ErbB1 with over expression of epidermal growth factor (EGF) and TGF alpha has got poor prognosis.
• DNA flow aneuploid status has got poor prognosis. Low S phase fraction has got good prognosis.

What are the specialities of bone secondaries in breast?

<table>
<thead>
<tr>
<th>Bone secondaries in carcinoma breast</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Commonest site of blood spread (70%)</td>
</tr>
<tr>
<td>• Common in lumbar vertebrae, femur, pelvis</td>
</tr>
<tr>
<td>• Pathological fracture can occur</td>
</tr>
<tr>
<td>• Can present with spinal compression and paraplegia</td>
</tr>
<tr>
<td>• Radiotherapy, internal fixation, spinal decompression is required</td>
</tr>
<tr>
<td>• Biphosphonates 1600 mg/day</td>
</tr>
</tbody>
</table>

What are the features of pleural effusion due to secondaries?

Malignant pleural effusion as secondaries from carcinoma breast—
• It signifies terminal event.
• It has got poor prognosis.
• HRCT is ideal diagnostic tool.
• Respiratory distress and failure is the main feature.
• Treated by
  – Intercostal tube drainage.
  – Pleurodesis using talc/tetracycline.
  – Chemotherapy.

**How carcinoma breast in pregnant woman is managed?**

**Carcinoma breast in pregnancy**
• Incidence is 3%.
• Treatment is modified radical mastectomy (MRM).
• Chemotherapy can be given in 2nd trimester with care.
• Radiotherapy has no role.
• As commonly ER negative, hormone therapy is not used.
• When distressing secondaries are present termination of pregnancy may be required.
• *Women with breast cancer can become pregnant 2 years after the completion of therapy, as recurrence is more common in 2 years.*

**Breast Reconstruction**

**Types of Reconstruction**
• Immediate reconstruction.
• Delayed reconstruction.

**Types of Materials for Reconstruction**
• Silicon gel implant under pectoralis major muscle.
• Expandable saline prosthesis with prior tissue expansion.
• If there is less skin or after radiotherapy-Latissimus dorsi musculocutaneous flap *(LD flap)* or contra lateral transversus abdominis muscle flap *(Tram flap).*

**Note:**
• Breast reconstruction is done in young patients with early stage disease.
• Skin sparing mastectomy with removal of nipple areola complex may be better for reconstruction.
Symmetry is the most important factor in breast reconstruction.

External breast prosthesis which fits within the bra is a simpler cosmetic method.

**Nipple** is created using—
- Local breast flaps 3 months after breast reconstruction.
- Nipple sharing from contralateral nipple using composite graft.
- **Skate flap**: Local flap with deepithelialised donor site around the periphery over which a full thickness graft is applied to reconstruct the areola.

**Areola** pigmentation is created using (*it is done 3 weeks after nipple creation*)—
- Full thickness skin graft from non hairy skin lateral to labia majora, as the pigmentation of this graft matches that of the areola.
- From contralateral areola if reduction mammoplasty is done on that side.
- Tattooing – Colour tends to fade with time and may need to be repeated.
- SSG from retroauricular area or from thigh.

### LD flap vs TRAM flap

<table>
<thead>
<tr>
<th>LD flap</th>
<th>TRAM flap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Myocutaneous flap based on subscapular artery</td>
<td>Transverse rectus abdominis myocutaneous flap based on superior epigastric artery</td>
</tr>
<tr>
<td>Easy to perform</td>
<td>It gives the bulk needed for reconstruction and so implant is not needed</td>
</tr>
<tr>
<td>Reliable flap, well vascularised</td>
<td>Donor site morbidity and fat necrosis can occur</td>
</tr>
<tr>
<td>Can be placed over prosthesis</td>
<td>Free TRAM flap into internal mammary/thoracodorsal axis can be done</td>
</tr>
<tr>
<td>Low complication rate</td>
<td>But causes unsightly donor area on the back</td>
</tr>
</tbody>
</table>
Other flaps used for reconstruction
- Superior gluteal flap based on superior gluteal vessels.
- Ruben’s flap using soft tissue pad overlying the iliac crest based on deep circumflex iliac vessels.

What are breast implants?
They are synthetic non-reactive materials placed under the breast to give breast contour.
- Technically simple.
- Achieves symmetry easily.
- Implant in submuscular plane is better whenever muscle has not been removed during surgery.
- If muscle is removed like during radical mastectomy, then subcutaneous implant is placed.
- Silicon gel implants are used.

Complications of breast implants
- Pain, exposure of implant and rupture
- Displacement, extrusion
- Infection
- Capsular contraction

Carcinoma of male breast
- It is less than 1% of cases of breast cancers
- Gynaecomastia and excess estrogen are said to be the etiological factors
- Commonly it is infiltrating duct carcinoma. Commonly ER positive
- Presentation, spread, behavior are same as carcinoma of female breast. Investigations and treatment are same as carcinoma female breast
- Tamoxifen is very useful in carcinoma male breast
- LHRH agonists are next option.
- Earlier bilateral orchidectomy was the preferred choice. Now not commonly done

Fig. 1.206A and B: Typical breast implant and its placement. It can be placed in subcutaneous or submuscular plane.

Fig. 1.207: Carcinoma male breast in a pre-existing gynaecomastia. Note Gynaecomastia on opposite side.

What is fibroadenoma?
It is a benign encapsulated tumour occurring commonly in young females of 15-25 yrs age group.
Presently it is considered as hyperplasia of a single lobule of the breast (may be classified under ANDI).
Types

Gross
- Soft.
- Hard.
- Giant (>5 cm in size).

Microscopy
- Intracanalicular—small and hard—mainly fibrous.
- Pericanalicular—large and soft—mainly cellular.

Clinical features
- It presents as a painless swelling in one of the quadrants, which is smooth, firm, non tender, well localized and moves freely within the breast tissue (‘mouse in the breast’).
- Axillary lymph nodes are not enlarged.

Investigations
- Mammography (well localized smooth regular shadow).
- FNAC.
- Ultrasound (to confirm solid nature).

Treatment
Excision through a circumareolar incision (Webster’s) or sub mammary incision (‘Galliard Thomas incision’) is done.

Points to be remembered
- Size of giant duodenal ulcer is > 2 cm
- Size of giant gastric ulcer is > 3 cm
- Size of giant fibroadenoma is > 5 cm
- Diameter of transverse colon in toxic megacolon is > 6 cm
- Giant naevus is size > 20 cm

Fibrocystadenosis (Fibrocystic disease of the breast/mammary dysplasia)
It is due to Aberration of Normal Development and Involution (ANDI) of breast causing.

- Fibrosis
- Cyst formation
- Glandular proliferation (Adenosis)
- Hyperplasia (Epitheliosis)
- Papillomatosis
- It is an estrogen dependent condition. One of the cysts may get enlarged to become a clinically palpable well localized swelling - bluedome cyst of Bloodgood.
- Diffuse, small, multiple cysts in fibrocystadenosis is called as Schimmelbusch’s disease.
- Disease is common in upper outer quadrant.
Clinical features
- Presentation is during menstruating age group as a bilateral, painful, diffuse, granular, tender, swelling which is better felt with palpating fingers (poorly felt with palm).
- Not fixed to skin, muscle or chest wall.
- Pain and tenderness are more during menstruation (Cyclical mastalgia).
- It subsides during pregnancy, lactation and after menopause.
- Discharge from the nipple when present will be serous or greenish.

Investigations
- FNAC (Epitheliosis, when florid is undoubtedly premalignant).
- Ultrasound, mammography.

Treatment
I. Conservative line of management is preferred.
   - Reassurance.
   - Oil of evening primrose (capsules): Contains gamolenic acid which reverses the saturated fatty acids to unsaturated fatty acids.
   - Gamolenic acid — 120mg.
   - Bromocriptine.
   - Vitamin E and B₆.
   - LHRH agonist.
   - Danazol.
   - NSAID’S.
   - Tamoxifen—antiestrogen.
II. Surgery: Subcutaneous mastectomy with prosthesis placement.

Indications for surgery in fibroadenosis
- Intractable pain
- Florid epitheliosis
- Blood good cyst

Phylloides Tumour (Cystosarcoma phylloides/Serocystic disease of Brodie)
- They are not simply giant fibroadenoma.
- They show a wide spectrum of activity, varying from almost a benign condition to a locally aggressive and sometimes metastatic tumour.
- Depending on mitotic index and degree of pleomorphism they are graded as low grade to high grade tumours.

Figs 1.210A and B: Cystosarcoma phylloides of right and left breasts in two different patients. Note the dilated veins. Tumor occupies the entire breast. Post-surgery specimen signifies enormous size of the tumour.

Gross
Large capsulated area with cystic spaces and cut surface shows soft, brownish, cystic areas.

Microscopy
- It contains cystic spaces with leaf like projections, hence the name.
- Cells show hypercellularity and pleomorphism.
- It may be a variant of intracanalicular fibroadenoma of breast.

Clinical features
- They occur in premenopausal women (30-50 years).
- It is usually unilateral, grows rapidly to attain a large size.
Swelling is smooth, non tender, soft, fluctuant with necrosis of skin over the summit due to pressure.
Recurrence is common.

Investigations
U/S, FNAC, mammography and chest CT.

Treatment
- Excision or subcutaneous mastectomy is done.
- If malignant (sarcoma), total mastectomy is indicated. Sarcoma may spread to lungs and so chest X-ray/ chest CT has to be taken.

Traumatic Fat Necrosis
It may be due to either direct or indirect trauma (most often trauma may not have been noticed or forgotten).

Pathogenesis
Capillary ooze causes triglyceride in the fat to dissociate into fatty acids. It combines with calcium from the blood resulting in saponification which causes inflammatory reaction and later presents as a nonprogressive swelling in the breast.

Features
- Painless swelling in the breast which is smooth, hard, nontender and adherent to breast tissue. (D/D-Carcinoma). It is nonprogressive.
- FNAC shows chalky fluid with fat globules.
- Mammography is done to rule out malignancy.
- It often mimics carcinoma breast.
- Treatment is excision.

Galactoceole
It is seen in lactating women. It is due to the blockage of lactiferous duct resulting in enormous dilatation of lactiferous sinus. It contains milk within. It is a retention cyst due to blockage of single duct which begins under the areola.

Features
- Lump in the lower quadrant of the breast which is usually unilateral, large, soft, fluctuant, with smooth surface and nontender. It is a retention cyst — subareolar type.
- It may get precipitated, inspissated, or get calcified.
- When it is calcified it mimics carcinoma breast.
- If it gets infected it will form an abscess.
- U/S and FNAC are used to diagnose.
- Treatment is excision (by submammary incision). Abscess when formed should be drained under general anaesthesia under cover of antibiotics.
• Differential diagnosis is Paget’s disease of the nipple.
• Treatment is under cover of antibiotics pus is drained of by making a sub areolar incision.

b. **Intramammary mastitis**

a. **Lactational abscess of the breast**
Commonly seen in lactating women.

*Mode of infection*
Bacteria (*Staph aureus*) enter the breast during sucking through the cracked nipple. Occasionally it can be haematogenous. Gram-negative and other bacterial infection can supervene later.

*Features*
• Pain in the breast and fever.
• Diffuse redness, tenderness, and induration in the breast.
• Purulent discharge from the nipple.
• Full breast may get involved eventually.
• Differential diagnosis is inflammatory carcinoma of breast.

*Treatment*
Antibiotics—Cephalosporins.
Drainage under general anaesthesia, a counter incision may be needed.

It is not advisable to wait till the formation of abscess.

*Complications*
• Antibioma formation.
• Sinus formation.
• Recurrent infection.

b. **Non-lactational abscess of the breast**
It commonly occurs in duct ectasia and periareolar infections. Common organisms are bacteroides, anaerobic streptococi, enterococi and gram-negative organisms. It is commonly recurrent with tender swelling under the areola.

*Treatment*
• Antibiotics.
• Repeated aspirations.
• Drainage and later cone excision of the duct is done.
c. **Retromammary mastitis**

It is due to tuberculosis of the intercostal lymph nodes or ribs beneath or suppuration in the intercostal lymph nodes.

Breast is normal.

**Investigations**
- Chest X-ray, FNAC, ESR.
- Peripheral smear.
- CT chest.

**Treatment**
- Cause has to be treated. Antibiotics are used.
- Drainage under general anaesthesia with submammary incision reaching submuscular plane.
- Often may need intercostal tube drainage in specific causes.

**Antibioma**

If intramammary mastitis is not drained but only treated by antibiotics, pus localizes and becomes sterile (flaques) with a thick fibrous tissue cover, it is called as antibioma.

**Features**
- Previous history of mastitis treated with antibiotics.
- Swelling which is painless, smooth, non tender, hard, fixed to breast tissue without involving the pectorals and chest wall.
- Differential diagnosis is carcinoma breast. (Scirrhous carcinoma breast).
- Investigations are FNAC, mammography and U/S breast.
- Treatment is excision (Submammary incision). Later antibiotics are given.

**Duct ectasia**

- It is dilatation of lactiferous ducts due to muscular relaxation of duct wall with periductal mastitis *(Plasma cell mastitis)*. Many ducts are commonly involved.
- Greenish discharge from the nipple.
- Indurated mass under the areola which is often tender.
- Retraction of nipple which occurs at later stage of the disease.
- Eventually it forms an abscess, and fistula.
- Often they are bilateral and multifocal.
- Differential diagnosis is carcinoma breast.
- Investigations are — discharge study and mammography.
- Treatment is cone excision of involved major ducts *(Hadfield operation)* with antibiotics.

**Mondor’s Disease**

- Mondor’s disease is thrombophlebitis of the superficial veins of the breast and anterior chest wall.
- Presents as a thrombosed subcutaneous cord which is attached to the skin.
- It is often a self limiting disease without any recurrence, complication or deformity.
- It mimics the lymphatic permeation of carcinoma breast.

**Duct Papilloma**

- It is usually single, from a single lactiferous duct.
- It is the commonest cause of nipple discharge.
- By blocking the duct it causes ductal dilatation.

**Features**
- Papilliferous swelling (projection), usually near the nipple orifice (4-5 cm from orifice).
- Blood stained discharge from the nipple is common.
• But serous or serosanguinous discharge can also occur.
• Single papilloma is not premalignant.
• But multiple papillomas in many ducts can be premalignant
• Study of discharge and ductogram may be needed.
• Treatment—Microdochectomy: Probed lactiferous duct is opened with excision of the papilloma using tennis racquet incision.

**Galactorrhoea**
• It is secretion of milk not related to pregnancy or lactation.
• *Primary galactorrhoea* is due to stress and other factors. Reassurance is the treatment.
• *Secondary galactorrhoea* is due to enhanced dopamine activity.
  - By drugs (haloperidol, methylidopa, chlorpromazine, metoclopramide),
  - Hyperprolactinaemia due to tumours.
• Treatment—bromocriptine/cause has to be treated.
  *Witch milk* is secretion of milk in both male and female infants due to maternal hormonal effects in foetus which lasts for 3 weeks after child birth.

**Gynaecomastia**
• It is hypertrophy of male breast more than usual, often attaining features of female breast.
• It can be unilateral or bilateral.

**Presentations**
• Diffuse enlargement of breast occupying all quadrants or as a well localized, small, firm or hard nodule under the areola which is often painful and tender.

<table>
<thead>
<tr>
<th>Cyclic mastalgia</th>
<th>Noncyclical mastalgia</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Pain related to menstrual cycle</td>
<td>• Pain due to causes other than ANDI like periductal masitis, malignancy, cervical root pain, musculoskeletal pain, previous surgery, <em>Tietze’s syndrome</em> (costochondritis of 2nd costal cartilage, commonly seen in females)</td>
</tr>
<tr>
<td>• Seen in Andi like fibrocystadenosis</td>
<td>• It is unilateral, chronic, burning/dragging pain occurs in pre and post menopausal age group</td>
</tr>
<tr>
<td>• Treatment is like for fibrocystadenosis</td>
<td></td>
</tr>
</tbody>
</table>

**Causes**
• Idiopathic.
• Teratoma testis.
• Ectopic hormonal production in bronchial carcinoma.
• Anorchism, after castration.
• Adrenal and pituitary disease.
• Leprosy, because of bilateral testicular atrophy.
• Drugs: Stilboestrol, Digitalis, Cimetidine, Spironolactone.
• Liver diseases and liver failure.
• Klinefelter’s syndrome. (XXY Trisomy).

*Investigations are relevant to the cause.*
Example: Liver function tests, DNA study, Hormone assay. Often gynaecomastia may turn into carcinoma.

**Treatment**
• When symptomatic or large or long standing, excision through circumareolar incision is done.
• Often subcutaneous mastectomy is needed.

**Mastalgia**
It is pain in the breast.

**Types**
• Cyclic
• Noncyclical
WRITING A CASE SHEET IN CASE OF THE THYROID DISORDERS

Name:

Address:
Residential place may be important in certain goitres. Iodine deficiency endemic goitre is common in interior areas, mountain areas like Vindhyas, Himalayas. Goitre is more common in south India than north India. It was also common in Middle East and European countries, North America, in Bulgaria near river Struma which eventually reaches Aegean Sea. Follicular and anaplastic carcinoma may be more in iodine deficiency areas but papillary carcinoma is not related to iodine deficiency.

Occupation:

Age:
Simple goitre is seen often in puberty in girls. Dyshormonogenesis goitre occurs in younger age group. Physiological goitre occurs when there is increased metabolic demand of the hormone like in puberty, pregnancy. Solitary nodule, colloid goitre, papillary carcinoma and primary thyrotoxicosis are seen between 20-40 years. Multinodular goitre, follicular carcinoma and Hashimoto’s thyroiditis are seen in middle aged women.

Chief Complaints
- Swelling in front of the neck and its duration
- Pain in the swelling and its duration
- Hoarseness of voice due to recurrent laryngeal nerve palsy.
- Difficulty in swallowing or breathing
- Tremor in the hands
- Generalized weakness
- Palpitation
- Loss of significant weight

History

History of Present Illness

Swelling: Its duration, onset sudden or insidious. Origin of the swelling, its progress- gradual (benign), rapidly progressive (malignancy) or in an existing swelling rapid increase recently (benign turning into malignancy) or sudden rapid increase may be seen in haemorrhage. Thyroglossal cyst may be present since childhood. Swelling may be single/multiple or occupying one lobe, or both lobes or isthmus.

Any thyroid of any size or any duration or any consistency or in any age group can be malignant unless proved otherwise.

Pain: Its duration, character like dull aching/pricking, site of pain, radiation, factors which alters the pain. Usually goitres are painless. Thyroiditis may be painful. Malignancy is initially painless but later becomes painful. Infiltration into surrounding structures/necrosis/haemorrhage makes it painful and tender.

Pressure symptoms: Dysphagia (oesophageal compression), dyspnoea (tracheal compression), stridor (infiltration into trachea), hoarseness of voice (recurrent nerve compression) and Horner’s syndrome (infiltration of cervical sympathetic chain – ptosis, loss of sweating, in face same side, miosis and enophthalmos). Their duration, onset and progression.

Features of toxicity: Increased appetite/loss of weight/diarrhoea/chest pain aggravated by exercise/palpitation/amenorrhoea/irritability/nervousness/sleeplessness (insomnia)/hand tremors/increased sweating/cold preference/heat intolerance/proximal muscle weakness in the thigh or arm like in getting down steps or lifting weight using arms (myopathy) due to difficulty in isometric contraction and increased muscle metabolism/wasting of muscles/visual disturbances with bulging of the eyes.
Features of hypothyroidism/myxoedema: Muscle weakness/lethargy/weight gain/poor appetite/facial swelling/cold intolerance/menorrhagia/constipation/superciliary madarosis in lateral half of the eye brows/loss of hairs in scalp/change in voice due to vocal cord oedema/dry skin.

Past history: Irradiation history for carcinoma thyroid. Irradiation to head and neck region for benign lesions like adenoids, tonsillitis, thymus, acne vulgaris or hamangiomas or malignancy in younger age groups like of lymphomas. Chernobyl nuclear disaster in Ukraine in 1986 caused increased incidence of papillary carcinoma of thyroid in children. Previous history of having Thyroglossal cyst which might have infected causing fistula either due to spontaneous burst or after surgical drainage of an infected cyst. Previous surgery for thyroid in recurrent thyroid swelling or earlier surgery for thyroglossal cyst in case of thyroglossal fistula should be asked for.

Personal history: Smoking, alcohol intake or any drugs which may cause alteration in thyroid function. Patient may be on thyroxine or on antithyroid drugs or beta blockers or other drugs like lithium, PAS or sulphanyleureas which alter the thyroid function. Dietary habits should be asked. Brassica family vegetables like cabbage, kale and rape are goitrogens. Type of salt used in the family iodized/home rock salt is also important.

Family history: Dyshormonogenesis, medullary carcinoma of thyroid can be familial (MEN syndrome). Endemic goitre and Grave’s disease can occur in families. Altered thyroid function may be cause for infertility.

Menstrual History
Treatment history: History of undergoing investigations or treatment relevant to thyroid disease.

General Examination
Like any other long case.
• Thyrotoxic patient is anxious/thin and undernourished. Obesity is seen in myxoedema. Patient may be cachexic in thyroid carcinoma which is advanced.
• Exophthalmos should be looked for in toxic patient. Irritable/agitated tensed face with eye signs is seen in toxic thyroid.
• Myxoedema face is typical. It is expressionless, mask-like puffy face. Patient will be dull with low intelligence.
• Hasty—rapid gait is seen in hyperthyroid and slow—lethargic gait in hypothyroidism.
• Pulse—its character, whether tachycardia, collapsing or pulsus paradoexus or ectopic or fibrillation has to be looked for.
• Blood pressure may be high in toxic thyroid.
• Sleeping pulse rate is checked at late night or early morning for three consecutive nights and average is taken. Sedation like diazepam or phenobarbitone to be given to check sleeping pulse rate prior to sleep is a controversial. Sleeping pulse rate is graded as Crile’s grading.

<table>
<thead>
<tr>
<th>Crile’s grading</th>
<th>Sleeping pulse rate/minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Up to 90</td>
</tr>
<tr>
<td>II</td>
<td>90-110</td>
</tr>
<tr>
<td>III</td>
<td>&gt; 110</td>
</tr>
</tbody>
</table>

Fig. 1.217: Palpation of radial pulse for its count, volume, variations should be done in thyroid diseases.
In toxic thyroid, patient will be thin and underweight. In hypothyroidism, patient will be obese and overweight. In metastatic thyroid cancer patient is cachexic.

Agitated stressful facial expression is observed in toxic thyroid. Puffy, expressionless, dull and mask-like face is seen in myxoedema.

Rapid aggressive gait is seen in toxicity but lethargic and slow gait is observed in hypothyroidism.

Skin is wet and warm in hyperthyroidism (moist palm while shaking hands).

Ankle (Achilles tendon) reflex is prolonged with delayed relaxation in hypothyroidism and it is shortened and brisk in hyperthyroidism.

Both legs and ankle region in front should be inspected for pretibial myxoedema. It is a feature of primary thyrotoxicosis. It is due to deposition of myxomatous tissue.

Tremor of the hands and tongue
Hand tremors observed by outstretching the hands and fingers forward to see tremors of the fingers. Often small object like pen may be kept to watch the tremor better. Fine tremor is observed in toxic thyroid. It is due to diffuse irritation of the gray matter. Tongue twitching can be observed by opening the mouth and carefully observing the tongue.

Assessment of voice change
- Pitch of the voice—whether raised/lowered or pitch locked
- Breath support during speaking is adequate or not
- Ability to alter the rapidity of speech—slow/fast/medium
- Altered laryngeal and neck muscle tension
- Indirect laryngoscopy—with tongue pulled out using gauze, warmed ILS is placed into the oral cavity to see vocal cords. Patient is asked to say ‘e’ to see the vocal cord movements

Local Examination

Inspection

Swelling: Its location/size (both vertical and horizontal dimensions of each lobe and isthmus or if it is one mass dimensions as a single swelling)/shape (butterfly shape if both lobes are involved)/extent (from posterior border of sternomastoid laterally to midline in one sided gland enlargement or from one side to opposite sternomastoid if both lobes are enlarged)/ upper extent is usually up to thyroid cartilage/lower margin is clearly visible or not or visible during deglutition/movement upwards with deglutition (thyroid moves upwards during deglutition due to attachment of the condensed vascular pretracheal fascia (Berry’s ligament) which is attached above, medially and behind to cricoid cartilage and also pretracheal fascia is attached to larynx, trachea and inferior constrictor muscle which moves upwards)/scar or dilated veins (in toxic goitre, carcinoma thyroid, venous

Fig. 1.218: Pretibial myxoedema is seen in primary thyrotoxicosis.
Figs 1.219A to F: Tremor of the hands outstretched and tongue should be checked properly in toxic thyroid.

Figs 1.220A and B: Simple goitre. Inspection of goitre is very important.
compression, retrosternal goitre) or pigmentation on the skin over the swelling/pulsation over the swelling (toxicity, malignancy)/surface on inspection (smooth or nodular).

**Fig. 1.221:** Thyroid moves upwards with deglutition. Often it is better to give a glass of water to the patient to drink.

**Swellings which move upwards with deglutition**
- Thyroid swelling
- Sub hyoid bursa
- Thyroglossal cyst
- Pretacheal/prelaryngeal lymph nodes
- Swelling from larynx/trachea

In some occasions swelling whether moves with protruding the tongue or not should be looked for. Thyroglossal cyst moves upwards with protrusion of tongue. Patient is asked to open the mouth and then swelling/cyst is held firmly. Now patient is asked to protrude the tongue to feel an upward movement of the swelling with a typical ‘tug’ in the swelling.

Any other swelling in the neck should be seen like for lymph nodes. Lymph nodes can be involved commonly in papillary carcinoma of thyroid occasionally in follicular carcinoma of thyroid.

**Figs 1.222A and B:** Large carcinoma of thyroid which is vascular. Note the dilated veins.

Occasions wherein thyroid swelling may not move upwards with deglutition:
- Anaplastic carcinoma thyroid – often
- Carcinoma thyroid with extensive local infiltration into soft tissues, trachea/larynx and posterior muscles
- Intrathoracic retrosternal extension with infiltration/impaction
- Riedel’s thyroiditis with encasement of trachea
- Massive thyroid wherein movement upwards is difficult to observe and appreciate

**Palpation**

**Swelling:** Temperature over swelling (swelling may be warm in toxic thyroid, malignancy, thyroiditis)/tenderness (haemorrhage, thyroiditis, tumour necrosis can cause tenderness)/
Figs 1.223A to C: Examination of thyroid from behind with patient is sitting in a stool comfortably and neck flexed. Careful palpation for nodules should be made.

Figs 1.224A to C: Contraction of sternomastoid one side/both sides to confirm that thyroid is deep to deep fascia.
Fig. 1.226: Skin should be pinched to confirm swelling is not adherent to skin.

Digastic muscle depresses and retracts the chin. Infrahyoid muscles (strap muscles) contract and get tensed to prevent ascent of hyoid bone when the digastic is in action.

Thrill is checked in the upper pole of the gland as superior thyroid artery is superficial and enters the gland in front upper pole. Thrill signifies toxicity or increased vascularity.

Fig. 1.227: Superior pole of thyroid should be palpated for thrill which signifies vascularity.

Fig. 1.225A and B: Lower border should be assessed in case of thyroid enlargement to rule out possible retrosternal extension.

extent/position/shape/size (should be measured in centimetre both vertically and horizontally)/movement of the swelling upwards with deglutition/surface (smooth or nodular)/consistency (soft or firm or hard or variable and if so different locations of different consistencies should be mentioned)/margin (well defined or diffuse, lower margin which is most important)/independent mobility of the swelling/plane of the swelling (it is checked by contracting the sternomastoid muscles by placing examiner’s hand under the chin of patient and patient has to flex the neck against resisting hand) (single side gland relation to sternomastoid muscle is checked by contracting the muscle by turning the chin against resistance of the examiner’s hand)/skin is free or not.
**Method of palpation of thyroid gland:** Thyroid gland is palpated from behind with patient sitting in a stool with neck partially flexed. Both thumbs of the examiner are kept over the cervical spine and fingers will be in front to feel the gland—both lateral lobes and isthmus for all features.

**Crile’s method of palpation of gland:** It is the palpation of the nodule/swelling in front using the pulp of the thumb.

![Fig. 1.228: Criles method of palpation using thumb for any nodules.](image)

**Pizzillo’s method of palpation:** It is the method of palpation of thyroid gland in short neck and obese individuals. Patient is asked to keep her/his both hands over the occiput and gland becomes prominent which will be palpated from front or behind.

![Fig. 1.229: Pizzillo’s method of examination.](image)

**Lahey’s method of examination:** It is the method used to palpate the any nodules in posterior part of the gland. It is mainly useful in solitary nodule of thyroid. Examiner should stand in front of the patient. If right lobe is needed to palpate, left lateral lobe is pushed towards right to make posterior aspect of the right gland more prominent as gland gets pushed and rotated towards right side. Posterior becomes posterolateral or lateral which is felt for any nodules. Left lobe posterior aspect is palpated by pushing the right lobe towards left side.

![Fig. 1.230: Lahey’s test.](image)

**Kocher’s test:** It is the test for tracheal compression. Patient is asked to see straight. With fingers and thumb both lateral lobes of the thyroid gland are gently compressed directing posteromedially. If patient develops stridor—Kocher’s test is positive. If no stridor means it is negative.

![Fig. 1.231: Kocher’s test.](image)
In a long standing goitre and large goitre, because of constant pressure tracheal rings get weakened which get narrowed/collapsed during compression. Goitre itself because of forward traction keeps trachea patent. But after thyroidectomy no support to trachea causes tracheomalacia—weakening of the tracheal rings. Such patients need tracheostomy after thyroidectomy. It is usually temporary tracheostomy for 2-3 weeks by then tracheal rings regain their strength to maintain the patency of the trachea.

**Confirmation of retrosternal extension:**
- Lower margin of the swelling/goitre is not visible—even on deglutition.
- Lower margin is not palpable on deglutition.
- Dilated veins over neck or chest wall may be visible.
- Normal resonant note becomes dull over the sternum on percussion.
- *Pemberton’s sign*—patient is asked to raise the both arms above the shoulder so as to touch the ears and made to keep like that for 3 minutes. Patient will develop dilated veins and cyanosis in the neck and upper chest wall, puffiness in face and respiratory distress and rarely dysphagia. It means sign is positive signifying retrosternal extension of goitre.

- Dyspnoea at night during lying down or neck extended.
- Rarely recurrent nerve palsy can occur.

Retrosternal goitre is defined as having >50% goitre below the suprasternal notch.
- *Primary is rare*—1%. Primary retrosternal goitre arises from ectopic thyroid tissue from mediastinum. It gets its blood supply from mediastinum itself, not from the neck. And also it is not related to the existing thyroid in the neck.
- *Secondary* is common. It is extension from the enlarged thyroid from the neck.

Commonly retrosternal goitre arises from lower pole of a nodular goitre. It is more observed in short neck people. Due to negative intrathoracic pressure nodule gets drawn into the superior mediastinum. Sometimes it may be also ectopic thyroid tissue.

Retrosternal goitre may be substernal (part of the nodule in the neck-palpable) or plunging goitre (intrathoracic goitre forced into the neck occasionally by increased intrathoracic pressure) or intrathoracic goitre with normal neck. It can be toxic/non-toxic nodules/malignancy.
Retrosternal goitre is confirmed by CT scan and radioiodine study. It is treated by complete surgical removal usually through neck approach, occasionally through median sternotomy. Radioactive iodine therapy is not used for retrosternal goitre. Surgical removal should be complete because recurrent retrosternal goitre is very difficult to re-operate.

Stridor due to compression of tracheo-bronchial tree by retrosternal goitre is very dangerous because it is often not possible to clear the airway either by intubation or by tracheostomy.

*Position of trachea* is checked by palpation using three fingers from below. Middle finger is kept just above the suprasternal space and index and ring fingers are placed over sternal heads of the sternomastoid muscles on each side. Middle finger is run upwards along the trachea to feel the position-central or deviated. In solitary nodule or disease of only one lateral lobe trachea will be usually deviated towards opposite side. In both lobes enlargement trachea will be usually central. Other features are absence of hollowness on the side of the deviation (trail sign), on auscultation hearing of breath sounds on the side of the deviation.

*Fig. 1.234:* Trachea in central position. It is central when both lateral lobes are enlarged. It is deviated to opposite side in solitary nodule thyroid.

*SUPERIOR BORDER OF THE Isthmus* of the normal thyroid gland is inferior to cricoid cartilage. Isthmus is felt over the tracheal rings below. Bare tracheal rings are observed in ectopic thyroid (which means in normal location thyroid tissue is not present) and also in absence of isthmus (rare).

*Carotid pulsation* should be checked. It is normally felt at the level of the upper border of thyroid cartilage over medial aspect of the sternomastoid muscle on the Chaissagne tubercle (carotid tubercle) on the transverse process of C6 vertebra. It may be deviated posteriorly/laterally in a large goitre. It may be absent in advanced carcinoma thyroid due to infiltration of the carotid sheath by the tumour (Berry’s sign).

*Figs 1.235A and B:* Method examination of trachea to find out deviation using three fingers.
**SRB’s Bedside Clinics in Surgery**

**Fig. 1.236:** Palpation of carotid artery (common carotid) at the level of thyroid cartilage on the medial border of sternomastoid muscle over Chaisagne tubercle in transverse process of C 6 vertebra. In Berry’s sign it is absent. It signifies advanced carcinoma of thyroid.

**Sympathetic chain in the neck** may get involved in locally advanced carcinoma thyroid causing Horner’s syndrome—enophthalmos due to Muller’s muscle weakness:
- Drooping of upper eyelid (ptosis).
- Anhidrosis.
- Miosis due to paralysis of dilator pupillae.
- Absence of ciliospinal reflex.
- Flushing of face and nasal congestion.

**Causes for Horner’s syndrome**
It is due to interruption of sympathetic nerve supply to head and neck. Preganglionic fibres arise from 1st and 2nd thoracic segments of the spinal cord which synapses with three cervical sympathetic ganglia. Any disruption of preganglionic fibres or cervical ganglia or their fibres will cause Horner’s syndrome.
- Posterior inferior cerebellar artery thrombosis
- Cervical sympathectomy
- Pancoast’s tumour
- Secondaries in neck
- Carotid artery aneurysm
- Spinal cord lesions
- Injuries to lower root of brachial plexus

**Examination of neck lymph nodes for secondaries.** It is common in papillary carcinoma of thyroid. It is usually in level III and IV nodes. It could be firm, hard or cystic. It is usually brownish black in colour often with papillary projections. Lymph nodes often can get enlarged in follicular carcinoma thyroid and lymphoma. Lateral aberrant thyroid is earlier thought as aberrant thyroid in lateral part of the neck but actually it is not so but it is secondary in lymph node with primary being papillary carcinoma of thyroid.

**Fig. 1.237:** Lymph node drainage of thyroid. Primary and secondary nodes are drainage groups.

**Percussion over the manubrium sterni** is important. Dullness signifies retrosternal extension. Tenderness may signify the secondaries in sternum from follicular carcinoma of thyroid.

**Auscultation** over the upper pole of the gland for bruit- in toxic thyroid severe cases and very vascular tumours.

**Cardiovascular system** examination is important in thyrotoxicosis- commonly secondary type. Tachycardia, ectopic, pulsus paradoxus, extrasystoles, atrial fibrillation are the cardiac presentations.
Respiratory system examination: Secondaries and pleural effusion can occur in follicular carcinoma of thyroid.

Abdomen examination: Hepatomegaly as secondaries in liver is known to occur in follicular carcinoma of thyroid. Hepatosplenomegaly can occur as part of Grave’s disease or Hashimoto’s disease.

Examination of skull and spine: Localized, warm, vascular, pulsatile secondaries can occur in skull commonly, rib and other bones occasionally as a spread from follicular carcinoma of thyroid.

In primary thyrotoxicosis exophthalmos and all eye signs are looked for.
- Both the eyelids cover the bulbar sclera partially in normal individual.
- Upper sclera is visible in only lid retraction—due to spasm of involuntary levator palpebrae superioris muscle. Here lower eyelid is in normal position. It does not indicate exophthalmos.
- In exophthalmos lower bulbar sclera is clearly visible and lower eyelid is below and will not cover the bulbar sclera. In severe exophthalmos sclera all over both above and below will be visible.
Fig. 1.240: Cardiovascular system is examined and auscultated for cardiac problems in secondary thyrotoxicosis.

Fig. 1.241: Hepatomegaly can occur in Graves’ and Hashimoto’s diseases as part of the autoimmune disease.

Fig. 1.242: Abdomen is percussed for free fluid.

• Exophthalmos is measured using exophthalmometer.

Other eye signs
Eye signs are common in primary thyrotoxicosis. Lid lag, lid spasm can occur in secondary thyrotoxicosis also.

1. Von Graefe’s sign: Lid lag sign is inabillity of the upper eyelid to keep face with eyeball when looking downwards—lid lag. Place the examiner’s left hand over the patient’s head. Place examiner’s right index finger near the level of eye and slowly bring it down and patient is asked to see the downward moving finger. If sclera upward
is visible then it is positive lid lag sign. Test is repeated few more times for confirmation. Normally upper eyelid follows the finger downwards properly but in primary thyrotoxicosis lid lag is observed.

2. **Naffziger’s sign:** While examiner standing behind the patient, patient’s neck is extended and examiner looks from behind along the superior orbital margin of the patient. Eyeball is seen beyond the superior orbital margin in exophthalmos.

3. **Dalrymple’s sign:** Upper eyelid retraction, so visibility of upper sclera.

4. **Stellwag’s sign:** Absence of normal blinking - so **starring look.** First sign to appear.

5. **Joffroy’s sign:** Absence of wrinkling on forehead when patient looks up (frowns) with the neck flexed.

6. **Moebius sign:** Lack of convergence of eyeball. Defective convergence is due to lymphocytic infiltration of inferior oblique and inferior rectus muscles in case of primary thyrotoxicosis. There will be diplopia. It may be an early sign of eventual ophthalmoplegia. Examiner’s left hand is placed over the patient’s head. Right index finger from distance is brought towards root of the nose between the eyes and patient is asked to follow the converging finger visually to look for convergence. If positive patient will be unable to converge and develops diplopia.

7. **Jellinek’s sign:** Increased pigmentation of eyelid margins.

8. **Enroth sign:** Oedema of eyelids (lower eyelid specifically) and conjunctiva.

9. **Rosenbach’s sign:** Tremor of closed eyelids.

10. **Gifford’s sign:** Difficulty in everting upper eyelid. Differentiates from exophthalmos of other causes.

11. **Loewi’s sign:** Dilatation of pupil with weak adrenaline solution.

12. **Knie’s sign:** Unequal pupillary dilatation.

13. **Cowen’s sign:** Jerky pupillary contraction to consensual light.
14. **Kocher’s sign**: When clinician places his hands on patient eyes and lifts it higher, patients upper lid springs up more quickly than eyebrows.

15. **Naffziger’s sign**: With patient in sitting position and neck fully extended, protruded eye ball can be visualized when observed from behind.

16. **Grove’s sign**: Upper lid resistance to downward traction.

17. **Rochin’s sign**: Reduced amplitude of blinking.

18. **Boston’s sign**: Uneven jerky movement of the upper eyelid in inferior movement.

19. **Mean’s sign**: Eye globe lags behind upper eyelid on upward gaze.

20. **Griffith’s sign**: Lower eyelid lags behind the eye globe on upward gaze.

21. **Sainton’s sign**: Frontalis contraction after cessation of levator activity.

22. **Vigourox’s sign**: Puffiness of lids.

23. **Ballet’s sign**: Ophthalmoplegia- paralysis of more extraocular muscles.

24. **Suken’s sign**: Difficulty in maintaining fixation in extreme lateral gaze.

25. **Wilder sign**: Jerking of eyes on movement from abduction to adduction.

26. **Trousseau’s/Payne’s sign**: Dislocation of the eye globe.

27. **Reisman’s sign**: Bruit over eyelid.

28. **Snellen/Donder’s sign**: Bruit over the eye.

29. **Goldzieher’s sign**: Deep injection of conjunctiva.

- **Lid retraction** is higher upper eyelid with normal lower eyelid with visible sclera adjacent upper eyelid

- **Lid lag** is inability of the upper eyelid to keep pace with the eyeball when it looks downwards to follow the examiners finger

- **Exophthalmos** is visible sclera first below (lower part) the lower edge of the iris and later eventually upper part of sclera will be visible. It is due to pushing of eyeball forwards due to fat, oedema fluid, cells like macrophages in retrobulbar space.

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**Figs 1.246A and B**: Movements of the eye ball should be checked in primary thyrotoxicosis with exophthalmos to rule out involving eye ball muscle infiltration by macrophages, inflammatory cells

**Fig. 1.247**: Moebius sign
Order of appearance of signs
1. Stellwags sign - Mild
   First sign to appear
2. Von Graefes sign - Mild
3. Joffroy's sign - Moderate
4. Moebius sign - Severe

Important signs to be remembered
- Visible lower sclera - sign of exophthalmos
- Naffziger's sign
- Von Graefes sign-upper lid lag- contraction/overactivity of the involuntary part of the levator palpebrae superioris muscle - Muller's muscle
- Joffroy's sign
- Moebius sign - most important-early sign of ophthalmoplegia

Thyroid ophthalmopathy in Grave's disease-Werner' abridged classification of ocular changes with van Dyke's modification

<table>
<thead>
<tr>
<th>Class-grade</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No signs and symptoms</td>
</tr>
<tr>
<td>1</td>
<td>Eye signs only—refer table below for eye signs</td>
</tr>
<tr>
<td>2</td>
<td>Soft tissue involvement</td>
</tr>
<tr>
<td>3</td>
<td>Proptosis more than 22 mm</td>
</tr>
<tr>
<td>4</td>
<td>Extraocular muscle involvement</td>
</tr>
<tr>
<td>5</td>
<td>Corneal involvement—ulceration</td>
</tr>
<tr>
<td>6</td>
<td>Loss of sight/vision due to optic nerve and corneal involvement</td>
</tr>
</tbody>
</table>

Eye signs only
- Resistance to retro displacement of eye
- Oedema of conjuctiva and caruncle
- Lacrimal gland enlargement
- Injection of conjuctiva
- Oedema and fullness of lids

Exophthalmos
- It is proptosis of the eye, caused by infiltration of the retro bulbar tissues with fluid and round cells, with visible lower bulbar sclera and with lid spasm of upper eyelid. (Lid spasm is spasm of levator palpebrae superioris muscle which is partly innervated by sympathetic fibres.)
- Sclera can be seen clearly below and often above the limbus of the eye.
- Proptosis can be measured by exophthalmometer.
- Exophthalmos is often self limiting, but not always. Sleeping in propped up position and lateral tarsorrhaphy will help to protect the eye.

Severe Exophthalmos
- Eyelid oedema, chemosis, conjuctival injection.
- Diplopia, ophthalmoplegia (Complete weakness of all extraocular muscles and so no movements possible).
Corneal ulceration.
- Papilloedema soon develops.
- Finally it may also cause loss of vision.
  It is called as **malignant exophthalmos**. (Even though it is neither malignant nor related to any malignancy).

Treatment of severe exophthalmos
- Steroids intravenously
- IV antibiotics
- Guanethidine, steroid, antibiotic drops
- Lateral tarsorrhaphy
- Orbital decompression
- Diuretics
- Dark spectacles, protective eye patches
- Eyelid surgeries

**Remember**—Antithyroid drugs may worsen exophthalmos and so observe the patient once antithyroid drugs are started as steroids may require to be supplemented.

Grading of exophthalmos
**Mild:** Widening of palpebral fissure due to lid retraction
**Moderate:** Orbital deposition of fat causing bulging with positive Joffroy’s sign
**Severe:** Congestion with intraorbital oedema, raised intra-ocular pressure and diplopia and ophthalmoplegia
**Progressive:** In spite of proper treatment progression of eye signs with chemosis, corneal ulceration and ophthalmoplegia

Causes of dysphonia/stridor in thyroid diseases
- Carcinoma thyroid causing infiltration of recurrent laryngeal nerve/trachea
- Large, long standing goitre causing tracheomalacia
- Retrosternal goitre
- Congestive cardiac failure in thyrotoxicosis

Recent rapid increase in thyroid swelling is due to
- Previous MNG – malignant transformation
- Haemorrhage into a nodule
- Anaplastic carcinoma of thyroid
Causes of exophthalmos

**Endocrinal**
- Thyrotoxicosis – common
- Cushing’s syndrome, acromegaly – rare

**Congenital deformities of skull**
- Craniostenosis, oxycephaly, hypertelorism

**Primary tumours**
- Periorbital meningioma
- Optic nerve glioma
- Orbital haemangioma
- Lymphoma
- Osteoma
- Pseudo tumour – granuloma

**Secondary tumours**
- Antral carcinoma, neuroblastoma

**Inflammatory**
- Orbital cellulites, frontal sinusitis

**Vascular causes**
- Cavernous sinus thrombosis/A-V fistula
- Ophthalmic artery aneurysm

**Other eye causes**
- Severe myopia
- Severe glaucoma-buphthalmos

Causes of pulsating exophthalmos

- Carotid-cavernous sinus A-V fistula
- Cavernous sinus thrombosis
- Orbital vascular neoplasm
- Orbital haemangioma
- Ophthalmic artery aneurysm

In a case of thyroid disease following things should be made very clear

- Functional status – hyperthyroid/euthyroid/hypothyroid
- Compression to trachea/recurrent nerve
- Neck lymph nodal status
- Tracheal deviation
- Carotid infiltration
- Retrosternal extension
- Systemic features like toxicity or malignant spread to different organs like bone/liver/lungs

Remember-
- *Goitre* is enlargement of the thyroid gland
- *Solitary nodule* is on clinical examination single palpable nodule without palpable rest of the gland
- *Dominant nodule* is single nodule with palpable enlargement of the remaining thyroid gland
- *Thyroid swelling* is confirmed by its movement with deglutition due to attachment of enclosed pretracheal fascia to inferior constrictor muscle which is attached to trachea and
cricoid cartilage and so moves with deglutition. Berry’s ligament is condensed vascularised pretracheal fascia postero-superomedially. It is important as it is close to recurrent laryngeal nerve
- Any thyroid swelling can be malignant unless proved otherwise
- U/S neck, FNAC, T3, T4, TSH are essential investigations
- CT scan neck is needed in large goitre and fixed or malignant thyroid.
- Radioisotope study ¹²³I is done only in selected cases like borderline toxicity, ectopic thyroid, retrosternal goitre and in follicular carcinoma thyroid after thyroidectomy to see secondaries during follow-up period
- Normal thyroid gland is usually not palpable.

Investigations for Thyroid Diseases
- T3, T4, TSH, Free T3, Free T4.
- U/S neck for thyroid and neck nodes.
- FNAC thyroid and lymph node.
- Radioisotope study.
- CT neck in malignancies or large goitre.
- Trucut biopsy if two trials of FNAC are inconclusive. It can injure deeper structures like recurrent laryngeal nerve and also can cause haemorrhage.
- Frozen section biopsy on table and proceed may be needed.
- Serum calcitonin, serum thyroglobulin estimation in neoplasms of thyroid.

Role of ultrasound (U/S) in thyroid diseases
- To detect number, size, nature of the nodules (cystic/solid/complex) (complex means cystic and solid together—more suspicious of carcinoma). Size up to 2 mm can be detected.
- U/S guided FNAC is very useful
- U/S at regular intervals is advisable to observe a small nodule in thyroid
- To detect recurrent nodule
- To find out the invasion/spread/vascularity/status of carotid artery and internal jugular vein
- To find out enlarged lymph nodes in neck

Role of FNAC in thyroid swelling
- Highly sensitive in papillary carcinoma of thyroid and also its nodal spread
- Useful to differentiate between benign and malignancy
- Useful in lymphoma/anaplastic carcinoma/medullary carcinoma thyroid/Hashimotos thyroiditis
- It is not very useful in follicular carcinoma as it is difficult to differentiate it from follicular adenoma as main feature in follicular carcinoma is capsular invasion/vascular invasion

Fig. 1.251: U/S neck showing thyroid nodule.

Fig. 1.252: FNAC thyroid is an important investigation in thyroid diseases.
Note:
- On table frozen section biopsy is useful in negative FNAC but doubtful cases. Definitive procedure is undertaken once frozen section report comes on table. But in frozen section biopsy itself, 15% of follicular carcinoma report may be inconclusive or negative which causes difficulty in taking decision. In such occasion hemithyroidectomy is done and once histology report of follicular carcinoma is obtained completion thyroidectomy is done usually immediately within a week. If biopsy report is delayed then completion thyroidectomy is done after 6 weeks.
- Trucut biopsy gives tissue diagnosis but danger of haemorrhage and injury to vital structures like trachea, recurrent laryngeal nerve, vessels are likely.

**Solitary Thyroid Nodule**

*What is solitary nodule of thyroid?*  
It is a single palpable nodule in thyroid on clinical examination, in an otherwise normal gland.

**Causes**  
- Thyroid adenomas—  
  - Colloid—commonest.  
  - Hurthle cell.  
  - Follicular.  
- Papillary carcinoma of thyroid.  
- Only one nodule may be palpable in an underlying multinodular goitre.  
- Thyroid cyst.

**Types:**  
1. Toxic solitary nodule.  
2. Nontoxic solitary nodule.

**Based on radioisotope study:**  
2. Warm—Normally functioning nodule.  
3. Cold—Non-functioning nodule; may be malignant-20% (need not be always). Cold nodule may be due to malignancy, thyroiditis, thyroid cyst or haemorrhage.  
4. Hot or warm in 99m technetium scan but cold in I123 scan—commonly they are malignant.

Note:  
- Thyroid nodule in children and elderly can be malignant.  
- Rapid enlargement of thyroid nodule can be malignant.  
- Medullary carcinoma of thyroid commonly and 6% of papillary carcinoma of thyroid can be familial.  
- Recurrent laryngeal nerve palsy, fixity, stridor, presence of palpable neck nodes are usually features of carcinoma thyroid.  
- Follicular carcinoma causes pulsatile, localized, warm, vascular secondaries in skull bone.  
- 30% of solitary nodules are cystic.
**Features**

1. Single nodule palpable in one or other lobes of the thyroid which is usually smooth, globular, well-defined margin and firm. Skin overlying is normal.

2. Lahey’s test does not show any other nodules in posterior part of the gland.

3. Tracheal deviation towards opposite side is common – confirmed by trail sign, three finger test and auscultation.

4. U/S neck is very useful. FNAC is essential. When FNAC is inconclusive Trucut needle biopsy may be done but it can cause pain/bleeding/recurrent laryngeal nerve injury.

5. T3, T4, TSH are done to find out the function

6. Radioisotope study. (I\textsuperscript{123}/I\textsuperscript{131}/\textsuperscript{99mTc}).

7. CT scan or MRI neck is done only in selected cases but not routinely. Large swelling/to see vascularity/retrosternal extension are the indications.

**Fig. 1.255:** Solitary nodule thyroid causes deviation of trachea to opposite side.

**Treatment**

- If it is a nontoxic nodule due to any cause, hemithyroidectomy with complete removal of lateral lobe and whole of the isthmus is done.

- If it is papillary carcinoma thyroid, then near total thyroidectomy is done along with suppressive dose of L-Thyroxine given 0.3 mg OD daily.

- If it is a toxic nodule, radioactive therapy, I\textsuperscript{131} —5 milli curie is given orally, if the age of the patient is more than 45 years.

- If age is less than 45 years, then initially toxicity has to be controlled by antithyroid drugs, always followed by surgery - Hemithyroidectomy.

- If FNAC is follicular adenoma, then hemithyroidectomy is done. If histology becomes follicular carcinoma (capsular and vascular invasion) then completion total thyroidectomy is done. Completion thyroidectomy is done usually within 7 days or after 3 weeks. If frozen section biopsy proves carcinoma then total thyroidectomy is done.
If there is a nodule in the isthmus, isthmectomy with excision of part of adjacent lateral lobes is done.

If FNAC is medullary carcinoma of thyroid, then total thyroidectomy with bilateral neck nodal dissection including central compartment is done.

Colloid nodule may respond for conservative drug treatment using thyroxine orally in 50% cases. If nodule reappears/enlarges progressively significantly/causing cosmetic problem then hemithyroidectomy is indicated in colloid nodule.

Possible features of suspected malignancy in solitary nodule thyroid

- Any nodule can be malignant whether
genital is hard/firm/cystic/small/large/asymptomatic
- Rapid onset/rapid recent increase in size
- Hoarseness of voice/dysphagia/stridor/dysphagia
- Fixity of the nodule
- Palpable significant neck nodes

Diffuse Hyperplastic Goitre

Initial persistent increase in TSH level causes diffuse active lobules. In late stages of diffuse hyperplasia, TSH stimulation decreases and many follicles become inactive get filled with colloid and it is called as colloid goitre. As diffuse hyperplastic goitre is a reversible stage, l-thyroxine is beneficial.

Nodular Goitre

Pathogenesis

<table>
<thead>
<tr>
<th>Indications for surgery in solitary nodule thyroid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malignant nodule</td>
</tr>
<tr>
<td>Follicular neoplasm</td>
</tr>
<tr>
<td>Toxic nodule in young</td>
</tr>
<tr>
<td>Nodules with obstruction</td>
</tr>
<tr>
<td>Recurrent cystic nodule</td>
</tr>
<tr>
<td>Complex cyst (both solid and cystic component)</td>
</tr>
<tr>
<td>Cosmetics</td>
</tr>
</tbody>
</table>
Other factors involved are growth stimulating immunoglobulins and growth prone cell clones.

**Features**
- It is a slowly progressive disease with many years of history.
- Multiple nodules of different sizes are formed in both lobes, also in isthmus, which is firm, nodular, non tender, moves with deglutition.
- Recent increase in size signifies malignant transformation or haemorrhage.
- Investigations are $T_3$, $T_4$, TSH, U/S neck, FNAC, X-ray neck will show ring or rim calcification.

![Fig. 1.257: Diagrammatic representation of multinodular goitre.](image1)

![Fig. 1.258: Large multi-nodular goitre.](image2)

![Fig. 1.259: Nodular thyroid involving both lobes in a female.](image3)

![Fig. 1.260: X-ray neck showing calcification in thyroid with retrosternal extension.](image4)
Complications of MNG
- Secondary thyrotoxicosis (30%)
- Follicular carcinoma of thyroid (10%)
- Haemorrhage in a nodule
- Tracheal obstruction
- Calcification
- Cosmetic problem

Treatment
Nodular goitre is an irreversible stage and so surgery is the treatment.
- Total thyroidectomy is universally accepted method presently. Only problems are chances of recurrent nerve palsy and postoperative risk of patient developing hypocalcaemia often severe.
- Subtotal thyroidectomy is done depending on the amount of gland involved, amount of normal gland existing and location of nodules.
- Hartley-Dunhill procedure is removal of one entire lobe which is more affected with subtotal removal of other gland.
- Partial thyroidectomy wherein gland behind the tracheo oesophageal groove is retained with removal of diseased glands in front. Earlier it used to be a popular method. Currently it is not well practiced.
- Postoperatively L-thyroxine is often given to prevent further fluctuation in TSH level.

Thyroid cyst
- It is thyroid swelling which is cystic in nature eliciting positive fluctuation
- Common cause is colloid degeneration
- 30% of solitary nodules are cystic
- 15% cystic swellings in thyroid are malignant
- Cyst formation is common in papillary carcinoma of thyroid
- A cyst if contains both solid and cystic areas is called as complex cyst which is more likely malignant
- FNAC may cause regression in simple cyst
  But after three repeated aspirations recurrence occurs, surgery is needed.
- Complex cyst and if cyst is more than 4 cm in size then surgery is indicated

Thyrotoxicosis and Hyperthyroidism
Symptoms due to raised levels of thyroid hormones.

Types
2. Toxic multi-nodular goitre (Secondary thyrotoxicosis.). (Plummer disease).
3. Toxic nodule.
4. Hyperthyroidism of rarer causes:
   a. Thyrotoxicosis factitia - drug induced. Due to intake of L-thyroxine more than normal.
   b. Jod Basedow thyrotoxicosis - because of large doses of iodides given to a hyperplastic endemic goitre.
c. Autoimmune thyroiditis or de’ Quervain’s thyroiditis.
d. Occasionally carcinoma thyroid.
e. Neonatal thyrotoxicosis. It subsides in 3-4 weeks as TsAb titres fall in the baby’s serum.

(Wolf-Chaikoff effect—iodides inhibit the further release of hormone causing hypothyroidism).

**Clinical Features**

i. It is eight times more common in females.
ii. Occurs in any age group.
iii. Primary type is seen commonly in younger age group.
iv. Secondary is common in older age group.

**Symptoms of Hyperthyroidism**

**Gastrointestinal system**
- Weight loss in spite of increased appetite
- Diarrhoea (due to increased activity at ganglionic level).

**Cardiovascular system**
- Palpitations, chest pain.
- Shortness of breath at rest or on minimal exertion.
- Angina.
- Cardiac irregularity.
- Cardiac failure in the elderly (CCF).

**Neuromuscular system**
- Undue fatigue and muscle weakness, exaggerated tendon reflexes, myasthenia like syndrome.
- Tremor, hyperkinesias, increased sweating.

**Skeletal system**
Increase in linear growth in children.

**Genitourinary system**
- Oligo- or amenorrhea.
- Occasional urinary frequency.

**Integument**
- Hair loss.
- Pruritus.
- Palmar erythema.

**Psychiatry**
- Irritability.
- Nervousness.
- Insomnia.

Sympathetic overactivity causes dyspnoea, palpitation, tiredness, heat intolerance, sweating, nervousness, increased appetite and decrease in weight. Because of the increased catabolism they are having increased appetite, decreased weight.
## WAYNE’S DIAGNOSTIC INDICES (CLINICAL)

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Present</th>
<th>Absent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Dyspnoea on effort</td>
<td>+1</td>
<td></td>
</tr>
<tr>
<td>2. Palpitation</td>
<td>+2</td>
<td></td>
</tr>
<tr>
<td>3. Tiredness</td>
<td>+2</td>
<td></td>
</tr>
<tr>
<td>4. Preference for heat</td>
<td>+5</td>
<td>—5</td>
</tr>
<tr>
<td>5. Preference for cold (Heat intolerance)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Excessive sweating</td>
<td>+3</td>
<td></td>
</tr>
<tr>
<td>7. Nervousness</td>
<td>+2</td>
<td></td>
</tr>
<tr>
<td>8. Appetite increased</td>
<td>+3</td>
<td></td>
</tr>
<tr>
<td>9. Weight decreased</td>
<td>+3</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Signs</th>
<th>Present</th>
<th>Absent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Bruit over thyroid</td>
<td>+2</td>
<td></td>
</tr>
<tr>
<td>2. Exophthalmos</td>
<td>+2</td>
<td></td>
</tr>
<tr>
<td>3. Lid retraction</td>
<td>+2</td>
<td></td>
</tr>
<tr>
<td>4. Lid lag</td>
<td>+1</td>
<td></td>
</tr>
<tr>
<td>5. Hyperkinetic movements</td>
<td>+4</td>
<td>—2</td>
</tr>
<tr>
<td>6. Fine finger tremors</td>
<td>+1</td>
<td></td>
</tr>
<tr>
<td>7. Hands Hot</td>
<td>+2</td>
<td>—2</td>
</tr>
<tr>
<td>Moist</td>
<td>+1</td>
<td>—1</td>
</tr>
<tr>
<td>8. Atrial fibrillation</td>
<td>+4</td>
<td></td>
</tr>
<tr>
<td>9. Pulse rate 80/minute</td>
<td>0</td>
<td>—3</td>
</tr>
<tr>
<td>80-90/minute</td>
<td></td>
<td></td>
</tr>
<tr>
<td>More than 90/minute</td>
<td>+3</td>
<td></td>
</tr>
<tr>
<td>10. Palpable thyroid</td>
<td>+3</td>
<td></td>
</tr>
</tbody>
</table>

< 11 points—non toxic 11-19—equivocal > 19 points—toxic goitre

and so also increased creatinine level which signifies **myopathy** (due to more muscle catabolism).

*Fine tremor is due to diffuse irritability of grey matter.*

Thrill is felt in the upper pole of the thyroid and also bruit on auscultation. It is because in upper pole, superior thyroid artery enters the gland superficially, and so thrill and bruit can easily be assessed. In lower pole inferior thyroid artery enters the gland from deeper plane and so thrill cannot be felt.

**Signs of Hyperthyroidism**

1. *Eye signs in toxic goitre (Refer above)*

2. **Cardiac Manifestations:**
   1. Tachycardia is common.
   2. Ectopic.
   3. Pulsus paradoxus.
   4. Wide pulse pressure.
   5. Multiple extrasystoles.
   6. Paroxysmal atrial tachycardia.
   7. Paroxysmal atrial fibrillation.
   8. Persistent atrial fibrillation (not responsive to digoxin).
3. **Myopathy:**
   1. Weakness of proximal muscles occurs, i.e. the front thigh muscles, or arm muscles.
   2. Weakness is more when muscle contracts isometrically either while getting down steps, or lifting a full bucket, etc.
   3. Often when it is severe it resembles myasthenia gravis. Once hyperthyroidism is controlled recovery occurs.

4. **Pretibial myxoedema** is often a feature of primary thyrotoxicosis (It is a misnomer)
   - It is usually symmetrical, shiny, red thickened skin, with coarse hair.
   - In severe cases skin of whole leg below the knee with foot and ankle is involved.
   - It is due to deposition of myxomatous tissues (mucin like deposits) in skin and subcutaneous plane.
   - It might or might not regress completely after treatment for toxicity
   - It is associated with exophthalmos with high levels of thyroid stimulating antibodies.

5. **Thyroid acropachy** is clubbing of fingers and toes in primary thyrotoxicosis. Hypertrophic pulmonary osteoarthropathy may develop.

Cardinal signs of toxic thyroid
- Palpable thyroid often with thrill and bruit
- Tremor of hands and tongue
- Tachycardia
- Exophthalmos

**Toxic Nodule**
- Is a solitary overactive nodule.
- There is an autonomous hypertrophy and hyperplasia of the part of the gland where there is a nodule. (It is not due to Thyroid stimulating antibody (Ts Ab)).
- Here high levels of circulating thyroid hormones suppress TSH secretion, and so normal thyroid tissue surrounding the nodule is itself suppressed and inactive.
- Once patient becomes euthyroid by drugs, surgery (hemithyroidectomy) is done or radioactive iodine therapy I\textsuperscript{131} in a therapeutic dose of 5mcurie is given orally.
- Because normal gland is inactive, radioactive iodine affects only the autonomous nodule, allowing the normal gland to remain intact which later gets activated and functions normally.

<table>
<thead>
<tr>
<th>Differentiating points between Primary and Secondary hyperthyroidism</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary thyrotoxicosis</strong></td>
</tr>
<tr>
<td>1. Symptoms appear first, then swelling</td>
</tr>
<tr>
<td>2. Goitre is diffuse, smooth, firm or soft, both lobes are involved</td>
</tr>
<tr>
<td>3. There is thrill and bruit</td>
</tr>
<tr>
<td>4. Features are much more severe compared to that of secondary toxicosis</td>
</tr>
<tr>
<td>5. Eye signs and exophthalmos are common</td>
</tr>
<tr>
<td>6. As it is an autoimmune disease, there may be hepatosplenomegaly</td>
</tr>
</tbody>
</table>

*Histologically, there is hyperplasia of acini, lined by columnar epithelium, often containing vacuolated colloid.*
• Drugs are used initially, only for a temporary period to make the patient euthyroid.

**Investigations**

**Thyroid function tests**

<table>
<thead>
<tr>
<th>Type of disease</th>
<th>T&lt;sub&gt;4&lt;/sub&gt;</th>
<th>T&lt;sub&gt;3&lt;/sub&gt;</th>
<th>TSH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional hyperthyroidism</td>
<td>increased</td>
<td>increased</td>
<td>undetectable</td>
</tr>
<tr>
<td>T3 hyperthyroidism</td>
<td>increased</td>
<td>Undetectable</td>
<td></td>
</tr>
<tr>
<td>Subclinical hyperthyroidism</td>
<td>Undetectable</td>
<td>Undetectable</td>
<td></td>
</tr>
</tbody>
</table>

• Serum T<sub>4</sub> and T<sub>3</sub> levels are very high. TSH is very low or undetectable. Some times, only T<sub>3</sub> level is increased and is called as T<sub>3</sub> toxicity. Here in T<sub>3</sub> toxicity, free T<sub>3</sub> estimation is important.

• Radioisotope study by I<sup>131</sup> (Diagnostic dose 5 micro curie is used) will show more uptake, i.e. hot nodules or hot areas. This is very useful in autonomous solitary toxic nodule.

• TRH estimation.

• ECG—To look for cardiac involvement and if required opinion from cardiologists’ is taken and cardiac problems are managed.

• Total count and neutrophil count are very essential base line investigations before starting antithyroid drugs (as it may cause agranulocytosis).

**Treatment**

1. Antithyroid drugs.
2. Surgery.
3. Radio-iodine therapy.

1. **Antithyroid drugs**

   **Indications for Antithyroid drugs**
   1. Toxicity in pregnant women—Propylthiouracil is preferred
   2. Toxicity in children and young adults
   3. Before subtotal thyroidectomy, to make the patient euthyroid usually for 6-12 weeks
   4. After radioactive I<sup>131</sup> therapy for 6-12 weeks (Effects of Radiotherapy start only in 6-12 weeks)

   a. **Carbimazole:**
   - It is the commonest drug used.
   - Dose is 5-10 mg, exactly 8th hourly, (as T1/2 of carbimazole is 8 hours).
   - Usually given for 12-18 months.
   - Peak plasma level should be maintained in optimum concentration to have a proper benefit.
   - Often tri-iodo thyronine 20 micro gram 4 times daily or Thyroxine 0.1 mg daily is given in combination with antithyroid drugs, to prevent iatrogenic thyroid insufficiency or to prevent the increase in size of goitre.
   - It acts by blocking thyroid hormone synthesis.
   - Carbimazole also suppresses the autoimmune process in thyroid in Graves’ disease. So thyroid stimulating antibody (TsAb) production diminishes.

   b. **Methimazole:** Similar like carbimazole. Dose is 5-20 mg daily.

   c. **Propylthiouracil:**
   1. It acts by blocking thyroid hormone synthesis as well as by blocking peripheral conversion of T<sub>4</sub> to T<sub>3</sub>.
   2. It also decreases the thyroid autoantibody levels.
   3. It can be given in hyperthyroidism in children and pregnancy.
   4. Dose is 200 mg 8th hourly.

   Antithyroid drugs are continued during and after surgery, for 7-10 days and after radioactive iodine therapy for 6 weeks to 12 weeks.

   Response to treatment and possibility of relapse in primary thyrotoxicosis can be assessed by studying HLA status and TsAb level.

   **Propranolol:**
   Dose is 40 mg tid.

   It reduces the cardiac problems and also blocks the peripheral conversion of T<sub>4</sub> to T<sub>3</sub> as it is the T<sub>3</sub> which is the principle active agent in periphery.

   Contraindications are bronchial asthma, heart block, cardiac failure.
Lugol’s iodine (5% iodine + 10% potassium iodide):

- It decreases the vascularity of the gland and makes it more firm and easier to handle during surgery. Dose is 10-30 drops/day (minims) for 10 days prior to surgery. Potassium iodide tablets 60 mg tid also can be given instead of Lugol’s iodine. But its use at present is disqualified.

(One minim = one drop. One ml = 16 drops).

**Advantages of antithyroid drugs**
1. Avoids surgery and its complications
2. Avoids radiotherapy.
   Clinical improvement occurs in 2 weeks. Biochemical improvement occurs in 6 weeks.

**Disadvantages**
1. Prolonged course of treatment for 18 months and inspite of this can not predict the remission or relapse. Relapse rate is 40%.
2. Size of swelling may not regress.
3. It may lead to agranulocytosis and thrombocytopenia, liver damage, hair loss.
   Sore throat is the earliest presentation of agranulocytosis. If it is so, drug has to be stopped; total count has to be done. If it is less, agranulocytosis is confirmed. High doses of injection benzyl penicillin 10-20 lakh, 6th hourly, IV has to be started to prevent infection. If required, blood transfusion has to be done. Patient usually recovers by this. To control toxicity, Tab. Propranolol 40 mg tid has to be started. Rarely they need bone marrow transplantation.

2. Surgery:

**Indications**
1. Failure of drug treatment in primary thyrotoxicosis in young patients
2. Autonomous toxic nodule
3. Nodular toxic goitre
4. When malignancy can not be ruled out

Surgery done is **subtotal thyroidectomy**—Both lobes with isthmus are removed and a tissue equivalent to pulp of finger is retained in lower pole of the gland on both sides.

In autonomous nodule, **hemithyroidectomy** is done – Entire lateral lobe with whole of isthmus is removed.

**Advantages:** Rapid cure and high cure rate.

Patient should be made euthyroid before doing surgery. (It should be confirmed by repeated estimation of TSH, T₃ and T₄ levels).

**Disadvantages:**
1. Recurrent thyrotoxicosis (5%). It is treated by radioiodine therapy or antithyroid drugs. Resurgery is technically difficult.
2. Thyroid insufficiency (20-45%). It is revealed in 6 months to 2 years and confirmed by doing T₃ and T₄ and TSH estimation. Hypothyroidism is better than recurrent thyrotoxicosis. It is treated by tab. L-thyroxine 0.1 mg daily (OD) for life long.
3. **Complications of thyroid surgery** itself.

3. **Radioiodine therapy:**

**Indications**
1. Primary thyrotoxicosis after 45 years of age
2. In autonomous toxic nodule
3. In recurrent thyrotoxicosis

- Radioiodine destroys the cells and causes the complete ablation of thyroid gland. It is given only after the age of 45yrs, as the chances of genetic mutation (damage), leukaemia; carcinomas are high in younger individual.
- Usual dose is 50-60 milli curie, or 160 micro curie/gm of thyroid. (300-600 MBq).
- It takes 3 months, to get full response, and so until then, the patient has to take antithyroid drugs. Often additional one or two doses of radioiodine are required to have complete ablation. Eventually they go for hypothyroidism (80%) and so require maintenance dose of l-thyroxine 0.1mg daily.
- To give therapeutic dose, patient should be admitted and isolated for 7 days (Half life) to prevent irradiation. It is given orally soon after getting from the manufacturer without much delay to have optimal efficacy.
Choice therapies

<table>
<thead>
<tr>
<th>Condition</th>
<th>Age</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diffuse toxic goitre:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Small goitre</td>
<td>Over 45 years</td>
<td>Antithyroid drugs for 18 months. Radioiodine therapy.</td>
</tr>
<tr>
<td>b. Large goitre</td>
<td>Under 45 years</td>
<td>Surgery (Subtotal thyroidectomy).</td>
</tr>
<tr>
<td>Toxic nodular goitre:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toxic solitary nodule:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recurrent thyrotoxicosis after</td>
<td></td>
<td></td>
</tr>
<tr>
<td>surgery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Failure of antithyroid drugs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>or radio iodine therapy:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Advantages:
1. No surgery.
2. No prolonged drug therapy.

Disadvantages:
1. Availability of facilities.
2. Proper follow-up is essential.

**Toxic Thyroid in Pregnancy**
- Radioiodine therapy is an absolutely contraindicated in pregnancy (High risk to foetus).
- Antithyroid drugs can be administered carefully.
- But, the problem here is that both TSH and antithyroid drugs crosses the placental barrier and baby born may be hypothyroid and goitrous.
- Propylthiouracil is preferred in pregnancy.
- Subtotal thyroidectomy can be done in second trimester.

**Toxic Thyroid in Children**
Radioiodine therapy is absolutely contraindicated in children because of high risk of developing thyroid carcinoma. Recurrence rate is also very high after surgery. So proposed treatment is, initially antithyroid drugs are given until adolescent period and then subtotal thyroidectomy is done.

**Thyrocardiac**
Severe cardiac damage resulting from hyperthyroidism (may be partly or wholly due to same), usually secondary type, requires proper opinion from cardiologists and treatment with propranolol. Subtotal thyroidectomy is the treatment.

In a patient with thyrotoxicosis, with recent onset of proptosis, early thyroidectomy has to be avoided. Because early surgery may precipitate malignant exophthalmos. Here the patient has to be treated initially with antithyroid drugs and if required with steroids, until the proptosis has remained static for six months. Then subtotal thyroidectomy is done.

Since half life of l-thyroxine is 7 days, propranolol and antithyroid drugs has to be continued for 7 days after thyroidectomy.

T, thyrotoxicosis should be suspected if the clinical picture is suggestive of toxicosis, but routine tests for thyroid function are within normal range.
Differential diagnosis of thyrotoxicosis
- Anxiety neurosis—hands are cold and moist; sleeping pulse rate is normal; thyroid enlargement is not present.
- Phaeochromocytoma.
- Malabsorption syndrome.
- Diabetes mellitus.

What are the different presentations of carcinoma thyroid?
- Any thyroid swelling can be malignant. It can be of short or long duration. It can be solitary/multinodular goitre. It can be solid/cystic/complex in nature.
- Preexisting thyroid swelling with recent history of rapid increase in size.
- Palpable neck lymph nodes.
- Recurrent laryngeal nerve palsy, dyspnoea, stridor are other presentations.
- Medullary carcinoma thyroid and papillary carcinoma thyroid (6%) can be familial.

Classification of thyroid neoplasm
A. Benign.
   a. Follicular adenoma.
   b. Hurthle cell adenoma.
   c. Colloid adenoma—commonest.
   d. Papillary adenoma—its existence is doubtful. It is invariably low grade papillary carcinoma.

Malignant (Dunhill classification).
- **Differentiated.**
  1. Papillary carcinoma (60%).
  2. Follicular carcinoma (17%).
  3. Papillofollicular carcinoma behaves like papillary carcinoma of thyroid.
  4. Hurthle cell carcinoma behaves like follicular carcinoma.
- **Undifferentiated.**
  Anaplastic carcinoma (13%).
- **Medullary carcinoma (6%).**
- **Malignant lymphoma (4%).**
- **Secondaries in thyroid (rare) - from colon, kidney, melanoma.**

Etiology of Thyroid Malignancy
1. Radiation either external or radioiodine can cause papillary carcinoma thyroid. There is increased incidence of thyroid carcinoma among children following exposure to ionising radiation after the Chernobyl nuclear disaster in Ukraine in 1986. Irradiation to head and neck region used to be the therapy for benign conditions like adenoids, acne.
vulgaris, thymus enlargement, haemangiomas which predisposed papillary carcinoma of thyroid. Radiotherapy for Hodgkin’s lymphoma in younger age group may cause papillary carcinoma of thyroid.

2. Preexisting multinodular goitre. It turns into follicular carcinoma of thyroid.

3. Medullary carcinoma thyroid is often familial.

4. Hashimoto’s thyroiditis may predispose to papillary carcinoma of thyroid and also NHL.

**Papillary Carcinoma**

- It is 60% common.
- Common in females (3:1) and young age group.

**Aetiology**

- Radiation either external or radioactive iodine therapy.
  - TSH levels in the blood of these patients are high. and so it is called as hormone dependent tumour.
  - It is a slowly progressive and less aggressive tumour.
  - It is commonly multicentric.
  - It spreads within the gland through intra-thyroidal lymphatics to other lobe, comes out of the capsule and spreads to lymph nodes.
  - Usually there is no blood spread.

**Types**

i. Occult (< 1.5 cm)

ii. Intrathyroidal

iii. Extrathyroidal

iv. Micropapillary carcinoma is less than 1 cm in size or clinically not detectable.

**Gross:**

It can be soft, firm, hard, and cystic. It can be solitary or multinodular. It contains brownish black fluid.

**Microscopy:**

It shows cystic spaces, papillary projections with psammoma bodies, malignant cells with ‘Orphan Annie eye’ nuclei (intranuclear cytoplasmic inclusions). (Nuclear grooving).

**Clinical Features**

1. Soft or hard or firm, solid or cystic, solitary or multinodular thyroid swelling.

2. Compression features are uncommon in papillary carcinoma thyroid.

3. Often discrete lymph nodes in the neck are palpable.

**Diagnosis**

FNAC of thyroid nodule and lymph node. To see psammoma bodies, nuclear changes. Radioisotope scan shows cold nodule. TSH level in the blood is higher.

**Treatment**

- Near total thyroidectomy or total thyroidec-tomy

- Suppressive dose of L-Thyroxine 0.3 mg O.D life long.

- Block dissection (modified radical neck dissection) is required if lymph nodes are involved.

- Occasionally if small lymph nodes are present, ‘Berry picking’ may be done. (Not accepted now).

- Extrathyroidal type needs radioactive iodine therapy also (I$^{131}$).

Near total thyroidectomy (by Thomas) is removal of both lobes of the thyroid and isthmus with retaining a small tissue close to recurrent laryngeal nerve and parathyroids.

Fig. 1.266: Papillary carcinoma of thyroid with lymph nodal spread.
*Note:* If tumour is unifocal, intrathyroidal, less than 1 cm and well differentiated tumour in a patient with age less than 40 years, then hemithyroidectomy is sufficient with regular, proper follow-up.

*Prognosis* is good and it is one of the curable malignancies.

<table>
<thead>
<tr>
<th>AMES scoring</th>
<th>AGES scoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>A: Age. Age less than 40 years has got better prognosis</td>
<td>A: Age less than 4 cm has got better prognosis</td>
</tr>
<tr>
<td>M: Distant metastasis</td>
<td>G: Pathologic Grade of the tumour</td>
</tr>
<tr>
<td>E: Extent of the primary tumour</td>
<td>E: Extent of the primary tumour</td>
</tr>
<tr>
<td>S: Size of the tumour. Size less than 4 cm has got better prognosis</td>
<td>S: Size of the primary tumour. Size less than 4 cm has got better prognosis</td>
</tr>
</tbody>
</table>

*Psammoma bodies are seen in*
- Papillary carcinoma thyroid
- Meningioma
- Serous cystadenoma of ovary

*Berry’s in thyroid*
- Berry ligament
- Berry sign
- Berry picking

**Lateral aberrant thyroid** is a misnomer. It is actually secondaries in neck lymph nodes which are palpable from an occult primary from papillary carcinoma of thyroid (which is clinically not palpable).

*Thyroid paradox*—Cellular tumours are soft, and cystic tumours are firm or hard (tensely cystic). It is observed in papillary carcinoma of thyroid.

**Features of thyroid carcinoma**
Any thyroid can be malignant of any size, of any texture—solid/cystic, of any number—single/multiple, in any age group

**Features of infiltration**
- Infiltration of strap muscles often with sternomastoid muscle
- Infiltration of laryngotracheal complex causing stridor and often haemoptysis
- Infiltration of recurrent laryngeal nerve causes hoarseness of voice
- Infiltration of oesophagus causes dysphagia/odynophagia (painful swallowing)
- Infiltration into carotid sheath causing absence of carotid pulsation—berry’s sign
- Infiltration of cervical sympathetic chain causing Horner’s syndrome
- Rarely infiltration into cranial nerves or brachial plexus can occur

**Features of lymph nodal spread**
- Discrete neck node involvement can occur commonly in papillary carcinoma of thyroid, often in medullary carcinoma and occasionally in follicular carcinoma. Lymph node is often cystic (20%) and contains brownish-black material in papillary carcinoma
- Central neck (level VI) and mediastinal nodes are also often can get involved in thyroid
malignancy. Primary nodes may be involved but clinically not palpable. Superior mediastinal nodes (level VII) can cause compression of SVC, recurrent laryngeal nerve with often dullness in the sternum. These nodes can get involved without palpable neck nodes.

- In the neck palpable nodes are commonly levels – II, III and IV occasionally level V.
- Secondary nodes – clinically palpable
- Only palpable neck node may be presentation without clinically palpable thyroid – occult secondary with primary (papillary) thyroid carcinoma. FNAC of the node concludes the diagnosis.
- Central node dissection is the common practice while doing total thyroidectomy in carcinoma thyroid especially in medullary carcinoma of thyroid.

**Features of blood spread**

- Follicular carcinoma commonly spreads through blood to bone, lungs, and liver. Bone secondary is typical. It is well-localized, smooth, soft/hard, warm, non mobile, vascular and pulsatile. It is common in the skull bone – frontal/parietal bone. It can occur in other bones also.
- Lung secondaries present with chest pain, dyspnoea and haemoptysis.
- Liver secondaries cause hepatomegaly and jaundice.
- Blood spread also can occur in medullary carcinoma of thyroid.

**Follicular Carcinoma**

- It is 17% common.
- It is common in females.
- It can occur either *denovo* or in a preexisting multinodular goitre.
- It is a more aggressive tumour.
- It spreads mainly through blood into the lung, bones, liver.
- Bone secondaries are typically vascular, warm, pulsatile, localized, commonly in skull, long bones, ribs.

- It can also spread to lymph nodes in the neck occasionally.

**Types**

- Non-invasive-blood spread is not common.
- Invasive- blood spread is common.

**Fig. 1.268**: Follicular carcinoma of thyroid in a male patient. It involved mainly left lobe but it is extensive and spreading to soft tissues adjacent to it.

**Figs 1.269A and B**: Follicular carcinoma of thyroid causing secondaries in skull. It is localized, vascular, smooth, pulsatile, warm secondaries (in skull).

**Typical Feature**

Angioinvasion and capsular invasion.
Clinical Features
1. Swelling in the neck, firm or hard and nodular.
2. Tracheal compression and stridor.
3. Dyspnea, hemoptysis, chest pain when there are lung secondaries.
4. Recurrent laryngeal nerve involvement causing hoarseness of voice, positive ‘Berry’s sign’ signifies advanced malignancy. (Infiltration into the carotid and so absence of carotid pulsation).
5. Pulsatile, warm, well localized, vascular secondaries in the skull (frontal/parietal bones), long bones.

Investigations
- Most often FNAC is inconclusive, because capsular and angioinvasion which is the main feature in follicular carcinoma cannot be detected by FNAC.
- Frozen section biopsy is very useful. But in 15% cases it shows negative results.
- U/S abdomen, Chest X-ray, X-ray bones are the other investigations required.

Fig. 1.271: CT scan of neck showing thyroid enlargement in follicular carcinoma of thyroid with infiltration.

Treatment
- Total thyroidectomy is done, along with block dissection whenever lymph nodes are enlarged.
- Maintenance dose of L-Thyroxine 0.1mg.O.D is given lifelong.
- FNAC in 50% of follicular carcinomas are inconclusive as it is difficult to differentiate between follicular adenoma and carcinoma. In such occasions frozen section biopsy on table may be useful. If on-table frozen section biopsy is positive for malignancy then total thyroidectomy is done.
- In 15% cases frozen section biopsy also may be inconclusive or frozen section biopsy facility may not be available in many places then initial hemithyroidectomy is done. If later report comes as follicular carcinoma of thyroid then completion thyroidectomy is done. It is done usually in 7 days of initial surgery otherwise 3 weeks after the first surgery.
- When neck nodes are present in 10% cases, modified radical dissection is done one or both sides.
**Follow-up**

It is by radioisotope $^{123}$I scan done at regular intervals (6 months) to look for secondaries.

**Thyroglobulin estimation** is a good follow-up method to decide for Radioisotope study. Normal value is 3-5 ng/ml. High value signifies persistent/recurrent/metastatic disease. It should be estimated once in 3 months. If thyroglobulin level is normal radioiodine study is not necessary.

If it is high, radioiodine study is indicated.

**Further Treatment**

- If secondaries are detected therapeutic dose Ra $^{131}$I is given. L-thyroxin has to be stopped for 6 weeks prior to RT, and then required dose of Ra $^{131}$I is given.
- Secondaries in bone are treated by *external radiotherapy*. Internal fixation should be done whenever there is pathological fracture.
- There is no role of chemotherapy for follicular carcinoma thyroid.

**Note:**
- High dose of retinoic acid will make $^{131}$I to concentrate in tumor cells (70mg/daily for 2 weeks).
- Fertility should be avoided for 1 year after $^{131}$I therapy.
- Avoid contrast CT in thyroid diseases as much as possible because $^{131}$I study in later period will be difficult.
- MRI is ideal when radioiodine therapy is needed.

**Hurthle cell carcinoma** is a variant of follicular carcinoma of thyroid which contains abundant oxyphil cells. It spreads more commonly to regional lymph nodes than follicular carcinoma of thyroid. $^{99m}$Tc sestamibi scan is very useful for Hurthle cell carcinoma.

**Differential diagnosis for carcinoma thyroid**

- Multinodular goitre
- Solitary nodule of other causes
- Riedel’s thyroiditis

---

Fig. 1.272: Carcinoma thyroid with dilated veins on the surface.

Fig. 1.273: Total thyroidectomy specimen done for follicular carcinoma of thyroid.
### TNM staging for thyroid cancer

<table>
<thead>
<tr>
<th>Tumour</th>
<th>Nodes</th>
</tr>
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<tbody>
<tr>
<td>Tx</td>
<td>Nx</td>
</tr>
<tr>
<td>T0</td>
<td>N0</td>
</tr>
<tr>
<td>T1</td>
<td>N1</td>
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<tr>
<td>T2</td>
<td>N1a</td>
</tr>
<tr>
<td>T3</td>
<td>N1b</td>
</tr>
<tr>
<td>T4</td>
<td></td>
</tr>
</tbody>
</table>

- **T** - Tumour
- **N** - Nodes
- **M** - Metastases

- **T**
  - Primary not assessed
  - No primary
  - < 1 cm limited to thyroid
  - 1-4 cm limited to thyroid
  - > 4 cm limited to thyroid
  - Any size extending beyond capsule

- **N**
  - Nodes cannot be assessed
  - No regional nodes
  - Regional nodes present
  - Same side neck nodes
  - Bilateral, midline, mediastinal nodes

- **M**
  - Cannot be assessed
  - No metastases
  - Metastases present

#### Anaplastic Carcinoma
- It is a very aggressive tumour of short duration, presents with a swelling in thyroid region which is rapidly progressive causing:
  - Stridor and hoarseness of voice.
  - Dysphagia.
  - Fixity to the skin.
  - Infiltration into the carotid sheath—Berry’s sign.

- Swelling is hard, with involvement of isthmus and bilateral lateral lobes.
- FNAC is diagnostic.
- Tracheostomy and isthmectomy has got a role to relieve respiratory obstruction temporarily.

---

**Fig. 1.274**: Carcinoma thyroid with neck secondaries.

**Fig. 1.275**: Anaplastic carcinoma of thyroid with infiltration through the capsule. It commonly encases the carotid artery causing Berry’s sign positive.

**Fig. 1.276**: Anaplastic carcinoma of thyroid.
• Treatment is external radiotherapy as usually thyroidectomy is not possible.
• However prognosis is poor.

Follow-up in differentiated thyroid carcinoma
• Proper clinical examination in the neck for residual/nodal disease and for distant spread.
• Whole body radioisotope scan after one week of surgery to see residual tumour in the neck or metastases.
• Estimation of thyroglobulin at regular intervals is very important.
• Follow-up whole body radioisotope scan at 3-6 months intervals. Thyroxine should be stopped for 6 weeks. It is commonly done if thyroglobulin level in the blood is significantly high.

Medullary Carcinoma of Thyroid (MCT)
• It is uncommon (5%) type of thyroid malignancy.
• It is arises from the para follicular ‘C’ cells which is derived from the ultimo bronchial body (neural crest). They are part of APUD (Amine Precursor Uptake Decarboxylation) cells. C cells are more in upper pole of the thyroid.
• It contains characteristic ‘amyloid stroma’ wherein malignant cells are dispersed.
• In these patients blood levels of calcitonin both basal as well as that following calcium or pentagastrin stimulation is high, a very useful tumour marker.
• Tumour also secretes 5-H.T (serotonin), prostaglandin and vasoactive intestinal polypeptide (VIP).
• It spreads mainly to lymph nodes (60% common).
• It may be associated with MEN II syndrome and phaeochromocytoma with hypertension.
• There may be mucosal neuromas in lips, oral cavity.

Clinical Features
1. Thyroid swelling often with enlargement of neck lymph node.
2. Diarrhoea, flushing.
3. Hypertension, phaeochromocytoma and mucosal neuromas when associated with MEN II syndrome.
4. Sporadic and familial types occur in adulthood whereas cases associated with MEN syndrome II occur in younger age groups.

Types
1. Sporadic: Usually solitary—70%.
2. MCT with MEN II syndrome: MCT with MEN II B with phaeochromocytoma is most aggressive
3. Familial MCT: It is autosomal dominant with proto-oncogene in chromosome number 10. It is commonly multicentric.

Investigations
• FNAC: Shows amyloid deposition with dispersed malignant cells and ‘C’ cell hyperplasia.
• Tumour marker: Calcitonin level will be higher. Normally, it is less than 0.08 ng/L.
• U/S neck-thyroid region.
• Urinary VMA, urinary catecholamines, urinary metanephrine, serum calcium, serum parathormone estimation.
• CT neck and chest to evaluate nodal status is a must.
• 111 Indium octreotide scanning is useful in detecting medullary carcinoma thyroid (70% sensitivity). It is also useful in postoperative follow-up to find out residual/metastatic disease.

Fig. 1.277: Medullary carcinoma of thyroid specimen.
**Treatment**

Surgery is the main therapeutic modality.
- *Total thyroidectomy with Central node dissection* (level 6) in all patients even if there are no nodes in the neck. + Maintenance dose of L-thyroxin.
- Neck lymph nodes block dissection if lymph nodes are involved (bilateral modified radical dissection of neck nodes). Later regular U/S neck to detect early neck nodes.
- Adriamycin is the drug used as chemotherapy with limited results.
- No role of suppressive hormone therapy or radioactive iodine therapy.
- External beam radiotherapy for residual tumour disease.
- Somatostatin/octreotide for diarrhoea.
- If there is associated phaeochromocyotma it should be treated surgically by adrenalectomy first and later only total thyroidectomy is done.
- *All family members of the patient should be evaluated for serum calcitonin and if it is high they should undergo prophylactic total thyroidectomy* (Can also be assessed by genetic evaluation). If there is positive RET proto-oncogene in MCT with MEN II A and familial MCT types, prophylactic total thyroidectomy is done at the age of 5 years. In positive RET proto-oncogene in MCT with MEN II B prophylactic total thyroidectomy is done at the age of one year.
- MCT with associated parathyroid hyperplasia (30%) in MEN IIA, total thyroidectomy with central nodal dissection with total parathyroidectomy and autotransplantation of half of gland in sternomastoid or non-dominant forearm brachioradialis muscle.

**Prognosis**

- Sporadic MCT and MCT with MEN II are aggressive.
- Familial MCT not associated with MEN II has got better prognosis.

**Malignant Lymphoma**

- It is NHL type. Occurs in a pre-existing Hashimoto’s thyroiditis (Not proved well).
- FNAC is useful to diagnose the condition.
- Chemotherapy is the main treatment.
- Often total thyroidectomy is done to enhance the results.

**Hashimoto’s Thyroiditis (Struma Lymphomatosa)**

- Also called as diffuse nongoitrous thyroiditis
- It is an autoimmune thyroiditis is common in women.
  - There is hyperplasia initially, then fibrosis, eventually infiltration with plasma cells and lymphocytic cells. Askanazy cells are typical (like Hurthle cells).
  - The river struma arises in Bulgaria and flows into Aegean Sea. Struma means goitre. Banks of this river are endemic goitre area.

**Clinical Features**

1. Painful, diffuse, enlargement of usually both lobes of thyroid which is firm, tender and smooth (occasionally one lobe is involved).
2. Initially, they present with toxic features but later, they manifest with features of hypothyroidism.
   - Hyperplasia $\rightarrow$ Hyperthyroid.
   - $\rightarrow$ Euthyroid.
   - Fibrosis $\rightarrow$ Hypothyroid.
3. There may be hepatosplenomegaly.
4. It is often associated with other autoimmune diseases.
5. In 85% cases significant rise in the thyroid antibodies (microsomal, thyroglobulin, or colloid antibodies) is observed.
6. Papillary carcinoma may develop in Hashimoto’s thyroiditis.
7. Often condition may be associated with or may predispose to malignant lymphoma. It is at present not well proved.

**Investigations**

FNAC, $T^3$, $T^4$, TSH. Thyroid antibodies assay. Usually ESR is very high (over 90 mm/hour).
Treatment
1. L-thyroxine therapy.
2. Steroid therapy often is helpful.
3. If goitre is large and causing discomfort, then subtotal thyroidectomy is done.

De-Quervain’s Subacute Granulomatous Thyroiditis
It is due to viral aetiology either mumps or Coxsackie’s viruses causing inflammatory response with infiltration of lymphocytes, neutrophils, multinucleated giant cells.

Clinical Features
• Pain is diffuse, swelling in thyroid which is tender.
• Commonly seen in females.
• Initially, there will be transient hyperthyroidism with high T3 and T4 but poor radioiodine uptake.
• It is usually a self limiting disease.

Riedel’s Thyroiditis (0.5% common)
• A very rare benign entity wherein thyroid tissue is replaced by fibrous tissue which interestingly infiltrates the capsule into muscles, paratracheal tissues, carotid sheath.
• It is often associated with retroperitoneal and mediastinal fibrosis (Woody Thyroiditis, Ligneous Thyroiditis).

Clinical Features
Hard, fixed, swelling with stridor, often Berry’s sign may be positive, i.e. absence of carotid pulsation.

Differential Diagnosis
Anaplastic carcinoma of thyroid.

Investigations
• T3, T4 may be low due to hypothyroidism.
• Radioisotope scan will not show any uptake.
• FNAC to rule out carcinoma.

Treatment
Isthmectomy is done to relieve compression on the airway. They require l-thyroxine replacement later, as hypothyroidism is common.

THYROIDECTOMY

Types
1. Hemithyroidectomy: Along with removal of one lobe, entire isthmus is removed. It is done in benign diseases of only one lobe.
2. Subtotal thyroidecomy commonly done in toxic thyroid either primary or secondary and also often for nontoxic multinodular goitre. Here about 8 grams, or a tissue, size of pulp of finger is retained on lower pole, on both sides and rest of the thyroid gland is removed.
3. Partial thyroidecomy is removal of the gland in front of trachea after mobilization. It is commonly done in nontoxic multinodular goitre.
4. Near total thyroidecomy: Here both lobes except the lower pole which is very close to recurrent laryngeal nerve and parathyroid is removed. It is done in case of papillary carcinoma of thyroid.
5. Total thyroidecomy: Entire gland is removed. It is done in case of follicular carcinoma of thyroid.
Subtotal thyroidectomy—it is done in toxic/nontoxic multinodular goitre. Most of the gland except lower pole (4-8 gram) on both sides removed.

Partial thyroidectomy—it is done in nontoxic nodular goitre if there is adequate normal gland posteriorly. Tissue in the tracheo-oesophageal groove is retained. Isthmus and gland with nodules in front is removed. It is not commonly done now.

Near total thyroidectomy is done in papillary carcinoma of thyroid. Here most of the gland except lower small tissue of 1 gram is retained to safeguard recurrent laryngeal nerve and parathyroid gland. Tissue is retained either in or both sides.

Total thyroidectomy is done for follicular carcinoma and medullary carcinoma of thyroid.

Hartley Dunhill procedure. Here one entire lateral lobe, isthmus, and most part of the opposite lateral lobe except small quantity of tissue in the lower pole/tracheo-oesophageal groove - subtotal/partial/one gram is retained.

Preoperative Preparation
- Blood grouping and cross matching. Keep the required blood ready.
- Indirect laryngoscopy. Patient is asked to tell ‘E’ to check the abduction of vocal cord.
- Serum calcium estimation—ionic calcium
- T3, T4, TSH.
- Thyroid antibodies.
- ECG and cardiac fitness especially in toxic goitre.
**Procedure**

**Position:** Under general anaesthesia patient is put in supine position with neck extended by placing a sand bag under shoulder—with table tilt of 15 degree head up to reduce venous congestion.

**Incision:** Horizontal crease incision is done, two finger breadth above the sternal notch, from one sternomastoid to the other.

Skin and platysma are incised – upper flap raised up to thyroid cartilage, lower flap up to sternoclavicular joint. Deep fascia is opened vertically in the midline. Strap muscles are retracted or cut in between two Kocher's forceps (in the upper part as in lower part ansa cervicalis nerve is present which supplies the muscles). Pretracheal fascia is opened to mobilize the thyroid. First, short stout middle thyroid vein is ligated, and then superior thyroid pedicle is ligated close to the gland so as to avoid injury to external laryngeal nerve. Inferior thyroid artery is ligated away from the gland so as to avoid injury to recurrent laryngeal nerve. Mobilized gland is removed. Bed is sutured with catgut so as to prevent bleeding. Drain is placed. The wound is close in layers.

**Thyroid steal:** Patient is taken to operation theatre for few days before doing surgery so as to reduce the anxiety of the patient.
SRB's Bedside Clinics in Surgery

Complications of Thyroidectomy

1. **Haemorrhage**: May be due to slipping of ligatures either superior thyroid artery or other pedicles. It will cause tachycardia, hypotension, breathlessness, and compression over the trachea may cause severe stridor, respiratory obstruction. As a first aid, immediate release of sutures including that of deep fascia has to be done and pressure over the trachea is released. Then patient is shifted to operation theatre, and under general anaesthesia exploration is done and bleeders are ligated. Blood transfusion may be required.

2. **Respiratory obstruction**. It may be due to haematoma (if it is so, the haematoma has to be evacuated), or due to laryngeal oedema. For laryngeal oedema, immediate emergency endotracheal intubation is done along with steroid injections. Often emergency tracheostomy may be required as a life saving procedure.

3. **Recurrent laryngeal nerve palsy**: It can be transient or permanent. Transient is 3% common. They usually recover in 3 weeks to 3 months. Often they require steroid supplement and speech therapy. Permanent paralysis is rare.

4. **Hypoparathyroidism** is rare 0.5% common. Mostly it is temporary due to vascular spasm of parathyroid glands, occurs in 2-5th postoperative day. Present with weakness, +ve Chvostek's sign, carpopedal spasm, convulsions. Serum calcium estimation has to done and then 10 ml of 10% calcium gluconate— is given IV eighth hourly, and
later supplemented by oral calcium 500 mg 8th hourly. After 3-6 weeks, patient is admitted, drug is stopped and serum calcium level is repeated.

Fig. 1.290: Note the location of parathyroid glands.

5. **Thyrotoxic crisis (Thyroid storm):** Occurs in a thyrotoxic patient inadequately prepared for thyroidectomy and rarely a thyrotoxic patient presents in a crisis following an unrelated operation or stress. They present in 12-24 hours with severe dehydration due to circulatory collapse, hypotension, hyperpyrexia, and often cardiac failure.

   *Treatment* is injection hydrocortisone, oral anti-thyroid drugs, tepid sponging of whole body, beta blocker injection, oral iodides, large amount of IV fluids for rehydration, digitoxin, cardiac monitor, often ventilator support, and observation. It has got high mortality rate with critical period of 72 hours. Fluid and electrolyte management, cardiac management are important aspects to be monitored and treated.
6. Injury to external laryngeal nerve causes weakness of cricothyroid muscle leading to alteration in pitch of voice.

7. Hypothyroidism. Revealed clinically after 6 months.

8. Wound infection, stitch granuloma formation.


**Treatment of thyroid crisis**

- Injection hydrocortisone high dose—500-1000 mg IV
- Rehydration with adequate IV fluids to control circulatory collapse
- Injection sodium iodide IV
- Injection propranolol
- Oral iodides
- Oral antithyroid drugs
- Tepid sponging
- Digitoxin
- Fluid and electrolyte management
- ICU care, ventilator support and cardiac monitor

**THYROGLOSSAL CYST**

Thyroglossal cyst is a swelling occurring in the neck in any part along the line of thyroglossal tract. It is a tubulodermoid. It is accumulation
of the cystic fluid secreted by the portion of the unobliterated part of the thyroglossal duct/tract.

Possible sites for thyroglossal cyst
a. Beneath the foramen caecum
b. In the floor of mouth
c. Suprahyoid
d. Subhyoid - commonest site
e. On the thyroid cartilage

Figs 1.294A to C: Operated specimen of thyroid showing nodules, cut section showing cavities, haemorrhagic areas.
It is usually congenital wherein there will be degeneration of a part of the tract causing cystic swelling. Normal thyroid may be present in the normal location (fossa). Sometimes, thyroid may not be present in the normal site but may be present in the wall of the thyroglossal cyst. It contains gel-like fluid. It is lined by columnar epithelium surrounded by lymphoid tissues.

**Clinical Features**

a. Swelling in the midline, towards the left.
b. Moves with deglutition as well as with the protrusion of tongue. Patient is asked to open the mouth and keep the lower jaw still. Examiner holds the cyst between the thumb and forefinger. When the patient is asked to protrude the tongue, a ‘tugging sensation’ can be felt.
c. Swelling is smooth, soft, fluctuant, (cystic), nontender, mobile, often transilluminate.
d. Thyroid fossa is empty, if there is no thyroid in normal location.
e. Thyroglossal cyst can get infected and may form an abscess.
f. Malignancy can develop in thyroglossal cyst (Papillary carcinoma).

**Investigations**

a. Radioisotope study I\(^{131}\).
b. U/S neck.
c. FNAC from the cyst.
d. T3, T4 and TSH estimation.

**Differential diagnosis for thyroglossal cyst**

- Subhyoid bursa
- Pretracheal lymph node
- Dermoid cyst
- Solitary nodule thyroid

**Treatment**

a. **Sistrunk operation:** Excision of cyst along with full tract up to the foramen caecum is done along with removal of part of the body of the hyoid bone as the tract passes through it. Anaesthetic should wear a glove and support and guide over the posterior third of the tongue while reaching the tract to foramen caecum.
b. If there is no normal thyroid gland after the surgery, maintenance dose of l-thyroxine 0.1 mg od is given life long.
   If tract is not completely excised, it will result in thyroglossal fistula.
Thyroglossal Fistula
- It is not a congenital condition.
- It either follows infection of thyroglossal cyst which bursts open or after inadequate removal of the cyst.
- It is lined by columnar epithelium, discharges mucus, and is a seat of recurrent inflammation. ‘Hood sign’ is characteristic.

**Investigations**
Radioisotope study and fistulogram.

**Treatment**
Sistrunk operation.
(Note: One more Sistrunk operation is done in case of lymphoedema).

Ectopic Thyroid
Ectopic thyroid tissue may lie anywhere along the line of descent. Whole of the thyroid gland or residual thyroid lies in an abnormal position either in the posterior part of the tongue, or in the upper part of the neck in midline, or intrathoracic region. Radioisotope scan, CT scan for intrathoracic thyroid will confirm the diagnosis.

**DYSHORMONOGENSES**
- It is an autosomal recessive condition wherein there is either deficiency of thyroid enzymes (either peroxidase or dehalogenase) or inability to concentrate or to bind or to retain iodine.
- It may be familial and patient presents with large diffuse vascular goitre involving both lobes.
- They respond very well to L-thyroxine and may not require surgery at any time.
- Condition may be associated with congenital deafness which is being called as Pendred’s syndrome.

Lingual Thyroid
It is a thyroid swelling in the posterior third of tongue at the foramen caecum, presenting as rounded swelling. It may be the only existing thyroid tissue which may cause.
- Dysphagia.
- Speech impairment.
- Respiratory obstruction.
- Haemorrhage.

Any diseases which can occur in normal thyroid can also occur in lingual thyroid, i.e. nodularity, toxicity, malignancy.

**Diagnosis**
- Radioisotope study shows the uptake of iodine by the lingual thyroid and also says the status of the thyroid in normal fossa.
- U/S neck has to be done to see the absence of thyroid in normal location.
**Treatment**

L-thyroxine is given daily orally. Often requires surgical excision and is technically easier.

Radioisotope therapy for ablation is also given.

**Radioactive iodine:**

It is used both as a diagnostic as well as a therapeutic agent.

1. \(^{131}I\) — is used for radioactive iodine therapy (beta rays).
2. \(^{123}I\) — is used for diagnostic studies (gamma rays).

For diagnostic purpose \(^{123}I\) is given orally on previous day. *(Dose—5 microcurie; \(T_{1/2}\) of \(^{123}I\) is 13 hours and so it is suitable for diagnostic purpose). Patient should not take l-thyroxine for 7 days prior to radioisotope study.

Thyroid treats this \(^{123}I\) similar to inorganic \(^{127}I\). This \(^{123}I\) enters the thyroid from the circulation and get incorporated into T\(^3\), T\(^4\) and later released into circulation as protein bound iodide (PBI). *Normal value of PBI is 8 mg%.*

Using Gieger Muller’s gamma ray counter scanning of thyroid gland is done to visualise gland.

- **Hot** area suggests more uptake,
- **Warm** area suggests normal uptake,
- **Cold** area suggests no uptake.

\(^{123}I\) radioisotope can be safely used in children and pregnancy for only diagnostic purpose (5 microcurie) as the dose is low.

Indications for diagnostic radioactive iodine study:

- Doubtful toxicity.
- Ectopic thyroid.
- Autonomous toxic nodule.
- After total thyroidectomy, to look for secondaries in follicular carcinoma thyroid.
- Retrosternal thyroid.

Radioisotope study is done to see the secondaries by doing whole body scanning (Total body scintigraphy). For diagnostic radioactive study Technetium 99 pertechnetate can also be used but it is not as good as \(^{123}I\).

**Therapeutic Uses**

1. In primary thyrotoxicosis after 45 years.
2. In autonomous toxic nodule after 45 years, it is useful as remaining gland still will function adequately after radiotherapy (As during radiotherapy radioisotope will not be taken up by this retained normal gland as it is suppressed in the presence of toxic nodule which will function later adequately).
3. In follicular carcinoma of thyroid, after total thyroidectomy, if there are secondaries elsewhere in the body, as in bone or lungs, then radioiodine therapy is given. \(^{131}I\) is given as its half-life is 8 days. Patient should be isolated for this period. It is given orally in a dose of 5 milli curies (160 micro curie/gm of thyroid).

### Dose of radioactive iodine

**Diagnostic**

- For thyroid—5-50 micro curie
- For whole body iodine scan—5-10 milli curie in 72 hours

**Therapeutic**

- Residual thyroid ablation—50 m curie
- Bone secondaries from FCT—100-120 m curie
- Lung secondaries from FCT—180 m curie

<table>
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<th>Radioactive Iodine</th>
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<th>Route</th>
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<tbody>
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<td>13 hours</td>
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<tr>
<td>(^{125}I)</td>
<td>60 days</td>
<td>Oral</td>
</tr>
<tr>
<td>(^{131}I)</td>
<td>8 hours</td>
<td>Oral</td>
</tr>
<tr>
<td>(^{132}I)</td>
<td>2.3 hours</td>
<td>Oral</td>
</tr>
<tr>
<td>Tc 99 scan</td>
<td>6 hours</td>
<td>Intravenous</td>
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DIFFERENTIAL DIAGNOSIS OF MASS ABDOMEN

WRITING A CASE SHEET FOR MASS ABDOMEN

In a patient presenting with mass abdomen, generally following clinical features should be assessed carefully.

- **Pain:** Site, nature, aggravating or relieving factors, duration of pain, referred pain.
- **Vomiting:** Type, content, haematemesis, relation to food, frequency.
- **Jaundice:** It is an important factor in relation to liver, gallbladder or pancreatic masses.
- **Bowel habits:** Constipation, diarrhoea, bloody diarrhoea, furious diarrhoea, tenesmus.
- **Decreased appetite and weight.**
- **Inspection of the mass:** Anatomical location, margin, surface, movement with respiration.
- **Palpation of the mass:** Site, extent, surface, tenderness, consistency, movement with respiration, mobility, borders, plane of the swelling (by leg rising test), presence of other masses.
- **Percussion** is an important aspect of examination in case of an abdominal mass. Percussion over the mass is important to predict the anatomical location of the mass. If mass is dull, then it is in the anterior abdominal wall or in front of the bowel intra-abdominally like liver, spleen, gallbladder, etc. If the mass is with a impaired resonant note, then the mass is arising from the bowel like stomach, colon, small bowel. If the mass is resonant on percussion, then the mass is probably in the retroperitoneal region. Other than this, liver dullness, free fluid in the abdomen should be elicited during percussion.
- **Per/rectal examination:** It is done to look for any secondaries in recto-vesical pouch, primary tumour or relation of lower abdomen masses (pelvic masses).
- **Per vaginal examination** is done to assess pelvic masses.

Abdomen is divided in to nine regions by four lines.

1. Upper horizontal or transpyloric line is midway between the suprasternal notch and symphysis pubis or line between tips of ninth costal cartilages on each side. It is often midway between xiphisternum and umbilicus.
2. Lower horizontal line is *transstibular line* at the level of two tubercles (5 cm behind the anterior superior iliac spine along the iliac crest) on the iliac crest.
3. Right vertical line is the line through the midpoint of right anterior superior iliac spine and pubic symphysis. It is usually a line joining midclavicular and midinguinal points.
4. Left vertical line is the line thro’ the midpoint of left anterior-superior iliac spine and pubic symphysis. It is usually a line joining midclavicular and midinguinal points.

**Fig. 1.300:** Different regions in the abdomen.

**Regions in the abdomen**
1. Right hypochondrium
2. Epigasium
3. Left hypochondrium
4. Right lumbar region
5. Umbilical region
6. Left lumbar region
7. Right iliac fossa
8. Hypogastrum
9. Left iliac fossa
Quadrants in the abdomen are four in number formed by two lines — one is vertical midline through the umbilicus; another is horizontal line passing through the umbilicus. Quadrants are — right upper, right lower, left upper and left lower.

**Chief Complaints**

- Mass per abdomen – duration, progress, site, mass appearing/disappearing (like intussusception, Dietl’s crisis hydronephrosis kidney, and choledochal cyst).
- Pain in the abdomen – region of pain to be mentioned; duration of pain.
- Vomiting – duration.
- Haematemesis, malaena – duration.
- Satiety – sensation of fullness after taking food (early satiety signifies gastrointestinal pathology like carcinomas.
- Yellowish discoloration of sclera – duration.
- Loss of appetite and decreased weight – weight loss more than 10 kg in short period/6 months is significant.
- Altered bowel habits/constipation/diarrhoea.
- Fever – its character like in abdominal tuberculosis, amoebic liver abscess, cholangitis, malignancy with tumour necrosis, infected pseudocyst of pancreas.

**History**

**History of Present Illness**

**Pain**

- Site of origin of pain — onset (sudden/insidious); duration.
- Radiation of pain/referred pain.
- Type of pain — intermittent/persistent; dull, severe pricking, colicky.
- Periodicity with an interval of free period — ulcer pain has got often periodicity unless it is complicated.
- Relation to food intake — more/less/not related to meals.
- Relation to vomiting/induced vomiting.
- Aggravating/relieving factors.
- Pain in relation to bowel habits/urinary habits.

**Vomiting**

- Duration, frequency, relation to food, (type projectile/effortless).
- Vomitus – content (food/blood/bile), quantity, smell, colour – coffee ground/bloody/yellow, taste.
- Relation to pain, details of haematemesis if present.
- It is better to ask the patient to collect and keep the vomitus and clinician should personally observe it.

**Jaundice**

- Duration, color–greenish yellow suggests obstruction, severity, progress – progressive/intermittent/static/reducing.
- Presence of fever with jaundice – cholangitis.
- Association with pruritus, clay stool/silvery stool.

**Altered bowel habits**

Duration, type, malaena, with distension of abdomen.

**Altered urinary symptoms**

- Frequency/urgency/hematuria/pyuria/oliguria/painful urination/burning urine/difficulty in passing urine/hesitancy/hiccough/oedema feet or face.
• Relation of urinary symptoms to pain, mass in abdomen.

Other relevant history
Cough and haemoptysis, bone pain, etc. – suggestive of metastases.

Past History
Earlier surgery of abdomen – reason for surgery, how long ago, whether earlier symptoms are relieved or not, symptoms are similar now or different, emergency or elective surgery, earlier properly investigated or not, drain placed or not – if placed when it was removed; what content was coming through the drain, whether blood transfusion was done during surgery or postoperative period.

Personal History
Alcohol intake, diet, smoking, etc.

Treatment History
Any relevant.

Family History
Any relevant.

General Examination
Palor/jaundice/clubbing/oedema feet/pulse/blood pressure/genitalia/respiration.

Local Abdominal Examination
Inspection
• Inspection of the abdomen is done in supine position with exposure from midchest to midthigh region with arms extended. Inspection is done from side of the bed as well as from foot end with eye level at the level of the patient.

Figs 1.302A and B: Obstructive jaundice in a patient with carcinoma head of pancreas. Note the sclera for discoloration. Severe itching is common in these patients.

Figs 1.303A and B: Proper exposure of the abdomen is important from midchest to midthigh region with arms extended. Proper exposure of the abdomen is important from midchest to midthigh region with arms extended.

Figs 1.304A and B: Inspection of the abdomen should be done at the level of the patient’s abdomen both from right side as well as from foot end.
• Shape–contour–normal/scaphoid/di-stended.
• Skin over the abdomen–stretched/pigmented/presence of scar–healed primarily or secondarily/site of scar/length and width of scar; whether there is incisional hernia or not.
• Dilated veins over the abdomen – caput medusae – is radiating dilated veins from the umbilicus–seen in portal hypertension. In inferior vena cava obstruction, (lateral abdominal wall) dilated veins are visible with their blood flow are from below upwards towards superior vena cava. In superior vena cava obstruction dilated veins with blood flow from above downwards. Dilated veins should be inspected in standing position and also direction of flow should be checked by placing two fingers apart over the vein and to release the finger one by one to see the direction of blood flow. Normally, above the umbilicus abdominal wall drains to superior vena cava and below the umbilicus towards inferior vena cava—water shed area.

Fig. 1.305: Superior vena caval obstruction causing dilated veins in the neck chest wall and shoulder. Note the neck swelling extending into the mediastinum.

Movements with respiration of regions.
• Pulsations over the mass or any region – patient should hold the breathing after full expiration to see pulsations.
• Inspection for visible peristalsis–Visible gastric peristalsis (VGP) is seen in upper middle region with waves beginning at left upper abdomen directing downwards and towards right to umbilical region. It is stimulated by drinking glass of water or by massaging the epigastrium. It signifies gastric outlet obstruction. It may be absent in gastric outlet obstruction if gastric paresis develops and stomach becomes dilated but silent without any motility. Visible intestinal peristalsis (VIP) is step ladder pattern in central abdomen from left to right or vice versa in umbilical region. Visible colonic peristalsis may be obvious from right to left along the line of colon.

Fig 1.306A and B: Inferior vena caval obstruction causing dilated veins over the lateral aspect of the flank with flow of blood upwards.

• Inspection of the mass — its location (exact location should be mentioned as in which region and then its extension into the other region should be mentioned later); extent; approximate size; well defined or ill defined (often mass is not clearly seen but fullness is visible); margin whether clear or not or which part is clear and which part is not clear; mass movement with respiration present or not (upper abdomen mass like liver, stomach, spleen, gallbladder, omental mass, kidney mass moves with respiration). Mass which is initially mobile once gets fixed to retroperitoneum or deeper plane may not be mobile later. Mass initially not mobile once gets attached to structures like omentum may start moving with respiration occasionally. Lower abdominal mass, retroperitoneal mass
will not usually move with respiration. Mass which comes in contact with diaphragm closely will move with respiration. Composite mass may move with respiration because of its component like omentum, lymph nodes, bowel, etc.

- **Carnett’s test – raising test (head or leg):** It is done to confirm whether mass is in the abdominal wall or intra-abdominal. Mass is seen initially and palpated and patient is asked to raise his head and if mass disappears, it is intra-abdominal; if becomes more prominent it is in the abdominal wall.

- **Umbilicus—position, everted/inverted. Tanyol sign:** Umbilicus is shifted upwards in pelvic/ovarian mass and shifted downwards in ascites.

- **Hernial orifices and genitalia inspection** – is a must.

- **Palpation**
  - While palpating the abdomen patient should take deep breath with open mouth to relax the abdomen otherwise it is difficult to get proper finding. Hands should be warm and
forearm should be horizontal at the same level as patient’s abdomen. Palpation is done with ventral aspect of the fingers. Legs should be partially flexed at hips and knees.

- Liver is palpated by placing flat of the hand parallel to the right costal margin – initially near right iliac fossa with fingers towards upwards up to the margin of the right rectus. Slowly with each phase of respiration fingers should be moved upwards towards right hypochondrium to feel the lower margin of the liver. Then feel the surface of the liver for tenderness, nodularity, round/sharp
margin. Level of lower margin at should be measured in centimeters from right costal margin. In children below 3 years, liver is 3 cm below the right costal margin. Liver is not palpable or just palpable in normal adult. Whenever there is ascites liver is palpated by ‘dip method’ (dipping fingers quickly so as to displace the fluid).

- **Gallbladder palpation**—normally it is not palpable. When enlarged its lower margin may be in right side of umbilical region/right lumbar region/right iliac fossa. It moves with respiration, globular in shape, smooth and soft, may be horizontally mobile but not vertically, upper margin merges under the liver when liver is enlarged or under the right costal margin. It is usually in right hypochondrium, just right of the right rectus muscle.

  *Murphy’s sign* is elicited in sitting position. While palpating in gallbladder area during summit of inspiration, patient winces with pain. During deep inspiration, inflamed gallbladder comes down and touches the gallbladder to cause tenderness. It is observed in chronic cholecystitis. If it is elicited in lying down position it is called as Moynihan’s sign.

- **Stomach** is palpated in the epigastrium. Entire stomach may be dilated and palpable due to gastric outlet obstruction. Succussion flash and auscultopercussion tests should be elicited in such occasion.

*Succussion splash*: Patient should not take anything orally for 4 hours as gastric emptying time for liquid is 4 hours. If patient drinks fluid even stomach is not dilated succussion splash may be positive. Bell of the stethoscope is placed in the epigastrium. Two thumbs of the two hands are placed over the bell and fingers of each hand are placed on costal area on each side and shaken well to hear splashing sound. This can occasionally elicited by dipping the hand over the dilated stomach also.

*Auscultopercussion test*: It is positive in gastric outlet obstruction. Bell of the stethoscope is placed over the epigastrium. Abdominal wall is scratched using pencil or finger tip by radiating strokes from bell area towards left hypochondrium, left lumbar and left and later towards right part of the umbilical regions. Change in the note of the sound is marked at each stroke line. All these marks are joined to get the greater curvature of the stomach. Only greater curvature is assessed. Reasons are only greater curvature dilates significantly when there is obstruction, not lesser curvature and greater curvature is more towards surface whereas lesser curvature is on deeper plane. Normal greater curvature is above the umbilical level on surface marking. In gastric outlet obstruction it will be below the level of umbilicus.

*Stomach mass* is commonly carcinoma stomach but occasionally it is gastric lymphoma or leiomyoma of stomach. Carcinoma stomach mass is in the epigastrium or upper part of umbilical region – which moves with respiration; all borders well made out; mobile in all directions; nodular and hard; upper border well made out; impaired resonant on percussion. If mass is close to the fundus of stomach then upper border may not be clearly felt and often patient should be examined in lateral position or after making the
patient to walk for few minutes so that to allow the mass to come down to make it easily palpable. Mass may be from the pylorus then there will be features of gastric outlet obstruction and mass is just above right of the umbilicus. Mass from the body of the stomach is horizontally placed commonly without features of obstruction and extending towards the left hypochondrium. Often a composite mass of carcinoma, lymph nodes, omentum and part of the liver may be palpable and attains a large size also. Carcinoma stomach when it is fixed may not move with respiration and may find it difficult to differentiate from pancreatic mass eventhough carcinoma pancreas is rarely palpable but palpable gallbladder and progressive severe jaundice will suspect the carcinoma pancreas. Often also carcinoma stomach can cause jaundice when there is secondaries in liver extensively in both lobes. In such occasion along with stomach mass nodular secondaries in liver with ascites can also be evident. Mass near the oesophago gastric junction presents as dysphagia. Linitis plastica (diffuse type of carcinoma stomach in submucosal plane) usually presents as loss of appetite and decreased weight with reduced stomach capacity. It usually does not present as mass abdomen. When mass is palpably present, it is a composite mass of nodes, omentum and stomach. It carries a poor prognosis. Total gastrectomy is the treatment. Clinically palpable carcinoma stomach (as mass) is advanced carcinoma stomach as serosa involvement according to definition is advanced. Without serosal breach it is difficult to be clinically palpable. But it could be surgically resectable.

Figs 1.316A to C: Ausculto percussion test

Figs 1.317A to C: Different locations of carcinoma stomach. (A) Pylorus (B) Body of stomach (C) Near OG junction.
Figs 1.318A to E: Carcinoma pylorus causes gastric outlet obstruction with palpable mass above the umbilicus. Carcinoma body of stomach mainly presents as loss of appetite and decreased weight with horizontally placed stomach mass. Carcinoma from fundus of the stomach presents as mass abdomen with loss of appetite and weight. Carcinoma OG junction presents as dysphagia. Carcinoma stomach is one of the common causes of secondaries in liver.

Pancreatic mass is palpable in the epigastrium. It is deep, nonmobile, not moving with respiration, with bowel in front. It is felt on deep palpation. Pseudocyst mass is having rounded lower margin with transmitted pulsation. Pancreatic masses are usually resonant.

**Palpation**

**Palpation of spleen**

Spleen normally is not palpable. When enlarged more than 2½ times it is clinically palpable. Non-palpable spleen still could be enlarged. Spleen enlarges towards right iliac fossa across umbi-
Figs 1.319A to E: Method of palpating spleen and also eliciting hook sign.
Figs 1.320A to C: Renal angle should be palpated and percussed in a kidney mass—in sitting position.

Murphy’s kidney punch is eliciting the tenderness in renal angle in sitting position from behind. In sitting position from behind loin should be inspected for any fullness. Renal angle tenderness is elicited using thumb at the angle (renal angle is between erector spinae muscle and 12th rib). Renal angle also should be percussed for change in note. Normally, it is resonant because of the ascending/descending colon but is replaced by kidney when enlarged making it dull to percuss.

Palpation of kidney
Kidney is palpated by placing right hand in front and left hand behind the loin area. When kidney is enlarged, it is palpable as bimanually palpable, ballottable (left hand from behind is pushed anteriorly and kidney coming forward and touching/pushing the right hand in front can be felt), moves with respiration (as it is related to diaphragm), vertically placed with resonant colonic band in front because of medial and anterior push of the colon by enlarged kidney. It is smooth and soft in hydronephrosis; it is hard and nodular in carcinoma kidney; it is firm, nodular and bilateral in polycystic kidney disease. Kidney may not move or may not be ballottable if it is adherent due to infection or advanced carcinoma.

Small bowel mass is felt as mobile, localized mass with resonant or impaired resonant note. It does not move with respiration. Intussusception is sausage shaped mass with concavity towards umbilicus. It appears and disappears; contracts under the palpatating finger.
Fig. 1.322: Renal bruit should be auscultated.

Fig. 1.323: Often abdominal mass also should be examined in side position to get better feeling and findings.

Fig. 1.324: Lower border of the mass is very important in lower abdominal masses. Bladder should be emptied or catheterised before palpation.

Figs 1.325A and B: Intrinsic mobility of the mass should be checked in all abdominal masses.

- All masses in the lower quadrants should be palpated after emptying urine or passing a urinary catheter. Upper border is clearly felt but not lower border which merges into the pelvis. Mass also should be bimanually palpated by placing fingers in rectum or per vagina.
- External genitalia should be palpated for any swelling/loss of testicular sensation, secondary hydrocele.
- Often there will be many masses in the abdomen. So once one mass is felt always look for other relevant mass also.
- Retroperitoneal masses and pulsatile mass like aneurysms should be examined in knee-
elbow/knee – chest position. Retroperitoneal mass will not fall forward whereas intra-abdominal mass will fall forward. Aortic aneurysm with expansile pulsation will retain its pulsation whereas mass with transmitted pulsation will show reduced/absent pulsation in knee-elbow position.

**Percussion**

- *Liver dullness* should be assessed by percussion. It is done by percussion from above downwards over right intercostal spaces in midclavicular line. Liver span also can be assessed by this.
- *Percussion over the mass* is very important. Mass in front of the bowel is dull on percussion like parietal/abdominal wall mass, liver, spleen, gallbladder, etc. Mass from the stomach/small bowel/colon shows impaired resonance on percussion. Mass from retroperitoneum shows resonance on percussion.
- *Percussion for free fluid* is important. Patient in supine position, initially percussion is done over the epigastrium to confirm resonance note. Then percussion is continued over one side flank until one gets dullness. Patient is tilted towards opposite side to make area of percussion outwards so as to displace

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**Fig. 1.326**: external genitalia should be palpated for mass/hydrocele, etc.

**Figs 1.327A to C**: Knee elbow position – palpation of retroperitoneal mass. Mass can be held to check mobility, relations, etc.
Fig. 1.328: Liver dullness should be assessed (upper border of liver) by percussing from above in intercostal spaces midclavicular line downwards until dullness is elicited and space is marked.

Fig. 1.329: Percussion over the mass is essential to say whether mass is anterior to bowel (dull); from the bowel (impaired resonant) or behind the bowel (resonant).

Fig. 1.330: Looking for minimal ascites in knee-elbow position - Puddle sign.

Figs. 1.331A to C: Massive ascites. Eliciting fluid thrill in massive ascites.
the fluid from that side. After 1-2 minutes (time to allow fluid to shift towards opposite side) without removing the fingers same area is percussed to get resonance note which confirms the presence of fluid. For massive ascites, fluid is confirmed by eliciting fluid thrill. Patient’s side of the hand is placed over the midline epigastrium firmly. Examiner should keep his one hand over one lumbar region and with fingers of other hand on the opposite lumbar region tapping is done to elicit fluid movement as fluid thrill. Small quantity of fluid can be elicited in knee elbow position. In this position over the umbilical site percussion is done to elicit dullness which signifies positive puddle sign—signifying minimal ascites.

- Percussion over renal angle for resonance (normal) or dullness (abnormal).
- Auscultation for bowel sounds, bruit over the renal artery just side of the umbilicus, over the mass like liver which signifies vascularity, over aneurysm for bruit.
- Left supraclavicular fossa between two heads of sternomastoid muscle should be palpated for Virchow’s node enlargement – Troisier’s sign—as secondary deposits.
- Examination of respiratory system for effusion, altered breath sounds suggestive of metastases.
- Examination of skeletal systems—sternum, spine, skull and other bones for tenderness, swelling, pathological fracture, neurological deficits.
- Digital examination of rectum (Per Rectal examination/P/R): P/R must be done in all abdominal mass cases. It is done in lateral position towards left side of the patient with right leg is flexed completely and left is straight. After informing patient above the technique and consent, procedure is done. Xylocaine jelly is applied over the anus. It is inspected for discharge, opening, skin changes and swelling. Pulp of the gloved right index finger is gently pushed into the anorectum in the direction of the umbilicus.

Figs 1.332A to D: Confirming ascites/free fluid in the peritoneal cavity by percussion—classical method.
Figs 1.333A and B: Spine and other skeletal system should be examined in mass abdomen patient.

Sphincter tone is assessed. Posteriorly sacral curvature, rectal mucosa are assessed. Finger is turned towards front. Prostate, its texture, size, median groove are felt. Rectum is palpated for any growth, stricture or secondary nodule in front above (as a hard nodule with free rectal mucosa – Blumer shelf). Gently finger is removed and finger tip should be inspected for content staining – blood/mucus/pus, etc. P/R is contraindicated in acute fissure in ano.

Mass in the Right Hypochondrium

Liver Palpable as Mass in Right Hypochondrium

- It is horizontally placed.
- It usually moves with respiration.
- Upper border is not felt.
- It is dull on percussion. (This dullness continuous over liver dullness above).
- Fingers cannot be insinuated under right costal margin.

Conditions where liver gets enlarged:

1. Soft, smooth, nontender liver—
   - Hydrohepatosis. It is due to obstruction of CBD causing dilatation of intrahepatic biliary radicles.
   - Congestive cardiac failure.

Figs 1.334A to C: Digital examination of the rectum is important (P/R; Per Rectal examination).
1. **Hydatid cyst of the liver** — Here mass is well localized in the liver with typical hydatid thrill (Three fingers are placed over the mass widely. When central finger is tapped fluid movement is elicited in lateral two fingers).

2. **Soft, smooth, tender liver**:
   - Amoebic liver abscess. Here liver often gets adherent to the anterior abdominal wall and will not move with respiration. Intercostal tenderness, right sided pleural effusion are common.

3. **Hard, smooth liver**:
   - Hepatoma: (HCC): Here a large single hard nodule is palpable in the liver. But occasionally there can be multiple nodules when it is multicentric. Rapidly growing tumour can be soft also. Hepatoma often can also be tender due to tumour necrosis or stretching of the liver capsule. Vascular bruit may be heard over the liver during auscultation. It mimics amoebic liver abscess in every respect.
   - Solitary secondary in liver.

4. **Hard, multiple nodular liver**:
   - Multiple secondaries in liver: Hard nodules here are having umbilication which is due to central necrosis.
   - Macronodular cirrhotic liver.

**Palpable Gallbladder in Right Hypochondrium**

- It is smooth and soft (Except in carcinoma gallbladder).
- It is mobile horizontally (side-to-side).
- It moves with respiration.
- It is located right of the right rectus muscle, below the right costal margin or below the lower margin of the palpable liver.
- It is dull on percussion.

Conditions where gallbladder is palpable:

1. **Soft, nontender gallbladder**:
   - Mucocele of the gallbladder.
   - Enlarged gallbladder in obstructive jaundice due to carcinoma head of the pancreas or periampullary carcinoma or growth in the CBD.

2. **Hard gallbladder**:
   - Carcinoma gallbladder.

**Other masses in the Right Hypochondrium**

**Pericholecystic inflammatory mass**: It is tender, smooth, firm or soft, not mobile, intra-abdominal mass often with guarding.
Kidney mass arising from upper pole of the kidney: It may be due to renal cell carcinoma or hydronephrosis.

Commonest benign tumour of liver is haemangioma.

### Hepatoma/hepatocellular carcinoma/HCC
- Common etiologies are aflatoxins, hepatitis B and hepatitis C virus infection, alcoholic cirrhosis, haemochromatosis, smoking, hepatic adenoma, clonorchis sinensis, polyvinyl chloride.
- Unicentric and right lobe involvement is more common.
- Fibrolamellar variant is common in left lobe, not related to hepatitis or cirrhosis without AFP level raise. There is increased serum vitamin B12 binding capacity and neurotensin levels.
- It can be multifocal/indeterminate/spreading/expanding – Okuda classification.
- Presents as large smooth hard liver mass – later jaundice, fever, pain and tenderness, ascites and bruit over mass.
- Spreads to lymphatics, blood and direct spread.
- Mimics amoebic liver abscess, secondaries, hydatid cyst, polycystic liver disease.
- LFT, CT scan, raised AFP, liver biopsy are the investigations.
- Hemihepatectomy in early operable growth is the treatment.
- Hepatic artery ligation/intra-arterial chemotherapy/chemoembolisation/percutaneous ethanol or acetic acid injection/radiofrequency ablation/chemotherapy using adriamycin, carboplatin, gemcitabine are palliative procedures.

### Amoebic liver abscess
- It is due to *Entamoeba histolytica* infestation
- It is more common in alcoholics and cirrhotics.
- Single abscess is common — 70%; common in right posterosuperior lobe — 80%.
- Chocolate coloured Anchovy sauce pus is classical.
- Secondary infection can occur – 30%; life threatening due to septicaemia.
- It can be acute or chronic; both mimics hepatoma.
- Rupture into lungs – commonest site of rupture.
- Most dangerous rupture is into pericardium – left lobe abscess.
- Liver failure can develop in cirrhotic patient.
- Common in males (20:1), fever, pain, intercostal tenderness, tender liver – features.
- Mimics cholecystitis, subphrenic abscess, hepatoma.
- Total count, LFT, prothrombin time, US abdomen are relevant investigations.
- Chest X-ray may show right sided sympathetic pleural effusion.
- CT scan to differentiate from hepatoma.
- Treatment – drugs like metronidazole, injection dihydroemetine, chloroquin tablets, diloxanate furoate; after controlling prothrombin time using inj vitamin K or FFP, US guided aspiration; if recurs percutaneous guided drainage using pigtail catheter; open laparotomy and drainage with placement of Malecot’s catheter.

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**Fig. 1.336**: Hepatocellular carcinoma/hepatoma. It is common in right lobe, unicentric, attains large size.
Surgical Long Cases

Exceptions for the rule are:

- Absence of gallbladder
- Intrahepatic gallbladder
- Previous cholecystectomy
- Double impacted stone
- Large stone in Hartman’s pouch.

Surgical Jaundice

Causes

1. Biliary atresia.
2. Choledochal cyst.
3. CBD stones.
4. Ascending cholangitis.
5. Biliary strictures.
7. Carcinoma of head and periampullary region of the pancreas.
8. Cholangiocarcinoma.
9. Klatskin tumour (Carcinoma at the confluence of hepatic ducts above the level of the cystic duct and so will cause hydrohepatosis without GB enlargement).
10. Extrinsic compression of CBD by lymph nodes or tumours.
11. Parasitic infestations.

Classification of Causes of Obstructive Jaundice

2. Inflammatory: Ascending cholangitis, sclerosing cholangitis.
4. Neoplastic: Carcinoma of head or periampullary region of pancreas, cholangiocarcinomas, Klatskin tumour.
5. Extrinsic compression of CBD by lymph nodes or tumours.

Courvoisier’s Law

In a patient with jaundice if there is palpable gallbladder, it is not due to stones.

In obstruction due to CBD stone, gallbladder does not distend because it is chronically inflamed, thickened and fibrotic.

In malignancy, like carcinoma of head of the pancreas or periampullary carcinoma, gallbladder will be distended and palpable to the right of rectus muscle in the right hypochondrium, as nontender, globular, smooth, soft, dull mass which moves with respiration and with horizontal mobility.

Investigations for Obstructive Jaundice

1. Serum bilirubin. Normal value is less than 1.0 mg%. Both direct and indirect are assessed.
   Direct is increased in obstructive jaundice,
i.e. conjugated hyperbilirubinaemia. Vandenberg test is done.

2. Serum albumin, globulin and A: G ratio. Normal S. albumin is more than 3.5 gm%.

3. Prothrombin time. Normal value is 12-16 seconds. If more than 4 from the control or more than one and half times the control is significant. It is corrected by injection vitamin K 10 mg IM od for 5 days or by fresh blood transfusion.

4. Serum alkaline phosphatase, SGPT, SGOT, 5’ nucleotidase.

5. U/S abdomen.

6. ERCP to visualize site of obstruction, brush biopsy, bile sample for analysis.

7. MRCP—Noninvasive diagnostic tool.

8. CT scan in case of tumours to assess operability.


**Fouchet’s test:** 10 ml of urine + 5 ml of BaCl₂ + pinch of MgSO₄ causes formation of BaSO₄ which is filtered over a filter paper and few drops of Fouchet’s reagent is added. Green or blue colour signifies bile pigments in the urine.

**Hay’s test for bile salt:** Sprinkle sulphur to 2 ml of urine. In presence of bile salts sulphur sinks to the bottom.

**Ehrlich’s test:** 5 ml of freshly voided urine + 1 ml of Ehrlich reagent (p-dimethyl amino benzaldehyde) and wait for 5 minutes. Formation of red colour signifies presence of urobilinogen in urine. Normally, it is present in traces, in obstructive jaundice it is absent and in haemolytic jaundice it is in excess.

**Preoperative Preparation of Patient with Obstructive Jaundice**

- Proper diagnosis and assessment.
- Injection Vitamin K IM 10 mg for 5 days.
- Fresh Frozen plasma—often requires 6 bottles or more.
- Blood transfusion in case of anaemia.
- Oral neomycin, lactulose.
- Mannitol 100-200 ml BD IV to prevent hepatorenal syndrome.
- Repeated monitoring by doing prothrombin time, electrolytes.
- Antibiotics like third generation cephalosporins.
- Calcium supplements as calcium chloride IV.

**Treatment of Obstructive Jaundice**

- CBD stones—ERCP stone removal, choledocholithotomy, transduodenal sphincteroplasty, choledochojjunostomy or Choledochoduodenostomy.
- Carcinoma periampullary or head of pancreas—Whipples operation or Triple bypass or ERCP stenting.
- Klatskin tumour—Radical resection or palliative stenting.
- Biliary atresia—Kasai’s operation or liver transplantation.
- Choledochal cyst—Excision, hepaticojejunostomy, mucosal resection.

**Postoperative Management**

- Monitoring with prothrombin time, bilirubin, albumin, creatinine, electrolyte estimation.
- FFP or blood transfusion.
- Antibiotics.
- Observation for sepsicaemia, haemorrhage, pneumonia, pleural effusion, bile leak.
- Care of T tube and drains.
- T tube cholangiogram in 10-14 days.
- TPN, CVP line, nasogastric tube, urinary catheter.

**Portal Hypertension**

Sustained raise of portal pressure more than 12 mm Hg.

Isolated splenic vein thrombosis causes left sided sinistral/segmental portal hypertension.

**Causes are:**

- Prehepatic — portal/splenic vein thrombosis, trauma, periportal inflammation, hypercoagulable status, neonatal umbilical sepsis.
• Hepatic (80%)—cirrhosis, idiopathic, primary biliary cirrhosis, hepatitis, schistosomiasis, Wilson’s disease, haemochromatosis, congenital hepatic fibrosis.
• Posthepatic—Budd-Chiari syndrome, constrictive pericarditis, veno occlusive disease, congestive cardiac failure.

Presentations: Oesophageal varices (haematemesis/malaena), splenomegaly, ascites, jaundice, features of encephalopathy.

Investigations: Gastroscopy, LFT, splenoportography, US abdomen, CT abdomen, prothrombin time, liver biopsy.

Acute bleed is managed by pharmacotherapy (vasopressin, glypressin, octreotide, propranolol, Sengstaken Blakemore balloon tamponade, surgical ligation of varices by various approaches.

Further bleeding is prevented by endoscopic banding for oesophageal varices; sclerotherapy; endoscopic glueing for gastric varices.

Shunt surgery is done if grading is Child’s grade A or B. Selective shunts like distal spleno renal shunt (Warren’s shunt) or Inakuchi shunt between left gastric vein and IVC. Portocaval, mesentricocaval, proximal splenorenal shunts are nonselective shunts.

Indications for Shunt Surgery
Child’s Grades A and B.

<table>
<thead>
<tr>
<th>Child</th>
<th>A</th>
<th>B</th>
<th>C</th>
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</thead>
<tbody>
<tr>
<td>Bilirubin</td>
<td>&lt; 2.0 mg</td>
<td>2.0-3.0 mg</td>
<td>&gt; 3.0 mg</td>
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<tr>
<td>Albumin</td>
<td>&gt; 3.5</td>
<td>3.0-3.5</td>
<td>&lt; 3.0</td>
</tr>
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<td>Normal</td>
<td>Disoriented</td>
<td>Coma</td>
</tr>
<tr>
<td>Nutrition</td>
<td>Very good</td>
<td>Good</td>
<td>Poor</td>
</tr>
<tr>
<td>Score</td>
<td>5-6</td>
<td>7-9</td>
<td>10-15</td>
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<tr>
<td>P.T.</td>
<td>Increase up to 3</td>
<td>Increase between 3 and 6</td>
<td>Increase &gt; 6</td>
</tr>
</tbody>
</table>

(Child’s grading is used for selecting patients for surgery and predicting prognosis).

Surgery is contraindicated in Child C.

Orthotopic liver transplant is ideal and best. If patient is for liver transplant open shunt surgery is contraindicated as liver hilum should be kept virgin for transplantation effectively. Transjugular Intrahepatic porta Systemic Stenting TIPSS can be done in these patients. TIPSS is a nonselective shunt.

Mass in the Epigastrum

Palpable Left Lobe of the Liver
• It is in the epigastric region.
• Its upper border cannot be felt.
• It moves with respiration.
• It extends towards left hypochondriac region.
• It is dull on percussion.

Conditions where left lobe of the liver is palpable:
• Hepatoma.
• Amoebic liver abscess in left lobe.
• Left lobe secondaries.
• Hydatid cyst of the left lobe.

Features of Stomach Mass
• It is in the epigastric region.
• It moves with respiration. It is intra-abdominal.
• It is resonant or impaired resonant on percussion.
Figs 1.339A and B: Different masses at different regions in the abdomen.

Figs 1.340: Hepatosplenomegaly is the common condition (clinical entity). It is due to macronodular cirrhosis with portal hypertension, lymphoma, autoimmune diseases, congestive cardiac failure, hepatoma with portal hypertension, haemolytic diseases, etc. There may be ascites, supraclavicular palpable lymph node, pleural effusion (right sided).

- Mass may be better felt on standing or on walking.
- Mass is often mobile, unless it gets adherent posteriorly.
- In pylorus mass, all margins are well felt which is mobile with features of gastric outlet obstruction.
- Mass from the body of the stomach is horizontally placed without any features of obstruction.
- Mass from the upper part of the stomach near the OG junction causes dysphagia.
- Mass from the fundus of the stomach is in the upper part of the epigastric region towards left side.
- Carcinoma stomach is nodular and hard. It is commonest cause for stomach mass.
- Leiomyoma of stomach is smooth and firm.

Management of gastric carcinoma
- Early growth – pylorus – lower radical gastrectomy with removal of tumour, proximal 5 cm clearance, nodal clearance, greater and lesser omentum, distal pancreas and spleen (now not regularly removed; it is removed to clear splenic nodes – one of the node stations) and Billroth II
anastomosis or Roux-en-Y anastomosis is done. Postoperatively adjuvant chemotherapy should be given – 5 fluorouracil, mitomycin, epirubacin, cisplatin

- Growth in body, proximal growth, diffuse carcinoma and generalized linitis plastica are the indications for total radical gastrectomy with oesophagojejunal anastomosis.
- Neoadjuvant chemotherapy in advanced gastric cancer prior to surgery and later gastrectomy
- Instillation of mitomycin C impregnated charcoal intraperitoneally to control lymphatic disease (Japan)
- Palliative procedures like palliative partial gastrectomy, anterior gastrojejunostomy, Devine’s exclusion procedure, luminal stenting in proximal inoperable growths, chemotherapy are used in inoperable cases.
- In early carcinoma proper lymph nodal clearance is important

Lymph node stations in gastric carcinoma
- (Japan) – 18 stations are there
  1. Right cardiac
  2. Left cardiac
  3. Nodes along the lesser curvature
  4. Nodes along the greater curvature
     a. Along short gastric vessels—4sa
     b. Along left gastroepiploic vessels—4sb
     c. Along right gastroepiploic vessels—4sd
  5. Suprapyloric nodes
  6. Subpyloric nodes
  7. Along left gastric artery
  8. Along common hepatic artery
  9. Along celiac axis
 10. At splenic hilum
 11. Along splenic artery
 12. At hepatoduodenal ligament
 13. Retrooduodenal lymph nodes
 14. At root of mesentery
 15. Around middle colic artery
 16. Para-aortic nodes
 17. Around lower oesophagus
 18. Supradiaphragmatic

Pseudocyst of the Pancreas
- Mass in the epigastric region. It is smooth, soft. It can be tender if it gets infected.
- It does not move with respiration.
- It is not mobile.
- It has got transmitted pulsation. It is confirmed by placing the patient in knee-elbow position.
- Lower border is well felt. Upper border is not clear.
- It is resonant on percussion.
- Baid test: Because stomach is pushed in front, Ryle’s tube when passed, can be felt per abdomen on palpation.

Pseudocyst of the pancreas is quite common condition. It has got a false capsule not true capsule as there is no epithelial lining. It usually occurs in 3 weeks after an attack of acute pancreatitis. Lesser sac is the common site. It also can occur in relation duodenum, jejunum, splenic hilum and colon. It can be communicating and noncommunicating. It mimics often aortic aneurysm, retroperitoneal cystic tumours, cystadenocarcinoma of pancreas.

Cystadenocarcinoma of the Pancreas
Mass is smooth, firm, does not move with respiration, not mobile, resonant on percussion. Patient is also having back pain.
Investigations for pseudocyst of pancreas –
• Ultrasound—commonly done procedure
• CT scan ideal and choice
• LFT, serum amylase, prothrombin time
• ERCP to find out communications
• Barium meal—not done now–shows widened vertebralgastric angle

Indications for intervention –
• Size more than 6 cm
• Formed thick walled pseudocyst
• Infected pseudocyst

Interventions –
• Roux-en-Y cystojejunostomy is ideal
• Cystogastrostomy – Jurasz procedure—commonly done
• Cystoduodenostomy
• Cystogastrostomy with external drainage if infected – Smith operation
• Endoscopic stenting
• Laparoscopic cystogastrostomy – popular – safer
• Guided aspiration helps but high recurrence rate of 70%

Complications
• Rupture – 3%
• Infection – 20%
• Bleeding – torrential 7%
• Cholangitis

• Acute fluid collection – just fluid collection
• Acute pseudocyst with thin wall
• Chronic pseudocyst – thick walled
• Pseudopseudocyst – inflammatory mass of bowel, omentum, etc. after acute pancreatitis mimics pseudocyst

Figs 1.342A to C: Cystadenocarcinoma of pancreas from body and tail of pancreas–large extensive tumour.
Surgical Long Cases

**Colonic Mass**
- It is carcinoma of transverse colon.
- It is mobile, horizontally placed, nodular, hard mass which does not move with respiration. Caecum will be dilated and palpable.
- It is resonant or impaired resonant on percussion.
- Patient will be having bowel symptoms, loss of appetite and decreased weight.

**Para-aortic Lymph Node Mass**
- Mass in the epigastric region which is deeply placed, not mobile, not moving with respiration.
- It is vertically placed, above the level of the umbilicus and resonant on percussion.
- Causes for enlargement are: Secondaries, Lymphomas or Tuberculosis.

**Aortic Aneurysm**
It is smooth, soft, pulsatile (expansile pulsation which is confirmed by placing the patient in knee-elbow position).
- It is vertically placed above the level of the umbilicus, not mobile, not moving with respiration and resonant on percussion.

**Mass in the Left Hypochondrium**

**Enlarged Spleen**
- Spleen has to enlarge three times to be palpated clinically.
- It enlarges towards the right iliac fossa from left costal margin.
- It moves with respiration, mobile, obliquely placed, smooth, soft or firm, with a notch on the lower margin.
- Fingers cannot be insinuated over the upper border.
- ‘Hook sign’ is positive, i.e. one cannot insinuate the fingers under the left costal margin.
- It is dull on percussion.

**Left Sided Colonic Mass**
- It is mobile, nodular, and resonant.
- It does not move with respiration.
- It is commonly due to carcinoma colon.

**Left Renal Mass from Upper Pole of any Cause**
It has got features of renal mass.

**Left Sided Adrenal Mass**
- It does not move with respiration. It is not mobile.
- It is deeply placed mass. Often it crosses the midline.
- It is resonant on percussion. It mimics kidney mass.

**Mass arising from the tail of the pancreas.**

**Mass in the Lumbar Region**

**Palpable Kidney Mass**
- There will be fullness in the loin which is better observed in sitting position.
- Mass moves with respiration. It is vertically placed.
- It is bimanually palpable. It is ballotable.
- Renal angle is dull on percussion (Normally it is resonant due to colon).
- There is a band of resonance in front due to reflected colon.
- It does not cross the midline.

**Conditions where Kidney Gets Enlarged**

**Hydronephrosis:**
- It is smooth, soft, lobulated, nontender mass.

**Pyonephrosis:**
- History of throbbing pain in the loin, pyuria and fever with chills.
- It is smooth, soft and tender kidney mass.

**Polycystic kidney:**
- History of loin pain and haematuria.
- Hypertension, anaemia and features of renal failure.
- Usually bilateral. But one side can present early than on the other side.
- Lobulated smooth surface.

**Renal cell carcinoma:**
- History of mass in the loin, haematuria, fever and dull pain.
- Mass is nodular and hard.
- It does not crosses the midline.
Mass from the Ascending Colon on Right Side or Descending Colon on Left Side
- History of altered bowel habits with decreased appetite and weight.
- Mass is nodular, hard which does not move with respiration and is not ballotable.
- It is resonant or impaired resonant on percussion.
- Renal angle is resonant.
- Proximal dilated bowel may be palpable.

Adrenal Mass
- It is nodular and hard.
- It does not move with respiration.
- It is not mobile and often crosses the midline.
- It is felt on deep palpation.
- It is resonant in front.
- It is not ballotable.

Retroperitoneal Tumours
- They are not mobile, resonant and do not fall forward in knee-elbow position.
- They are deeply placed mass which are usually smooth and hard.
- They may be retroperitoneal sarcomas or teratomas, etc.

Retroperitoneal Cysts
They are smooth and soft with the same features as retroperitoneal tumours.

Mass in the Umbilical Region
Usual masses are:
- Mesenteric cyst.
- Omental cyst.
- Ovarian cyst (Pedunculated).
- Small bowel tumours.
- Extension of masses from other region.

Mesenteric Cyst
- Tillaux triad:
  - Soft intra-abdominal umbilical region mass.
  - Mobile in the direction perpendicular to the attachment of the mesentery.
  - Resonant mass.
- May precipitate intestinal obstruction, volvulus.

Omental Cyst
- It is smooth, soft and nontender.
- It moves with respiration. It is mobile in all directions.
- It is dull on percussion.

Small Bowel Swellings
- Small bowel lymphomas.
- Small bowel carcinomas.
- Intussusception.

Intussusception
- Mass in umbilical region usually towards left and above the umbilicus.
- Occasionally towards right side.
- Mass is intra-abdominal which is sausage shaped, well-defined, smooth, firm and mobile.
- Mass does not move with respiration.
- Mass contracts under palpating fingers.
- Often mass disappears and mass reappears.
- Mass is resonant or impaired resonant on percussion.
- ‘Red currant jelly’ stool with features of intestinal obstruction may be present.
Mass in the Right Iliac Fossa
- Appendicular mass or abscess.
- Carcinoma caecum.
- Ileo-caecal tuberculosis.
- Amoeboma.
- Psoas abscess.
- Lymph node mass either mesenteric or external iliac lymph nodes.
- Bony swellings.
- Ectopic kidney.
- Undescended testis (Abdominal).
- Actinomycosis.
- Crohn’s disease.
- Iliac artery aneurysm.
- Ovarian swelling-ovarian cyst, tubo-ovarian mass.
- Tubo-ovarian mass.
- Uterine mass: like pedunculated fibroid.

Appendicular Mass
- It is smooth, firm, tender mass in the right iliac fossa.
- It is not mobile. It does not move with respiration.
- It is resonant on percussion. It is well localized mass with distinct borders.

Appendicular Abscess
It is smooth, soft, tender and dull mass in the right iliac fossa with indistinct borders.

Carcinoma Caecum
- It is nodular, hard mass in the right iliac fossa.
- It does not move with respiration.
- It is mobile but mobility may be restricted once it gets adherent to psoas muscle.
- Mass is resonant or impaired resonant on percussion.
- Often features of intestinal obstruction may be there.

Ileocecal Tuberculosis
- Mass in the right iliac fossa which is smooth, hard, resonant and nontender.
- It does not move with respiration and has restricted mobility.
- Caecum may be pulled up to lumbar region due to fibrosis.
**Amoeboma**
- H/O dysentery with pain in the right iliac fossa.
- Smooth, hard, well-defined mass in the right iliac fossa which is not mobile.
- It may or may not be tender.

**Psoas Abscess**
- It is localized; smooth, soft, nonmobile mass in the right iliac fossa.
- *Psoas spasm* (flexion of the hip joint) is typical.
- Spine may show gibbus, tenderness, paraspinal spasm. Spinal movements will be restricted.

**Mass in the Left Iliac Fossa**
- Carcinoma sigmoid or descending colon.
- Bony masses.
- Ovarian/uterine masses.
- Psoas abscess.
- Ectopic kidney.
- Lymph node mass.
- Undescended testis.

**Mass in the Hypogastrium**

**Bladder Mass**
- It is in the midline. It is dull on percussion. Lower border is not felt.
- It can be mobile in horizontal direction. Mass reduces in size after emptying the bladder. It can be felt on per-rectal examination.
- It is either carcinoma bladder (common) or leiomyoma or sarcoma bladder.

**Uterine Mass**
- It is midline mass which is smooth, hard.
- Lower border is not felt which extends in to the pelvis.
- It is felt on pervaginal examination.

**Ovarian Mass**
- Pelvic soft tissue mass.
- In all lower abdomen masses P/R and or P/V is must.

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**Fig. 1.346:** Ovarian cyst—large tumour on table finding.

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**In all regions parietal masses can occur:**
- Benign and malignant soft tissue tumours. Common one is lipoma.
- Fatty hernia of linea alba, interstitial hernia
- Desmoid tumour.
- Parietal wall abscess.

**Investigations for Mass Abdomen**
- Haematocrit, liver function tests, renal function tests, stool/urine examination.
- Ultrasound abdomen.
- Endoscopies-Gastroscopy-Colonoscopy-ERCP.
- Barium studies-Barium meal-Barium enema-Barium meal follow through.
- CT scan – contrast CT is ideal for mass abdomen. It clearly gives idea about the origin of mass, its extent and operability, vascularity, relation to major vessels. Intravenous as well as oral water soluble iodine contrast agent should be given.
- MRI, MRCP.
- Endosonography.
- Ascitic tap.
- Diagnostic laparoscopy.
- U/S guided/CT guided biopsy.
- IVU/RGP/Cystoscopy/Isotope renogram.
- Exploratory laparotomy.
Surgical Short Cases

Section 2
EXAMINATION OF A SWELLING/LUMP

Swelling/lump denotes enlargement or protuberance in any part of the body due to congenital/inflammatory/traumatic or neoplastic causes.

1. History

Duration
Duration of onset is important in all swellings. Swelling which is present since birth could be congenital like meningocoele. Swelling of short duration with pain may be inflammatory. Benign tumours are usually painless and of long duration. Malignant tumours are of short duration, rapidly growing, initially painless (but can be painful later).

Mode of onset
Swelling whether appeared after trauma or spontaneously.

Rapid progress or slow in progress—malignancy progresses rapidly whereas benign swellings progress slowly.

Whether painful or not

Pain
When pain started? Location of pain/type of pain/severity/whether it interferes with work or not. Inflammatory conditions are painful whereas malignant conditions are painless to begin with but later it becomes painful.

Presence of fever—
Fever may be present in inflammatory condition. Certain malignancies also can present with fever at later stage like in Hodgkin’s lymphoma or renal cell carcinoma.

Presence of other lumps/secondary changes in the swelling like ulceration/fungation.

History of previous surgery

Loss of function of part or as a whole.

Loss of weight and decreased appetite may signify that swelling is related to malignant condition and also probably advanced.

Personal history of alcohol consumption/smoking/tobacco chewing/history of sexual contact/dietary habits are also important.

Family history suggestive of similar swellings is important. Neurofibromatosis is often familial.

2. General examination

Detailed general examination is a must. Anaemia/oedema/jaundice/clubbing/lymphadenopathy/radial pulse/blood pressure/raise in temperature/attitude of the patient/nutritional assessment by skin texture, subcutaneous fat, weight, body mass index/any other relevant findings should be mentioned.

3. Local examination

Location of the swelling
Exact anatomical location of the swelling/its size/shape—globular or hemispherical or oval or pear-shaped or irregular or kidney shaped/diffuse or well localized. Vertical and horizontal dimension should be assessed and should be measured using a measuring tape.

Dermoid cysts occur in midline/outer canthus of eye/or, along any line of fusion. Lipoma can occur any where in the body.

- Colour of the swelling
Blue colour of haemangioma/black colour of naevus or melanoma/blue colour of ranula are often diagnostic. Redness over the swelling suggests inflammation.

- Surface over swelling
Smooth/irregular/nodular/cauliflower like:

  - Number of the swellings—neurofibromas and sebaceous cysts can be multiple. Dermoid cyst is usually single.
  - Edge of the swelling whether well-defined or ill-defined/whether pedunculated or sessile should be looked for.
  - Pulsation over the swelling
Arterial swelling has got expansile pulsation. It is checked by keeping two fingers over the swelling. Swelling which is very close to artery or adherent to it also can show pulsation but it is transmitted pulsation.
• **Reducibility**—whether swelling gets reduced while pressing and disappears. Hernia is reducible.

• **Presence of expansile impulse** on coughing signifies hernia or communication into the deeper cavity like abdomen or thorax or cranium.

• **Skin over the swelling** should be inspected.
  Skin over the swelling may be tense, glossy with prominent veins in sarcoma and malignancy. It is red oedematous in inflammatory swellings. Pigmentation, ulceration/fungation/discharge from ulcer/bleeding from the fungation should be inspected.

**Scar**—its size, features whether healed by primary intention or secondary intention should be mentioned. Linear and regular/broad, puckered and irregular.

• **Inspect the area and distally** especially when swelling is in the limbs for pressure effects and wasting. Wasting should be confirmed by proper measurement of the part from equal distance from a bony point.

4. **Palpation**

• **Local raise of temperature** is checked using back of fingers. It may be due to inflammation (infection) or due to tumours.

• **Tenderness** is checked while palpating the swelling by observing the face of the patient. Patient expresses the tenderness. Inflammatory conditions are tender. Neoplastic conditions are initially non-tender but later can become tender.

• **Size** is measured using tape; shape is confirmed and extent of the entire swelling and its anatomical location should be mentioned properly.

• **Edge or margin** of the swelling can be well-defined (distinct) or ill-defined (indistinct). In acute conditions and deep swellings it is ill-defined. In superficial swellings it is well-defined. Margin may be irregular in malignancy and may be regular in benign swellings.

  Edge of the swelling is examined using pulp of the index finger. Erosion of the margin into the deeper plane like bone is also checked. Dermoid cyst commonly shows erosion into the bone. In lipoma margin slips away from the bone—finger-slip sign. In sebaceous cyst margin gets yielded by the finger.

**Surface of the swelling**
It is done using palmar surface of the fingers. It may be smooth like in a cyst/nodular in lymph nodes/lobular in lipoma/matted in tuberculose nodes/irregular in carcinoma. It may be variable and if so which part is smooth and which part is nodular should be mentioned.

**Consistency**
It may be soft (like consistency of lip)/may be firm (like consistency of nose)/may be hard (like consistency of forehead). Lipoma, cystic swellings, abscess are soft. Fibromas, neurofibromas, certain nodal enlargements are firm. Chondroma, osteomas are bony hard. Malignant swellings are stony hard. Variable consistency in one swelling may be observed. In such occasion which area is soft, which area is firm or hard should be confirmed properly. Variability may be due to tumour necrosis/inflammation. Swelling like sebaceous cyst or dermoid cyst which contains pultaceous material or putty like material gets moulded.

**Fluctuation**
Swelling is fixed usually by holding with both thumbs and middle fingers. With the index finger of one hand one side of the swelling is pressed and index finger of other hand placed on diagonally opposite side feels the fluid movement and also a raise. Procedure should be repeated in perpendicular direction to confirm fluctuation (two right angle planes). This is **standard fluctuation**. Positive fluctuation signifies presence of fluid. Examples are hydrocele, cysts, etc. *(Note: Often muscle gives fluctuation like feeling when elicited in one direction but not in two perpendicular directions).*

In swelling which cannot accommodate two fingers to do standard fluctuation test, margin of the swelling is fixed using two fingers (index and ring) and using middle finger summit/centre
of the swelling is pressed/indented to feel displacement of the fluid to get yielding sensation. This test is called as Paget’s test of fluctuation.

Fluctuation may be present in a cystic swelling which contains fluid with two components on either sides of an anatomical barrier (across an anatomical barrier). It is called as cross fluctuation. Ranula (across mylohyoid muscle), psoas abscess (across inguinal ligament), compound palmar ganglion (across flexor retinaculum), bilocular hydrocele (across a band or superficial inguinal ring) are cross-fluctuant.

False fluctuation may be elicited in lipoma, myxoma and vascular swellings.

Transillumination test
When light is illuminated over the swelling it transmits light through it. It is called as transillumination/translucency. It is positive means swelling illuminates to light. It means it contains clear fluid. It is negative when it contains blood, pus, pultaceous material. Torch light is placed on one side of the swelling and illumination is observed on the diagonally opposite side using a rolled paper or rolled X-ray.

Lymph cyst, cystic hygroma, ranula, meningocele, hydrocele are transilluminant.

Reducibility
Swelling is pressed to see if it reduces completely and disappears. Hernia is reducible.

Compressibility
On applying pressure swelling reduces in size only partially and will not disappear completely and on releasing the pressure swelling comes back again to its original size and shape immediately. Usually vascular and lymphatic swellings are compressible. Example: haemangioma, lymphangioma.

Pulsatility
Two fingers are placed over the swelling with adequate gap between two fingers. If fingers over the swelling are raised and separated with each beat of the artery it means pulsation is expansile. If fingers are only raised but not separated then pulsation of the swelling is transmitted. Pure arterial swelling like aneurysm shows expansile pulsation. Swelling which is close to the artery may show pulsation because of its close proximity and it is only transmitted pulsation.

Fixity to the skin
Mobility of the skin over the swelling is checked or skin over the swelling is pinched to see whether skin is free or attached to swelling underneath. Sebaceous cyst has skin adherent over the summit with a punctum (70%) often present. In dermoid cyst skin is always free. In lipoma skin is usually free. In neurofibromas skin may be adherent but depends on from which
nerves neurofibroma arises, whether from deeper plane or from cutaneous nerves.

*Fig. 2.2:* Skin over the swelling should be pinched/ held to check swelling is adherent to skin or not.

**Fixity to deeper structures**
If swelling is freely mobile it could be in subcutaneous plane. Lipoma, sebaceous cyst, often neurofibroma are subcutaneous. If swelling is adherent to muscle underneath, then when muscle is contracted again mobility of the swelling is restricted but it becomes more prominent. While muscle is relaxed swelling will be mobile.

If swelling is arising from the muscle or deep to muscle then size of the swelling decreases in size (less prominent) when muscle is contracted. Again mobility which is present initially will disappear completely during contraction of the muscle. Disappearance occurs much more significantly in swelling which is deeper to the muscle.

Swellings arising from vessels or nerves will move only horizontally/perpendicular to the line of nerve but will not show any mobility in longitudinal direction. Example—neurofibroma, aneurysm.

Swelling arising from the bone is hard and absolutely fixed and cannot be moved separately from the bone.

**Percussion over the swelling** in relevant area like hernia should be done.

**Auscultation**
It is done to look for bruit over the swelling like in A-V malformation, arterial stenosis, aneurysms.

**Joints above and below the swelling** should be examined both for active and passive movements.

**Regional lymph nodes** should be examined for significant enlargement.

**Relevant systemic examination** is a must like respiratory, cardiac, skeletal and abdomen.

**Proper diagnosis** of the swelling should be given.

**Relevant investigations**
- FNAC, U/S of part, CT scan, MRI for bony and joint swellings, angiography and Doppler in vascular swellings, biopsy in soft tissue sarcomas.
- Swelling may be congenital/traumatic/inflammatory/neoplastic. It may be benign or malignant. In malignancy it may be early or advanced.

**Lipoma**
- Lipoma is benign tumour arising from yellow fat. It is usually encapsulated.
- It is also called as universal/ubiquitous tumour.
- It can occur anywhere except brain.
Figs 2.4A and B: Swelling should be inspected properly.

Fig. 2.5: Slip sign should be elicited using finger. Lipoma slips between fingers.

Figs 2.6A to D: Eliciting fluctuation – in two directions. Swelling should be fixed before eliciting fluctuation. Fluctuation cannot be elicited in intra-abdominal swelling as it cannot be fixed.
• It can be subcutaneous, submuscular, subsynovial, intra-articular, intracavitary, retroperitoneum, submucosal, etc.
• Diffuse lipoma can occur in sole and palm.
• Lipoma is slow growing tumour which slips by the palpating finger; mobile with free skin, semifluctuant, nontransilluminating.
• Lipoma can turn into liposarcoma especially in back, thigh, shoulder region and retroperitoneum. There will be rapid increase in size; warmth, increased vascularity, fixity, often blood spread to lungs.
• Dercum’s disease is painful deposition of hypertrophied fat, occurs usually in thigh.
• Lipoma can be fibrolipoma, neurolipoma (painful), naevolipoma.
• Lipoma is treated by excision.

Complications—malignant transformation, intussusception occurs in submucosal lipoma in intestine, degeneration, saponification, calcification.

Papilloma
It is warty swelling from the skin or often from the mucous membrane.

It has got a central axis of connective tissue, blood vessels and lymphatics.

1. True papilloma
It is a benign tumour with localized overgrowth of the epidermis. It is commonly pedunculated but rarely can be sessile.

Pedunculated papilloma is villous with a central axis of connective tissues, blood vessels and lymphatics.

2. Infective papilloma
It is a warty lesion due to infection, e.g. condyloma acuminata.
Papilloma may be

Single.
Multiple.
Papilloma may be Pigmented. Nonpigmented.

Fig. 2.10: Diagram of papilloma.

True papilloma may turn into squamous cell carcinoma occasionally. There will be sudden increase in size, bleeding or ulceration.

**Differential Diagnosis**
Amelanotic melanoma, pedunculated lipoma, carcinoma.
- Papilloma occurring in the breast is called as duct papilloma which is the commonest cause of bloody discharge from the nipple.
- Papilloma can occur in mucus membrane like in oral cavity, urinary bladder (transitional papilloma), in the rectum (columnar), in the larynx, in the gallbladder (cuboidal).

**Treatment**
- *True papilloma* is excised with its base along with surrounding 1 cm skin margin.
- *Infective warts* can be treated by excision or CO₂ snow or diathermy coagulation.

**Complications of papilloma**
- Bleeding
- Malignant transformation
- Ulceration
- Mechanical disability like voice change when it occurs in vocal cord

**Cysts**
Cyst is a collection of fluid in a sac lined by epithelium or endothelium.
Word meaning of cyst is ‘bladder’ (Greek).

1. **True cyst**
   - Cyst wall is lined by epithelium or endothelium.
   - If infection occurs cyst wall will be lined by granulation tissue.
   - Fluid is usually serous or mucoid derived from the secretion of the lining.

2. **False cyst**
   - It does not have epithelial lining.
   - Fluid collection is result of exudation or degeneration.

Examples:
- Pseudocyst of pancreas.
- Wall of cystic swelling in tuberculous peritonitis.
- Cystic degeneration of tumour.
- After haemorrhage, in a haematoma, RBC’s are lysed and absorbed and fluid remains as a false cyst.

3. ‘*Apoplectic cyst*’ is formed in brain as a result of ischaemia causing collection of fluid.

**Classification**

**Congenital cyst**
- *Dermoids*: Sequestration dermoid.
- *Tubulodermoids*: Thyroglossal cyst, postanal dermoid, ependymal cyst, urachal cyst.
- *Cysts of embryonic remnants*: Cysts from paramesonephric duct and mesonephric duct. Cysts of urachus and vitellointestinal duct.

**Acquired cysts**
- *Retention cysts*: They are accumulation of secretion of a gland due to obstruction of a duct. E.g, Sebaceous cyst, Bartholin cyst, cyst of pancreas, cyst of parotid, breast, epididymis.
- *Distention cyst*: Lymph cyst, ovarian cyst, colloid goitre.
- *Exudation cyst*: Bursa, hydrocoele.
Cystic tumours: Dermoid cyst of ovary, cystadenomas.

Traumatic cyst: Due to trauma, haematoma occurs usually in thigh, loin, and shin. It eventually gets lined by endothelium containing brown coloured fluid with cholesterol crystals.

Degenerative cyst: Due to cystic degeneration of a solid tumour (due to necrosis of tumour).

Parasitic cyst: Hydatid cyst, trichiniasis, cysticercosis.

Clinical Features of a Cyst
- Hemispherical swelling which is smooth, fluctuant, nontender, well localised. Some cysts are transilluminant.
- Presentation varies depending on its anatomical location.

Effects of a Cyst
- Compression to adjacent structures: Choledochal cyst compressing over the CBD.
- Infection.
- Sinus formation.
- Haemorrhage.
- Torsion, e.g. Ovarian cyst.
- Calcification.
- Cachexia: In malignant ovarian cyst patient goes for severe cachexia.

Swellings which are brilliantly transilluminant
- Ranula
- Cystic hygroma and lymph cyst
- Hydrocoele
- Epididymal cyst [Chinese-lantern pattern]
- Meningocele

Dermoids
Sequestration Dermoid?
It occurs at the line of fusion due to inclusion of epithelium beneath the surface which later get sequestered forming a cystic swelling in the deeper plane.

Common sites are
1. Forehead.
2. External angular dermoid.
3. Root of nose.
4. Sublingual dermoid.
5. Any where in midline or in the line of fusion.

- Dermoids occurring in the skull may extend into the cranial cavity. When it occurs as external angular dermoid, it extends into the orbital cavity. Or it can extend into any cavity in relation to its anatomical location (e.g. thorax, abdomen).
- Dermoid cyst contains putty like desquamated material. It is lined by both dermal and epidermal components.

Types of Angular dermoid
- External angular dermoid: It is a sequestration dermoid situated over the external angular
process of the frontal bone. Outer extremity of the eyebrow extends over some part of the swelling. This typical feature differentiates it from the swelling arising from the lacrimal gland. It may extend into the orbital cavity also.

- **Internal angular dermoid:** It is a sequestration dermoid near central position at the root of the nose.

**Clinical features**
- Painless swelling in the line of fusion, presents in the second or third decade onwards, which is smooth, soft, nontender, fluctuant (*Paget’s test* positive, i.e. swelling is fixed with two fingers and summit is indented to get yielding sensation due to fluid), nontransilluminating, with free skin often adherent into the deeper plane.
- There will be resorption and indentation of the bone beneath (*Bony guttering*). It is true cyst.

**Differential diagnosis**
- Sebaceous cyst.
- Lipoma.

**Investigations**
- X-ray skull or part.
- CT scan head or part.

**Treatment**
Excision is done under general anaesthesia. Often formal neurosurgical approach is required by raising cranial osteocutaneous flaps.

**Submental dermoid** is sequestration dermoid arising from sequestration at the site of fusion of ectoderm of 1st and 2nd branchial arches.

**Tubulodermoids**
It arises from the embryonic tubular structures. Examples includes:
- Thyroglossal cyst.
- Ependymal cyst.
- Postanal dermoid.

**Implantation Dermoid**
- Due to minor pricks or trauma, epidermis gets buried into the deeper subcutaneous tissue which causes reaction and cyst formation (*Trauma is often forgotten*).
- It is common in fingers (common in tailors), toes and feet.

**Clinical features**
- Swelling which is painless, observed after minor trauma, slowly progressing in fingers or toes.
- It is smooth, soft, mobile, tensely cystic, nontransilluminating and is adherent to skin.

**Differential diagnosis**
- Lipoma.
- Bursa.

**Treatment**
- Excision.

**Teratomatous Dermoid**
- It arises from all germinal layers ecto, meso and endoderms.
- It occurs in ovary, testis, retroperitoneum, mediastinum.
- It contains hairs, teeth, cartilage, muscle.
- It can be benign or malignant.

**Sebaceous Cyst (Wen, Epidermal Cyst)**
- It is a retention cyst. It is due to obstruction to the mouth of a sebaceous duct, causing a cystic swelling.
- It is common in face, scalp, and scrotum.
- *It is not seen in palms and plantar aspect of foot (sole)* as there are no sebaceous glands.
• Sebaceous cyst contains yellowish material with fat, epithelium which has putty like consistency, with a parasite in the wall of the sebaceous cyst—*demodex folliculorum*.
• Its lining is only epidermal layer of squamous epithelium.

**Clinical Features**
• Painless swelling which is smooth, soft, nontender, freely mobile, adherent to skin especially over the summit, fluctuant (positive Paget’s test), nontransilluminating with Punctum over the summit.
• It moulds on finger indentation. Content has got unpleasant smell.
• **Punctum** is present over the summit in 70% of cases because here sebaceous duct directly opens into the skin which gets blocked. Punctum is depressed black coloured spot over the summit of the sebaceous cyst. It is black in colour because of the denuded squamous epithelium (keratin). In 30% cases sebaceous duct opens into the hair follicle and so punctum is not seen.

**Complications**
• Infection and abscess formation.
• Surface gets ulcerated with discharge and is called as—*Cock's peculiar tumour*—often resembles epithelioma.
• Sebaceous horn.

**Treatment**
• Excision including skin adjacent to punctum using elliptical incision.
• Incision and avulsion.
• If abscess is formed, then drainage initially and later excision.
• If capsule is not removed properly the cyst will recur.

**Neurofibroma**
• It is tumour arising from connective tissue of the nerve.
• It can be single or multiple. Neurofibromas may be associated with pheochromocytomas, scoliosis, hypertension and few syndromes.

**Sites**
• Cranial.
• Spinal.
• Peripheral.

**Types**
• **Nodular neurofibroma** presents as single smooth, firm, tender (often) swelling which moves horizontally or perpendicular to the direction of the nerve, not in the direction of the nerve. There is pain and hyperaesthesia in the distribution of the nerve.
• **Plexiform neurofibroma** commonly occurs along the distribution of 5th cranial nerve in the skin of the face. It often occurs in the cutaneous distribution of the peripheral nerve. It attains enormous size with thickening of the skin which hangs downwards. It causes erosion into the bone, orbit and deeper structure. It may cause myxomatous degeneration also. It causes cosmetic problem.
• **Generalised neurofibromatosis (von-Recklinghausen’s disease):**
  - It is an inherited autosomal dominant disease wherein there will be multiple neurofibromas in the body.
  - It may be cranial, spinal or peripheral.
  - It is associated with pigmented spots (coffee coloured) in the skin, commonly seen on the back, abdomen, thigh (*café au lait spots*).
  - **Elephantiatic neurofibromatosis:** It is of congenital origin. Skin of the limb is greatly thickened and coarse.

**Complications**
1. **Sarcomatous changes:** When it occurs it shows rapid enlargement, warmness, more vascularity with dilated veins. Secondaries in lungs can occur through blood spread.
2. **Haemorrhage** into the tissues.
3. Spinal and cranial neurofibromas can cause neurological deficits.
4. Erosion into deeper planes, bone, orbit.

**Treatment**
- **Excision**
  - Indications:
    - Symptomatic neurofibroma.
    - Cosmetically problematic lesion.
    - Recent increase in size.
    - Malignant transformation.

**Neurilemmoma (Schwannoma)**
- It arises from Schwann (neurilemmal cells) cells. They are lobulated, encapsulated, soft, and whitish in appearance. They displace the nerve from which they arise and can be removed. They are common in acoustic nerve but do can occur in a peripheral nerve. Often they are multiple.
- Presentation is pain along the distribution of the nerve, hyperaesthesia, and tenderness.
- Treatment is excision.
- Recurrent Schwannoma could be malignant.

**Ganglion**
It is a cystic swelling occurring in relation to tendon sheath or synovial sheath or joint capsule. It contains clear gel like fluid.

**Common Sites**
1. Dorsum of wrist.
2. Flexor aspect of wrist.
3. Around ankle joint—occasionally.

**Pathogenesis**
- Cystic degeneration of the tendon sheath.
- Leakage of synovial fluid through joint capsule.
- There are small islets of microspaces in synovial sheath which often fuses together or one of them gets enlarged to form ganglion.

**Clinical Features**
- Well localised, smooth, soft, cystic, or tensely cystic, (Paget’s test is +ve), non-tender,
transilluminant, swelling which is mobile but mobility is restricted when tendon is contracted against resistance.

- Occasionally it is communicating with joint capsule.
- Often pain, tenderness and restricted joint movement may be the presentation (but rare).

Differential diagnosis: Lipoma, lymph cyst, sebaceous cyst.

Treatment

- **Excision.** Usually under local anaesthesia (lignocaine plain 2%).
  - Patient should be explained of high recurrence rate (30%).
  - After excision, always it should be sent for histopathology.

- Pressure compression (people used to place bible over it to have pressure on it).

**Bursae**

- Bursa is a sac like cavity containing fluid within, which in normal location prevents friction between tendon and bone.
- Minor injuries and pressure leads in to bursitis, which will present as a swelling at the site.
- Inflammation of this bursa due to friction causes **bursitis**, which commonly presents as swelling, pain, and restricted movements.

**Different Types**

It can be **anatomical or adventitious**.

**Anatomical**

- Subhyoid bursa—A horizontally oval swelling situated below the hyoid bone and in front of the thyrohyoid membrane.
• **Subacromial bursa**: In front and lateral to humeral head in relation to supraspinatus tendon between acromion and greater tuberosity of humerus.
• **Bicipito radial bursitis**.
• **Olecranon bursitis** (*Student’s elbow*) (*Miner’s elbow*).
• **Psoas bursa**: A tensely cystic swelling beneath and below the inguinal ligament on the lateral aspect of the femoral triangle. But it will not extend above the inguinal ligament in to the iliac region (unlike in psoas abscess which extends above and is cross fluctuant).
• **Prepatellar bursitis** (*Housemaid’s knee*).
• **Infrapatellar bursitis** (*Clergyman’s knee*).
• **Semimembranosus bursitis**.
• **Bursa anserina**: Under the tendons of Guy ropes (sartorius, gracilis and semitendinosus tendons) (*Goose’s foot*).
• **Retrocalcaneum bursitis** between calcaneum and tendo-Achilles.

**Adventitious bursa**
- **Adventitious bursa** occurs in an unusual site like in hallux valgus (*bunion*) over first metatarsal, over lateral malleolus (*tailor’s bursa*), between tendo-Achilles and skin (*retro-Achilles bursitis*) or over gluteal tuberosity. It occurs due to friction or pressure.
- It often mimics soft tissue tumour.
- **Management**: X-ray of the part and often FNAC are required. Later excision of the bursa is done.

**Ulcer**

**Definition**
An ulcer is a break in the continuity of the covering epithelium either skin or mucus membrane due to molecular death.

**Parts of an Ulcer**
- **Margin**: It may be regular or irregular. It may be rounded or oval.
- **Edge**: Edge is the one which connects floor of the ulcer to the margin.

**Different edges are:**
- **Sloping edge**: It is seen in healing ulcer.
  - Its inner part is red due to red, healthy granulation tissue.
  - Its middle part is white due to scar/fibrous tissue.
  - Its outer part is blue due to epithelial proliferation.
- **Undermined edge** is seen in tuberculous ulcer. Disease process advances in deeper plane (in subcutaneous tissue) whereas (skin) epidermis proliferates inwards.
- **Punched out edge** is seen in gummatous (syphilitic) ulcer and trophic ulcer.
  - It is due to end arteritis.
- **Raised and beaded edge** (pearly white) is seen in rodent ulcer (BCC). Beads are due to proliferating active cells.
- **Everted edge (rolled out edge)**: It is seen in carcinomatous ulcer due to spill of the
proliferating malignant tissues over the normal skin.

- **Floor**: It is the one which is seen. Floor may contain discharge, granulation tissue.
- **Base**: Base is the one on which ulcer rests. It may be bone or soft tissues.

### Classification

**Classification I (Clinical)**

- **Spreading ulcer**: Here edge is inflamed and oedematous.
- **Healing ulcer**: Edge is sloping with healthy pink/red granulation tissue with serous discharge.
- **Callous ulcer**: Floor contains pale unhealthy granulation tissue with indurated edge/base. Ulcer has no tendency to heal. It lasts for many months to years.

**Classification II (Pathological)**

1. **Specific ulcers**:
   - Tuberculous ulcer.
   - Syphilitic ulcer: It is punched out, deep, with ‘wash-leather’ slough in the floor and with indurated base.
   - Actinomycosis.
   - Meleney’s ulcer.
2. **Malignant ulcers**:
   - Carcinomatous ulcer.
   - Rodent ulcer.
   - Melanotic ulcer.
3. **Non-specific ulcers**:
   - *Traumatic ulcer*: It may be mechanical, physical, chemical.
   - *Arterial ulcer*: Atherosclerosis, TAO.
   - *Venous ulcer* (Gravitational ulcer, post- phlebitic ulcer).
   - *Trophic ulcer*.
   - *Infective ulcers*: Pyogenic ulcer.
   - *Tropical ulcers*: It occurs in tropical countries. It is callous type of ulcer, e.g. Vincent’s ulcer.
   - *Ulcers due to chilblains and frostbite* (cryopathic ulcer).
   - *Martorell’s hypertensive ulcer*.
   - *Bazin’s ulcer*.
   - *Diabetic ulcer*.
   - *Ulcers due to leukaemia, polycythaemia, jaundice, collagen diseases, lymphoedema*.
   - *Cortisol ulcers* are due to long-term application of cortisol (steroid) creams to certain skin diseases. These ulcers are callous ulcers lasting for long-time and requires excision and skin grafting.

### Different discharges in an ulcer: (as well as from a sinus)

- **Serous**: In healing ulcer
  - *Staphylococci*: yellowish and creamy
  - *Streptococci*: bloody and opalescent
  - *Pseudomonas*: greenish colour
- **Purulent**: In infected ulcer
  - *Staphylococci*: yellowish and creamy
  - *Streptococci*: bloody and opalescent
  - *Pseudomonas*: greenish colour
- **Bloody**: Malignant ulcer, healing ulcer from healthy granulation tissue
  - *Sero-purulent*
  - *Sero-sanguinous*: Serous and blood
  - *Serous with sulphur granules*: Actinomycosis
  - *Yellowish*: Tuberculous ulcer

### Examination of an Ulcer

An ulcer is break in continuity of the covering epithelium of skin or mucus membrane.

#### History

- Mode of onset.
- Duration.
- Pain—its time of onset, progress, severity.
- Discharge from ulcer.
- History suggestive of associated disease/treatment history.

#### Local examination of an ulcer

**Inspection**

- Site of ulcer.
- Size of ulcer.
- Shape of ulcer.
- Number.
- Margin whether regular/irregular/well-defined/ill-defined.
- Edge of ulcer.
• Floor of the ulcer—floor is the one what is seen. It rests on the base (Base is not seen; it is only felt).
• Discharge from ulcer bed may be serous, serosanguinous, bloody, purulent; colour of discharge – greenish in pseudomonas infection.
• Surrounding area to be examined for inflammation, oedema, eczema, scarring.
• Inspection of the entire part/limb.

**Palpation**
• Tenderness over edge and base and surrounding area.
• Warmness over surrounding area.
• Edge palpation for induration.
• Palpation of base for induration/fixity.
• Depth of ulcer—trophic ulcer is deep with bone as its base.
• Bleeding on palpation and touching.
• Palpation of deeper structures and its relation to ulcer.
• Surrounding skin.

Examination of regional lymph nodes is essential. Examination of arterial pulse peripherally in relation to ulcer. Examination for varicose veins in standing position. Examination of spine and neurological system like sensation and muscle power.

Figs 2.22A to C: Inspection of ulcer for its site, size, shape, margin, edge, floor and surrounding area.

Figs 2.23A and B: Checking the temperature in surrounding area and comparing opposite/normal area.

Fig. 2.24: Palpating the edge for tenderness and induration.
Palpation may cause bleeding on touch in healthy granulation tissue or carcinoma. Base of an ulcer also should be palpated for tenderness and induration.

Mobility of an ulcer should be checked. If free mobility is present it means that it is not fixed to bone. If is absent then it could be fixed to bone.

Bone thickening should be felt by palpation over proximal and distal part of the ulcer. Here ulcer is in ankle region and so thickening of tibia and calcaneum should be checked.

Joint near the ulcer area should be checked for its change in movement. Fibrous ankylosis and total loss of joint movement can occur.

**Granulation Tissue**

It is proliferation of new capillaries and fibroblasts intermingled with RBC’s and WBC’s with thin fibrin cover over it.

**Types:**

- **Healthy granulation tissue:** It occurs in a healing ulcer. It has got sloping edge. It bleeds on touch. It has got serous discharge. Skin grafting takes up well with healthy granulation tissue. Streptococci growth in culture should be less than $10^5$/gram of tissue before skin grafting.

- **Unhealthy granulation tissue:** It is pale with purulent discharge. Its floor is covered with slough. Its edge is inflamed and oedematous. It is spreading ulcer.
Regional lymph nodes should be palpated for enlargement. In lower limb ulcer, vertical superficial group of inguinal nodes are palpated. External iliac nodes are also need to be checked above and on medial aspect of the inguinal ligament. Its enlargement signifies severity of the disease.

Fig. 2.30: Systemic examination like of abdomen, respiratory, cardiovascular system, spine, neurological examination is a must.

- **Unhealthy, pale, flat granulation tissue**: It is seen in chronic nonhealing ulcer (callous ulcer).
- **Exuberant granulation tissue (Proud flesh)**: It occurs in a sinus wherein granulation tissue protrudes out of the sinus orifice like a proliferating mass. It is commonly associated with a retained foreign body in the sinus cavity.
- **Pyogenic granuloma**: It is a type of exuberant granulation tissue. Here granulation tissue from an infected wound or ulcer bed protrudes out presenting as well localised, red swelling which bleeds on touching.
  
  *Differential diagnosis*: Papilloma, skin adnexal tumours.
  
  *Treatment*: Antibiotics, excision and should be sent for biopsy.

Fig. 2.31: Ulcer with healthy granulation tissue ready for split skin grafting.

**Induration in an ulcer** is due to carcinomatous ulcer or long standing ulcer due to fibrosis.

**Investigations for an Ulcer**

- **Study of discharge**: Culture and sensitivity, AFB study, cytology.
- **Edge biopsy**: Biopsy is taken from edge because edge contains multiplying cells. Usually two biopsies are taken. Biopsy is not taken from the centre because of central necrosis and biopsy may be inadequate.
- **X-ray of the part**.
- **FNAC of the lymph node**.
- **Chest X-ray, Mantoux test in suspected case of tuberculous ulcer**.
Trophic Ulcer
It is due to—
• Impaired nutrition.
• Defective blood supply.
• Neurological deficit.

It usually occurs—
• In the heel.
• In relation to heads of metatarsals.
• Buttocks.
• Over the ischial tuberosity.
• Sacrum.
• Over the shoulder.
• Occiput.
  − Because there is neurological deficit trophic ulcer is called as neurogenic ulcer/neuropathic ulcer.
  − Initially, it begins as callosity due to repeated trauma and pressure which suppurates and gives way through a central hole which extends into the deeper plane as perforating ulcer (penetrating ulcer).

Fig. 2.32: Bed sore in sacral region—
It is a trophic ulcer.

Clinical features:
• Painless ulcer which is punched out.
• Ulcer is nonmobile with base formed by bone.

Investigations: Study of discharge, biopsy from the edge, X-ray of the part, X-ray spine, blood sugar.

Treatment:
• Cause should be treated.
• Nutritional supplement.
• Rest, antibiotics, slough excision, regular dressings is done.
• Once ulcer granulates well flap cover or skin grafting is done.
• Excision of the ulcer and skin grafting.

Ulcer due to Chilblains
It is due to exposure to intense cold causing blisters and ulceration in the feet.
These ulcers are superficial.
It is due to excessive cutaneous arteriolar constriction.
The condition is also called as perniosis.

Ulcer due to Frostbite
• It is due to exposure of the part to wet cold below the freezing point.
• There is arteriolar spasm, denaturation of proteins and cell destruction.
• It leads on to gangrene of the part.
• Ulcers here are always deep.

Martorelle’s Ulcer
• It is seen in hypertensive patients often with atherosclerosis.
• It is seen in calf. Often it is bilateral. It is painful.
• Necrosis of calf skin with sloughing away occurs with formation of deep, punched out ulcer extending into the deep fascia.
• There is sudden obliteration of the arterioles of the calf skin.
• All peripheral pulses are present.
• It takes months to heal.
• Treatment is once ulcer granulates well, skin grafting with lumbar sympathectomy.

Neurological causes are:
• Diabetic neuropathy
• Peripheral neuritis
• Tabes dorsalis
• Spina bifida
• Leprosy
• Spinal injury
• Paraplegia
• Peripheral nerve injury
• Syringomyelia.

Bedsores are trophic ulcers
SRB's Bedside Clinics in Surgery

Bairnsdale Ulcer
- It is a chronic, irregular, undermined ulcer due to *Mycobacterium ulcerans* infection.
- Discharge study will show acid-fast bacilli.
- Antituberculous drugs resolve the ulcer usually. Skin grafting may be required later.

Diabetic Ulcer

**Causes:**
- Increased glucose in the tissue precipitates infection
- Diabetic microangiopathy which affects microcirculation
- Increased glycosylated haemoglobin decreases the oxygen dissociation
- Increased glycosylated tissue protein decreases the oxygen dissociation
- Diabetic neuropathy involving all sensory, motor and autonomous components
- Associated atherosclerosis

**Sites**
- Foot-plantar aspect is the commonest site.
- Leg.
- Upper limb, back, scrotum, perineum, etc.
  - Diabetic ulcer may be associated with ischaemia. Ulcer is spreading and deep.

**Investigations**
- Blood sugar both random and fasting.
- Urine ketone bodies.
- Discharge for culture and sensitivity.
- X-ray of the part.
- Arterial Doppler of the limb.

**Treatment**
- Control of diabetes using insulin.
- Antibiotics.
- Nutritional supplement.
- Regular cleaning, debridement, dressing.
- Once granulates well it is covered with skin grafting or flap.

Melaney's Ulcer
- It is an acute rapidly spreading ulcer with gangrene of skin and subcutaneous tissues.

**Aetiology:**
- It is common in old age and immuno-suppressed individuals.
- It is caused by microaerophillic streptococci and anaerobes.
- **Site:** It begins in scrotum or perineum and spreads to groin and lower abdominal wall rapidly. It can occur in other areas of skin also.
- Infection is severe with endarteritis of the skin leading on to ulcer and gangrene.

**Clinical features:**
- Toxic features.
- Spreading ulcer with skin gangrene with foul smelling discharge.

**Management**
- Blood sugar is checked and if diabetic it is controlled.
- Antibiotics.
- Blood transfusion.
- Adequate excision of dead tissues until it bleeds.
- Once healthy granulation occurs skin grafting is done.

Lupus Vulgaris
- It is cutaneous tuberculosis which occurs in young age group.
- Commonly seen on face, starts as typical *apple-gelly nodule* with congestion of face around. Eventually ulceration occurs with scarring, necrosis and undermined edge.
• Often lesion extends into nose and oral cavity involving mucosa.
• Due to lymphatic obstruction oedema of face can occur.
• Long standing lupus vulgaris can turn into squamous cell carcinoma.

**Investigation**
ESR, discharge study, biopsy, chest X-ray.

**Treatment**
• Antituberculous drugs.
• If complete healing does not occur, then excision and skin grafting is required.

**Bazin’s Disease**
• It is also called as Erythema induratum.
• It is localised area of fat necrosis affecting adolescent girls.
• Symmetrical purple nodules develop in the calves which eventually break down forming indolent ulcers with pigmented scars.
• It may be due to tuberculosis.
• Antitubercular drugs and sympathectomy are the treatment.

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**Sinus**
It is a blind track lined by granulation tissue leading from an epithelial surface into the surrounding tissues.
Sinus means ‘hollow’ or ‘a bay’ (Latin).

![Fig. 2.34: Sinus](image)

**Fistula**
It is an abnormal communication between the lumen of one viscus to another or the body surface or between the vessels. Fistula means ‘flute’ or ‘a pipe or tube’.

![Fig. 2.35: Fistula](image)

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**Management of an ulcer**
• Cause should be found and treated
• Correct the deficiencies like anaemia, protein deficiency, and vitamins
• Transfuse blood if required
• Control the pain
• Investigate properly
• Control of infection and rest to the part
• Care of the ulcer by debridement (wound excision), ulcer cleaning and dressing
• Removal of the exuberant granulation tissue
• Topical antibiotics for infected ulcers only like framycetin, silver sulphadiazine, mupirocin
• Antibiotics are not required once healthy granulation tissues are formed
• Once granulates, defect is closed with secondary suturing, skin graft, flaps
Types

<table>
<thead>
<tr>
<th>Congenital</th>
<th>Acquired</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preauricular sinus</td>
<td>Ruptured abscess</td>
</tr>
<tr>
<td>Branchial fistula</td>
<td>Tuberculosis</td>
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<tr>
<td>Tracheo-oesophageal fistula</td>
<td>Actinomycosis</td>
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<tr>
<td>Congenital A-V fistula</td>
<td>Chronic osteomyelitis</td>
</tr>
<tr>
<td>Fistula in ano</td>
<td>Fistula in ano</td>
</tr>
<tr>
<td>Acquired A-V fistula</td>
<td>Acquired A-V fistula</td>
</tr>
</tbody>
</table>

Clinical Features

- Discharge from the opening of sinus.
- No floor.
- Raised indurated edge, indurated base, nonmobile.
- Often sprouting granulation tissue is seen over the sinus opening.

Causes of Persistence of a Sinus or Fistula

1. A foreign body or necrotic tissue may be present underneath, e.g. suture, sequestrum.
2. Insufficient or nondependent drainage.
3. Persistent obstruction in the lumen. E.g. in faecal fistula, biliary fistulas (distal obstruction).
4. Lack of rest.
5. Walls get lined with epithelium or endothelium.
6. Dense fibrosis prevents contraction and healing.
7. Specific infections: Tuberculosis, actinomycosis.

Investigations

- Fistulogram/sinusogram using ultrafluid lipidl or water soluble iodine dye.
- Discharge for C/S, AFB, cytology, staining
- Biopsy from the edge.
- Chest X-ray.
- ESR.

Treatment

- Treat the cause.
- Excision of sinus or fistulas. Always specimen should be sent for histology.

Compound Palmar Ganglion

- It is chronic tenosynovitis of flexor tendon sheaths due to tuberculosis (tuberculous tenosynovitis) or rheumatoid arthritis.
- It can be unilateral or bilateral.

Pathology

- Flexor tendon sheath on either side of the wrist is involved, i.e. both in the volar surface of palm and lower forearm.
- Swelling contains fluid with typical melon seed bodies.
- Condition is often bilateral in case of rheumatoid arthritis.

Clinical Features

- Swelling in the palm and lower forearm which is smooth, soft, nontender, fluctuant and cross-fluctuant across flexor retinaculum, non-transilluminating.
- Wasting of hand and forearm muscles.
- Matted axillary lymph nodes may be palpable.
- Primary focus may be present in lungs.

Investigations

- ESR.
- Chest X-ray.
- FNAC of axillary lymph node and swelling itself.

Hamartomata

Hamartano means ‘I miss’ (Greek). Or ‘fault’ or ‘misfire’ or ‘error’.

- It is a benign lesion with aberrant differentiation producing a mass of disorganised but mature specialised cells or tissue indigenous to the particular site and is called as hamartomata.
- It is tumour like overgrowth of tissue or tissues proper to that part.
- It may be single lesion or multiple lesions.
- Haemangiomas, lymphangiomas, A-V malformations, neural malformations are the examples.

Problems with Hamartomas

- Pressure symptoms locally.
• Bleeding.
• Infection.
• Gigantism.
• Cosmetic problem.

**Treatment**
• Depends on site, type, extent.
• Cryotherapy, ligation of feeding vessels, sclerotherapy, excision.

**Haemangioma**
• It is the commonest Hamartoma (a congenital malformation).
• They are not true tumours.
• Commonly seen in skin and subcutaneous tissue, but can occur anywhere in the body like in liver, brain, lung or other organs.

**Classification**
1. Capillary.
2. Cavernous (venous).
3. Arterial: Is a type of congenital arteriovenous fistula.

**Capillary Haemangioma**

**Types**
2. *Port wine stain (Naevus flammeus)*: Present at birth and persists throughout life without any changes. No spontaneous regression. It presents as reddish blue, warm area commonly on face. Often it is nodular. It requires cosmetic coverage, excision and grafting or laser ablation.
3. *Strawberry haemangioma*: Child is normal at birth. Between one and three weeks it appears as red mark which rapidly increases in three months to form strawberry or raspberry haemangioma which contains immature vaso formative tissues.
   • It is clinically warm, compressible, and bluish in colour.

**History of bleeding after minor trauma.**
• It involves skin, subcutaneous tissue and often muscle also.
• After one year of age, it slowly involutes and by 7-8 years it disappears completely (commonly).

**Treatment**
• Allow for spontaneous regression.
• Otherwise by laser therapy.
• CO₂ snow therapy.
• Sclerosant therapy.
Cavernous Haemangioma

- It is present at birth and consists of a multiple venous channels.
- Its size increases gradually and may cause problems.
- It often contains feeding vessels which is of surgical importance.

![Fig. 2.38: Cavernous haemangioma in tongue. It is one of the causes for macroglossia.](image)

**Sites**
Face, limbs, liver and other internal organs.

**Clinical features**
- Smooth, bluish, well localised, soft, compressible, warm swelling from skin and subcutaneous tissue.
- Compressibility of a swelling is checked by gently and gradually pressing the swelling so as to reduce it partially and pressing finger is released. After release swelling reappears to attain its original size. It is called as compressibility. Vascular and lymphatic swellings are compressible. Examples are – haemangioma; cavernous haemangioma; often arteriovenous malformations.

**Complications**
- Haemorrhage.
- DIC.
- Thrombosis.
- Infection and septicaemia.
- Erosion into the adjacent bone.

**Investigations**
- U/S.
- Doppler.
- Angiogram to find out feeding vessel.
- Platelet count.

**Treatment**
- Ligation of feeding artery.
- Therapeutic embolisation.
- If small in accessible area then excision.
- Sclerosant therapy.
- Laser ablation.

**Associated Syndromes**
- **Klippel-Trenaunay-Weber syndrome**: Naevus flammeus + osteohypertrophy of extremities + AV fistula
- **Kasabach-Merritt syndrome**: Capillary haemangioma + DIC (Disseminated intravascular coagulation)
- **Sturge-Weber syndrome**: Haemangiomas + hemiplegia and epilepsy (Calcified vascular cerebral and meningeal deposits) + glaucoma
- **Maffucci syndrome**: Cavernous haemangioma + dyschondroplasia

Cirsoid Aneurysm

- It is a rare variant of capillary haemangioma occurring in skin, beneath which abnormal artery communicates with the distended veins.
- Commonly seen in superficial temporal artery and its branches.
- Often the underlying bone gets thinned out due to pressure.
- Sometimes extends into the cranial cavity.
- Ulceration is the eventual problem which will lead on to uncontrollable haemorrhage.

**Clinical Features**
Pulsatile swelling in relation to superficial temporal artery, which is warm, compressible, with arterialisation of adjacent veins and with bone thickening (due to erosion).
Investigations
- Doppler study.
- CT scan.
- Angiogram.
- X-ray of the part.

Treatment
- Ligation of feeding artery and excision of lesion, often requires preliminary ligation of external carotid artery.
- Intracranial extension requires formal neurosurgical approach.

Arteriovenous Fistula (AVF)
It is a type of arteriovenous malformations.

Types
- Congenital.
- Traumatic.

Congenital AVF
During developmental period AV communications occur.

Sites
- Limbs either part or whole of the limb. Part may be in toes or fingers.
- Lungs.
- Brain in circle of Willis.
- Other organs like bowel, liver.

Clinical Features
Structural changes in the limb.
- Limb is lengthened due to increase in blood flow since developmental period.
- Limb girth is also increased.
- Limb is warm.
- Continuous thrill and continuous machinery murmur all over the lesion.
- Dilated arterialised varicose veins are seen due to increased blood flow and due to valvular incompetence.
- Often there will be bone erosion or extension of AVF into the bone as such.

Fig. 2.39. Hypertrophic changes due to AV malformation in index finger. Auscultation reveals a continuous bruit/murmur over it.

Figs 2.40A and B: Congenital AV malformation of right upper limb with increased length, girth, and warmness. There is also right side facial hypertrophy.
Physiological changes: Because of the hyperdynamic circulation, there will be increased cardiac output and so often congestive cardiac failure.

Complications
- Haemorrhage.
- Thrombosis.
- Cardiac failure.

Investigations
- Angiogram.
- Doppler study.
- X-ray of the part.

Treatment
- Avoid injury.
- Ligation of feeding artery.
- Sclerosant therapy.
- Therapeutic embolisation.
- Amputation when required (only) as life saving procedure.

Acquired AVF

Causes
1. Trauma in
   a. Femoral region.
   b. Popliteal region.
   c. Brachial region.
   d. Wrist.
   e. Aorta venacaval.
   f. Abdomen: It may be following road traffic accidents, penetrating wounds, Cock-fights injury (common in South India).

2. After vascular surgical intervention for major vessels.
3. Therapeutic: For renal dialysis, AVF is created (cimino fistula) to achieve arterialisation of veins and also to have hyperdynamic circulation. It allows easy adequate venous assess for long term haemodialysis. Common sites are wrist, brachial, and femoral region.

Pathophysiology
- Physiological changes: Cardiac failure due to hyperdynamic circulation.
- Structural changes:
  - Changes at the level of fistula: Blood flows from high pressure artery to low pressure vein causing diversion of most of the blood. Between the artery and vein, at the site of fistula, dilatation develops with fibrous sac formation called as aneurysmal sac. This presents as warm, pulsatile, smooth, soft, compressible swelling at the site with continuous thrill and continuous machinery murmur. It is warm at the site.
  - Changes below the level of the fistula: Because of diversion of arterial blood distal part becomes ischaemic. Because high pressure veins become arterialised, valvular incompetence occurs causing varicose veins.
  - Changes proximal to the fistula: Hyperdynamic circulation causing cardiac failure.

    If pressure is applied to the artery proximal to the fistula, swelling will reduce in size, thrill and bruit will disappear, pulse rate and pulse pressure becomes normal. This is called as Nicoladoni's sign or Branhan's sign.

    Cardiac failure may be very severe in traumatic AVF (Often resistant to drug therapy).

Investigations
- Doppler.
- Angiogram.
- ECG.
- Echocardiography.
**Treatment**

- **Excision** of fistula and **reconstruction** of artery and vein with graft.
- In emergency situation, **quadruple ligation**, i.e. both artery and vein above and below should be ligated without touching the fistula and sac. Patient recovers well from cardiac failure.
- Therapeutic embolisation may be tried.

**Hunter’s ligation should be avoided.** It is used as a life-saving measure because it invariably causes limb ischaemia and gangrene even though patient recovers from cardiac failure. It is ligation of both artery and vein proximally so as to make cardiac function normal. But it invariably steals the blood from the limb leading to gangrene.

**Lymphangiography**

**Indications**

- Congenital lymphoedema like aplasia, hypoplasia, hyperplasia.
- Lymphomas, it shows reticular pattern. It is also useful to assess the response to treatment.
- Secondaries in lymph nodes, especially iliac and para-aortic lymph nodes.

**Technique**

Patent blue dye or 1 ml Isosulphan blue is injected subcutaneously between toes. Dye will be taken up by lymphatics which will be visualised clearly. After making incision, one of the lymphatic vessels is dissected and 30G needle is passed. Ultra fluid lipiodol which is an oily contrast medium is injected slowly using pressure pump at a rate of 1 ml in 8 minutes (total quantity is 7 ml). Slowly in 24 hours, it passes through the lymphatics and reaches the iliac and para-aortic lymph nodes. Radiographs taken will help to visualise both lymphatic vessels as well as lymph nodes.

Secondaries in lymph nodes cause filling defects. Lymphomas show enlarged nodes which have foamy or reticular appearance.

**Disadvantages**

- Technically difficult.
- Extravasation of dye can occur.

- Dye might not have reached the required area.
- Time consuming and invasive procedure.

**Lymphangiographic Classification of Lymphoedema**

- Congenital hyperplasia (10%).
- Distal obliteration (80%).
- Proximal obliteration (10%).

**Isotope Lymphoscintigraphy**

Radioactive Technetium labelled antimony sulphide colloid particles are injected into the web space using fine needle. These particles are specifically taken up by lymphatics. Using gamma camera, limb and inguinal region is exposed to visualise the lymphatics and inguinal lymph nodes. In 3 hours it reaches para-aortic lymph nodes, other abdominal lymph nodes and liver. Later thoracic duct also can be visualized. It can be compared to the take up on the other limb.

**Advantages**

- It is more sensitive.
- Technically easier and faster compared to lymphangiography.
- Thoracic duct, other lymph nodes and liver can be visualized.

**EXAMINATION OF LYMPHATIC SYSTEM**

Lymphatic system is important in relation to many diseases like lymphoma, tuberculosis, secondary deposits, nonspecific infections, lymphatic leukaemia, AIDS.

In generalised lymphadenopathy a thorough examination is needed.

**1. History**

- Duration, progress, site/sites.
- Fever.
- Jaundice.
- Loss of appetite and weight.
- Pruritus.
- Cough, haemoptyisis, dyspnoea.
- Bone pain.
- History of exposure.
2. **General examination**: Clubbing, jaundice, fever, anaemia, built, respiration.

3. **Lymphatic system examination**
   - Oral cavity – tonsils and inner Waldeyer ring.
   - Neck nodes – superficial and deep; outer Waldeyer ring.
   - Axillary nodes.
   - Epitrochlear nodes – above and medial to medial epicondyle.
   - Mediastinal widening for mediastinal nodes.
   - Inguinal/iliac nodes.
   - Paravertebral nodes.
   - Hepatosplenomegaly/ascites.
   - Popliteal nodes.

Bone tenderness, sternal tenderness.
Spine tenderness.
Respiratory system examination for pleural effusion and altered breath sounds.

**Lymphomas**
They are progressive neoplastic condition of lymphoreticular system arising from stem cells.

**Types**
- Hodgkin’s lymphoma (HL).
- Non-Hodgkin’s lymphoma (NHL).

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**WHO modified REAL classification (Revised European American Lymphoma) of lymphoma:**
1. B cell neoplasms
   - Precursor B cell neoplasm—ALL, LBL.
   - Peripheral B cell neoplasm—It includes all B cell related Non-Hodgkin’s lymphomas
2. T-cell and putative NK cell neoplasms
   - Precursor T cell neoplasms—ALL and LBL. T cell related.
   - Peripheral T cell and NK cell neoplasm—It includes all T cell related Non-Hodgkin’s lymphomas.
3. Hodgkin’s lymphoma
   - Predominant HL—Nodular lymphocyte type
   - Classical HL
     - Nodular sclerosis
     - Lymphocyte rich
     - Mixed cellularity
     - Lymphocyte depletion

---

**Note:** In modification, following additions are there.
- Single extralymphoid site is IE.
- An extralymphoid site with one or more lymph nodes same side of diaphragm is II E.
- An extralymphoid site with lymph nodes on both sides of diaphragm III E.
- An extralymphoid site with spleen and lymph nodes on both sides of diaphragm III SE.
- Spleen with lymph nodes on both sides of diaphragm is III S.

N—Nodes, H—Liver, S—Spleen, L—Lung, M—Marrow.
P—Pleura, O—Bone, D—Skin.
Stage III (1) is nodes above renal vein level and (2) is below it.

**Hodgkin’s Lymphoma (HL)**
- It is the commonest type of lymphoma.
- Grossly lymph nodes are fleshy, pinkish grey, and rubbery in consistency.
- Microscopically contains cellular infiltration with lymphocytes, reticulum cells, histiocytes, fibrous tissue and *Reed-Sternberg* cells.
  (Reed-Sternberg cells are giant cells with two large mirror image nuclei).

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**Fig 2.42:** Hodgkin’s lymphoma in a boy.
Rye’s classification
1. Lymphocytic predominance. Has got good prognosis.
4. Lymphocytic depletion has got bad prognosis.
Reed-Sternberg cells are also seen occasionally in certain other conditions like glandular fever.

Clinical Features
- It is more common in males.
- It has got bimodal presentation. It is seen in young and adolescents (20-30 yr) as well as in elderly (> 50 yr).
- Painless progressive enlargement of lymph nodes. They are smooth, firm, nontender, typically of India rubber consistency.

Site
- Cervical lymph nodes commonest. 82% (lower deep cervical group in posterior triangle).
- Others include axillary, mediastinal, inguinal, abdominal.

Specific Features
- Nodular sclerosis is most common type.
- Consecutive group of lymph nodes are involved.
- Splenomegaly is very common (45%).
- Hepatomegaly with jaundice—jaundice is due to haemolysis or due to diffuse liver involvement.
- Constitutional symptoms like fever, malaise, pruritus, weight loss may be present which signifies stage ‘B’, which has got poor prognosis. Stage ‘A’ is absence of these symptoms which signifies better prognosis.
- Mediastinal lymph node involvement may cause compression features like SVC obstruction.
- Occasionally bone may get involved, like vertebrae. But it is not common in NHL.
- Anaemia, pancytopenia.

Ann—Arbor clinical staging
Stage 1: Confined to one group of lymph node.
Stage 2: More than one group of lymph nodes on one side of the diaphragm.
Stage 3: Nodes involved on both sides of the diaphragm.
Stage 4: Extranodal involvement like liver, bone marrow.
Suffix ‘S’—Spleen involved
Suffix ‘B’—Presence of constitutional symptoms.
Suffix ‘A’—Absence of constitutional symptoms.

Differential Diagnosis
- Tuberculosis.
- NHL.
- HIV.
- Chronic lymphatic leukaemia.
- Nonspecific lymphadenitis.
- Sarcoidosis.
- Secondaries in lymph nodes.

Investigations
- Blood: Hb%, ESR, peripheral smear, blood urea, serum creatinine.
- FNAC of lymph nodes.
- Excision biopsy of lymph nodes. Full lymph node has to be excised to retain the architecture of the lymph node. It is important to grade the tumour.
- Chest X-ray to see mediastinal lymph nodes, pleural effusion.
- U/S abdomen—to see for the involvement of liver, spleen, abdominal lymph nodes.
- CT scan of mediastinum and abdomen.
- Lower limb lymphangiography to see the pelvic and retroperitoneal lymph nodes.
- Bone marrow biopsy to stage and also to see the response to treatment.
- Staging laparotomy:
  - Open the abdomen. Do splenectomy mainly to remove the tumour bulk, as
spleen is commonly involved and also to avoid irradiation to splenic area which often causes unpleasant pulmonary fibrosis. Take biopsies from both lobes of the liver (needle biopsy) from para-aortic, mesenteric, iliac nodes. In females ovaries are fixed behind the uterus to prevent radiation oopheritis (oopheropexy).

**Treatment for HL**

- **Stages I and II**
  1. Mainly *radiotherapy*—external high cobalt RT.
     - Above the diaphragm *‘Y’ field therapy*, covering cervical, axillary, mediastinal lymph nodes.
     - Below the diaphragm, *mantle or inverted ‘Y’ field therapy*, covering para-aortic and iliac nodes.
  2. Chemotherapy is also often used.
- **Stage III and IV**: Mainly *chemotherapy*.
  Drugs used includes:
  — Oncovine. O. (Vinca alkaloids).
  — Procarbazine. P.
  — Prednisolone. P.
  Other regimens available — MVPP, ABVD.

**Prognosis**: 5 years survival rate is 80%.

**Non-Hodgkin’s Lymphoma (NHL)**

- It occurs in middle aged and elderly. It is more aggressive than HL.
- It involves asymmetrical group of lymph nodes.
- General condition is poor.
- Inner-Waldeyer ring, epitrochlear lymph nodes, peripheral lymph nodes are commonly involved.
- Spleen is not commonly involved.
- Hepatomegaly is common.
- Vertebral involvement is common; paraplegia can occur.
- Secondary infection, cachexia and immunosuppression is more common.

**Types**

- Nodular (follicular)
- Diffuse lymphocytic
- Undifferentiated
- Histiocytic type

**Rappaport**

<table>
<thead>
<tr>
<th>Type</th>
<th>Working classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nodular</td>
<td>a. Low grade</td>
</tr>
<tr>
<td>Diffuse</td>
<td>b. Intermediate grade</td>
</tr>
<tr>
<td>Histiocytic</td>
<td>c. High grade</td>
</tr>
</tbody>
</table>

**Treatment**

Mainly *chemotherapy*

Various regimens available include:

- ChOPP—Chlorambucil, Oncovin, Procarbazine, Prednisolone.
- ABVD—Adriamycin, Bleomycin, Vincristine, Dacarbazine.
- ABVP—Adriamycin, Bleomycin, Vincristine, Prednisolone.
- Combinations of above.

**Differences between HL and NHL**

<table>
<thead>
<tr>
<th></th>
<th><strong>HL</strong></th>
<th><strong>NHL</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Young and elderly</td>
<td>Middle age and elderly</td>
</tr>
<tr>
<td>Pattern of involvement</td>
<td>Symmetrical and consecutive</td>
<td>Asymmetrical</td>
</tr>
<tr>
<td>Cervical lymph node</td>
<td>Commonly involved</td>
<td>Any group can be involved</td>
</tr>
<tr>
<td>Splenomegaly</td>
<td>Common</td>
<td>Not common</td>
</tr>
<tr>
<td>Peripheral lymph node involvement (e.g. epitrochlear nodes)</td>
<td>Not common</td>
<td>Common</td>
</tr>
<tr>
<td>Treatment</td>
<td>Mainly radiotherapy</td>
<td>Mainly chemotherapy</td>
</tr>
<tr>
<td>Prognosis</td>
<td>Better</td>
<td>Poor</td>
</tr>
</tbody>
</table>
Role of radiotherapy in NHL: When vertebra is involved.
Prognosis is poor compared to HL.

Burkitt’s Lymphoma (Malignant Lymphoma of Africa)
- It is common in South Africa and New Guinea.
- Epstein-Barr virus may be the aetiological agent.
  It is common in children.
- It is associated with infectious mononucleosis.
- It is common in malaria endemic area.
- The tumour is multifocal, rapidly growing, painless.
- Different groups of lymph nodes can also be affected.

Microscopy
Primitive lymphoid cells with large clear histiocytes—starry night (starry sky) pattern.

Site
It is common in jaw either lower or upper. Abdominal presentation and renal involvement is common (75%).
  Renal involvement often may be bilateral.
  In females ovaries are commonly affected.

Investigation
- FNAC and biopsy confirms the diagnosis.
- X-ray jaw shows osteolytic lesions.
- U/S abdomen to see involvement of kidneys.
- Blood urea and serum creatinine estimation is done.

Treatment
Radiotherapy.
Chemotherapy: Cyclophosphamide, Methotrexate, Orthomelphalan.
  Surgery is usually not indicated unless it is localised or in case of involvement of ovaries.

Prognosis
Prognosis is good.

Skin Adnexal Tumours
- They are tumours arising from accessory skin structures like sebaceous glands, sweat glands, hair follicles, etc.
- It is not uncommon. It may be benign or malignant.
- It presents as protruding well-localised swelling in the skin.
- Malignant skin adnexal tumour forms a nodular, hard, indurated swelling in the skin, often with involvement of hard, nodular regional lymph glands.
- It mimics squamous cell carcinoma of skin.

Differential Diagnosis
- Squamous cell carcinoma of skin.
- Dermatofibrosarcoma protuberans.

Diagnosis
- Biopsy.
- FNAC of lymph node.

Treatment
- Excision for benign tumour.
- Wide excision and regional lymph node block dissection when required.

Dermatofibroma (Sclerosing Angioma or Subepithelial Benign Nodular Fibrosis)
- It is a benign tumour arising from skin.
- It is formation of firm, single or multiple nodules occurring commonly in extremities (limbs).
- It can be red, brownish yellow (due to lipid), or bluish black (due to haemosiderin).

Differential Diagnosis
- Squamous cell carcinoma of skin.
- Melanoma.
- Basal cell carcinoma.
- Skin adnexal tumour.

Treatment
Excision.
Dermatofibrosarcoma Protuberans
- It is a low grade fibrosarcoma which grows slowly but persistently.
- Occurs in the limb, abdominal wall, back, etc.
- It is not a rare entity, often attains a large size with multiple, nodular, hard, swelling with often involvement of lymph nodes.
- Rarely does it spread into lungs through blood.
- It mimics squamous cell carcinoma of skin, and skin adnexal tumour.
- It presents as a rapidly growing painless single swelling in the skin with central brown area.
- It grows usually for 4 weeks and later shows spontaneous regression in 4 months.
- During regression phase, central area separates from the lesion leaving a deeply seated scar.
- Mobile, hard painless, nontender, lump with a central brownish area.
- No lymph nodes are enlarged.
- It is totally benign.
  Differential diagnosis—squamous cell carcinoma
  Treatment is excision. Always send the tissue for histopathological study.

Diagnosis
- Biopsy of the lesion.
- Chest X-ray.
- FNAC of the lymph node.

Treatment
- Wide excision and follow up.
- Recurrence is common.
- Prognosis is good.

Keratoacanthoma (Molluscum Sebaceum)
- It is a overgrowth and subsequent spontaneous regression of hair follicle seen commonly in adults.
- Cause is unknown. It may be self limiting benign neoplasm of viral origin.
- Squamous Cell Carcinoma (Epithelioma)
- It occurs in premalignant conditions like Bowen’s disease, chronic scars, chemically induced chronic irritation, radiodermatitis, senile keratosis. For example, Khangri cancer

PREMALIGNANT CONDITIONS OF THE SKIN
- Bowen’s disease of skin: It is an intradermal precancerous condition. It presents as brownish induration with a well-defined edge. Microscopically it contains large clear cells. Eventually it will turn into carcinoma.
- Paget’s disease of nipple.
- Leukoplakia.
- Senile or solar keratosis: It is multiple, dry, hard, scaly, lesions in face and backs of hands due to exposure to sunlight, occurs after middle age. Squamous cell carcinoma occurs later.
- Radiodermatitis.
- Chronic scars develop into Marjolin’s ulcer.
- Xeroderma pigmentosa wherein there is defective DNA excision repair mechanism. It turns into malignant melanoma.
- Chronic lupus vulgaris.
- Prolonged irritation of skin by various chemicals like dyes, tar, soot, etc.
- It is arising from squamous layer of the skin.

**Clinical Features**
- An ulcerative or ulceroproliferative lesion.
- **Raised** and **everted edge**.
- Indurated.
- Bloody discharge from the lesion.
- Regional lymph nodes are commonly involved with hard, nodular features, initially mobile but eventually fixed to underlying structures.
- Usually no blood spread.

**Fig. 2.44:** Squamous cell carcinoma in foot. Note the cauliflower like lesion.

**Varicents**
- **Marjolin’s ulcer** which occurs in chronic scar is a type of squamous cell carcinoma without lymph node spread.
- Verrucous carcinoma is a squamous cell carcinoma, commonly occurring in mucus membrane or mucocutaneous junction without lymph node spread. It is dry exophytic warty indurated growth. It has got good prognosis. It is curable malignancy.

**Histology**
Malignant whorls of squamous cells with epithelial or keratin pearls are characteristic.

**Broder’s Classification**
I. Well differentiated. > 75% keratin pearls.
II. Moderately differentiated: 50-75% keratin pearls.
III. Poorly differentiated: 25-50% keratin pearls.
IV. Dedifferentiated: <25%. keratin pearls.

**Differential Diagnosis**
BCC, melanoma, keratoacanthoma, skin adnexal tumours.

**Investigations**
Edge biopsy, FNAC from lymph node.

**Treatment**
- Radiotherapy using radiation needles, moulds, etc.
- Wide excision.
- Amputation with one joint above.
- For lymph nodes, block dissection of the regional lymph nodes is done.
- Advanced cases with fixed lymph nodes, palliative external radiotherapy is given to palliate pain, fungation and bleeding.
- Chemotherapy is given using methotrexate, vincristine, bleomycin. *(Unstable scar of long duration).*

**Marjolin’s Ulcer**
It is a well differentiated squamous cell carcinoma which occurs in chronic scars like burn scar, scar of venous ulcer (unstable scar of long duration).
- Because it develops in a scar due to chronic irritation and there are no lymphatics in scar tissue, it will not spread to lymph nodes.
Because scar is relatively avascular it grows slowly. As scar does not contain nerves it is painless.

- Once it reaches the normal skin it may behave like any other squamous cell carcinoma, i.e. it will spread to lymph nodes.
- History of pre-existing venous ulcer or burn.
- Indurated, painless, nontender, ulcer with raised and everted edge.
- Biopsy from the edge confirms the diagnosis.
- Treatment:
  - Wide excision.
  - If large ulcer, amputation is required.
  - Radiotherapy should not be given as it may turn into poorly differentiated squamous cell carcinoma.

- It is curable malignancy.

**Basal Cell Carcinoma (Rodent Ulcer)**

- It is low grade, locally invasive, carcinoma arising from basal layer of skin or mucocutaneous junction. It does not arise from mucosa.
- It is common in white skinned people than blacks.
- Common in places where exposure to UV light is more (Australia).
- It is common in males, common in middle aged and elderly.
- Common site is face – above the line drawn between angle of mouth and ear lobule.
- It is called as tear cancer because it is commonly seen in area where tears roll down.
- Often can occur in mucocutaneous junctions.

- It is only locally malignant. It does not spread through lymphatics nor through the blood. But it erodes deeply into local tissues including cartilages, bones causing extensive local destruction. Hence, the name ‘rodent ulcer’.

**Types**

- Nodular.
- Cystic.
- Ulcerative.
• Multiple, often associated with syndromes and other malignancies.
• Pigmented BCC — mimics melanoma.
• Geographical or field fire or forest fire BCC is wide area involvement with central scabbing and peripheral active proliferating edge.
• Basisquamous BCC— behaves like squamous cell carcinoma with spread into lymph nodes. BCC which has not been treated for long-time can turn into basisquamous carcinoma.

**Microscopic Types**
• Superficial type.
• Morphia type.
  It contains malignant cells arranged as outer palisading columnar cells with central polyhedral cells without prickle cells or keratinisation.

**Clinical Features**
• Ulcer on the face in a middle aged man which is nontender, dry slowly growing, nonmobile, with raised and beaded edge with central scab.
• Site of beading signifies the area of active proliferating cells. In between beaded areas dormant nonactive cells are present.
• No lymph node or blood spread.

**Differential Diagnosis**
1. Squamous cell carcinoma.
2. Melanoma.

**Investigations**
Edge biopsy, X-ray of the part.

### Treatment
- It is **radiosensitive**. If lesion is away from vital structure (like away from eyes), then curative radiotherapy can be given. Radiotherapy is not given once it erodes to cartilage or bone.
- **Surgery:** Wide excision (2 cm clearance) with skin grafting or flap is the procedure of choice.
- Laser surgery, cryosurgery, **MOHS** (Microscopically Oriented Histographic Surgery).

**Indications for Surgery**
- Rodent ulcer eroding into cartilage or bone.
- BCC close to the eye.
- Recurrent BCC.

**NAEVI**
- It is a hamartoma of melanocytes due to excessive stimulation.
- It may present during birth or appear later in life.

**Types**
- Hairy mole is a mole with a hair growing on its surface.
- Nonhairy mole.
- **Blue naevus:** It is seen in children. It is located deep in the dermis, hence appears blue. It is common in buttock (**Mongolian spot**), hand, feet.
- **Junctional naevus:** It is located centered in the junctional layer (basal layer) of the epidermis as clusters. It is immature, unstable and premalignant. Microscopically, there is proliferation of melanocytes at the epidermal junction. Features of malignant transformation are change in the size, colour, bleeding, ulceration, crusting, and satellite spots.

### TNM staging of skin cancer other than melanoma

<table>
<thead>
<tr>
<th>Tumour</th>
<th>Node</th>
<th>Metastasis</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0—No tumour found</td>
<td>N0—No nodes</td>
<td>M0—No distant spread</td>
</tr>
<tr>
<td>Tis Tumour in situ</td>
<td>N1—Regional nodes ++</td>
<td>M1—Distant spread ++</td>
</tr>
<tr>
<td>T1 Tumour &lt; 2 cm</td>
<td></td>
<td></td>
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<tr>
<td>T2 Tumour 2-5 cm</td>
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<td></td>
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<tr>
<td>T3 Tumour &gt; 5 cm</td>
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<tr>
<td>T4 Spread to cartilage, muscle or bone.</td>
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</tbody>
</table>
Compound naevus: It is combination of intradermal and junctional naevus. Intra-
dermal part is inactive but junctional part is potentially malignant.

Juvenile melanoma: It is appearance of junctional like mole before puberty. It is seen in children in face.

Hutchinson’s freckle: It is seen in elderly with large area of dark pigmentation. In the macular stage it is smooth and brown. In the tumour stage it is dark and irregular. It can turn into melanoma commonly.

Treatment

Excision: Always specimen should be sent for histopathology

Melanoma

- Melanoma is most aggressive cancer of the skin. It also can occur in mucosa, mucocutaneous junction. It arises from the melanocytes.
- It often occurs denovo in skin or in a pre-existing naevus- commonly junctional type.
- Recent increase in size, bleeding, itching, ulceration, increased colour, halo around the naevus are the features of malignant transformation.
- Clark’s staging; Breslow’s grading are the classifications used.

Clark’s levels

- Level 1: Only confined to epidermis.
- Level 2: Extension into papillary dermis.
- Level 3: Filling of papillary dermis completely.
- Level 4: Extension into reticular dermis.
- Level 5: Extension into subcutaneous tissue.

Breslow’s Classification

Based on thickness of invasion measured by optical micrometer.

- I: Less than 0.75 mm.
- II: Between 0.76 and 1.5 mm.
- III: 1.51 to 4 mm.
- IV: more than 4 mm.

Superficial spreading type is the commonest type. It spreads through lymphatics as well as blood. It can spread to brain, lungs, and liver. It causes massive enlargement of liver.

Incision biopsy is contraindicated in melanoma. Excision biopsy, sentinel node biopsy, CT scan brain, chest are the investigations.

Treatment is wide excision/amputation/radical block dissection of regional nodes/isolated limb perfusion/chemotherapy/immuno-therapy. It has got poor prognosis.

Please refer chapter Surgical Pathology for detail.

EXAMINATION OF ORAL CAVITY

1. History

- Swelling—in detail.
- Ulcer—detail.
• Pain.
• Type of pain, radiation to ear (through lingual and auriculotemporal nerves) or other places, severity.
• Fever.
• Excessive salivation is common in carcinomas.
• Difficulty in speech.
• Voice change—in carcinoma larynx.
• Halitosis—foul smelling breath.

2. Personal history
Smoking history, chewing pan and keeping pan/quid in the cheek, alcohol intake, spicy diet, trauma by teeth.

3. Examination
i. Inspection
• Site of lesion/type/extent/edge/margin/floor/mouth opening (trismus) is adequate or not/gums/dentition/floor of mouth/tongue/palate/tonsils/lips/leukoplakia present or not.
• Skin over the cheek also should be inspected for swelling/oedema/ulceration/discholoration.
• Tongue depressor is needed for proper inspection of the oral cavity.

ii. Palpation
• Lesion is palpated after wearing a glove for tenderness/extent/induration/mobility/fixity/bleeding on touch/palpation of different parts of the oral cavity.
• Bone thickening is checked using two fingers—thickening/tenderness/irregularity/evidence of fracture site (pathological).
• All parts of the oral cavity should be palpated properly.

4. Neck is examined for significant lymph nodes of different groups and levels. Submandibular nodes are checked with neck flexed and tilted towards same side. It should be differentiated from submandibular salivary gland by bidigital palpation. Lymph gland is not bidigitally palpable whereas salivary gland is bidigitally palpable.

5. Relevant systemic examinations should be done.

Figs 2.51A to C: Carcinoma cheek stage IV disease and carcinoma angle of mouth lip and extending into cheek—inspection from outside is important. Inspection also should be done properly inside the oral cavity also.
Figs 2.52A to E: Neck nodes should be examined in carcinoma oral cavity. Same side and opposite side submandibular and upper deep cervical lymph nodes should be examined.

Figs 2.53A and B: Trismus should be assessed by passing fingers sidewise through the teeth into the mouth.

Fig. 2.54: Oral cavity should be examined and palpated in oral cavity cancers.
Figs 2.55A and B: Bone should be palpated bidigitally as well as from outside in oral malignancies – tenderness, pathological fracture, bone thickening should be looked for.

Fig. 2.56: Bidigital palpation for submandibular salivary glands and palpation of all parts of the oral cavity is important – vestibule, lip, floor of the mouth, tongue, cheek, tonsils, palate, etc.

Figs 2.57A and B: Proper palpation for induration, tenderness, bleeding on touch should be done.

Fig. 2.57: Oral cavity is examined using tongue depressor to see posterior third of the tongue, tonsils, etc.
Leucoplakia
It is a white patch in the mucosa of the oral cavity that cannot be characterized clinically or pathologically to any other disease. It is a premalignant condition.

**Types**
1. Homogenous.
2. Nodular—more potentially malignant.
3. Speckled—more potentially malignant.

Fig. 2.59: leucoplakia cheek.

Clinically the lesion appears as white or greyish coloured, well localised patch in the cheek, tongue, palate or other areas of the oral cavity.

**Common Causes**
- Smoking.
- Spirit.
- Sepsis.
- Superficial glossitis.
- Syphilis.
- Spices.
- Sharp tooth.
- Susceptibility.
- Pan chewing using areca, tobacco, slaked lime.
- Chronic hypertrophic candidiasis (long standing Candida infection.).

Incidence of leucoplakia in those who smoke or chew pan is 20%, whereas incidence in non-smokers is 1%.

**Incidence** of it turning into malignancy is 2-4%. It increases with age, duration of the pan chewing, smoking.

**Histology:** Parakeratosis with widening of rete pegs.

**Histological Staging**
- Acanthosis.
- Parakeratosis.
- Widening of rete pegs.
- Dyskeratosis.
- Dysplasia.
- Carcinoma in situ.
  Biopsy confirms the diagnosis as well as rules out the carcinoma.

**Treatment**
- Pan chewing and smoking has to be stopped.
- Excision, if required skin grafting has to be done.
- Regular follow-up is necessary.

Erythroplakia
- It is red velvety appearance of the mucosa which cannot be characterised as any recognized condition.
- It is 17-20 times more potentially malignant than leucoplakia.
- Histologically parakeratosis with severe epithelial dysplasia is the typical feature.
- Diagnosis is by taking biopsy.
- **Treatment:** Biopsy and surgical excision.

Oral Submucosal Fibrosis
- It is a progressive fibrosis deep to the mucosa of the oral cavity which causes trismus and ankyloglossia.
- The mucosa of cheek, gingivae, palate and tongue shows a mottled/marbled pallor.
- It is common in Asians and Indians.
- **Etiology:** Hypersensitivity to chilli, betel nut, tobacco and vitamin deficiencies probably alter the collagen metabolism leading to
juxtaepithelial fibrosis, epithelial atrophy and dysplasia.

- 30-33% of oral submucosal fibrosis can turn into malignancy.
- **Treatment:** Precipitating factors has to be avoided.
- Surgical excision when required followed by skin grafting has to be done.

### Retromolar Trigone
Retromolar trigone is the anterior surface of the ascending ramus of the mandible. It is triangular in shape with the base being superior and apex inferiorly behind the third molar tooth.

<table>
<thead>
<tr>
<th>Premalignant conditions of oral cavity</th>
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</thead>
<tbody>
<tr>
<td>Leucoplakia</td>
</tr>
<tr>
<td>Erythroplakia</td>
</tr>
<tr>
<td>Chronic hyperplastic candidiasis</td>
</tr>
<tr>
<td>Oral submucosal fibrosis</td>
</tr>
<tr>
<td>Syphilitic glossitis</td>
</tr>
<tr>
<td>Sideropenic dysphagia</td>
</tr>
<tr>
<td>Oral lichen planus</td>
</tr>
<tr>
<td>Discoid lupus erythematosus</td>
</tr>
<tr>
<td>Dyskeratosis congenita</td>
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</tbody>
</table>

### Carcinoma Cheek
- Squamous cell carcinoma is the most common carcinoma of the cheek.
- Occasionally it can be adenocarcinoma arising from the minor salivary glands or mucus glands. Rarely it can also be melanoma.

#### Precipitating Factors
All ‘S’—Smoking, Spirit, Syphilis, Sharp tooth, Sepsis.

#### Premalignant Conditions
- Leucoplakia.
- Erythroplakia.
- Oral submucosal fibrosis.
- Hyperplastic candidiasis.

Betel nut chewing (Pan, with pan quid kept in cheek pouch for a long time) is an important causative factor of carcinoma cheek.

#### Types:
1. Ulcerative
2. Proliferative (exophytic)
3. Verrucous

#### Verrucous Carcinoma
- It occurs as a superficial proliferative exophytic lesion with minimal deep invasion.
- Lesion has got white, dry, velvety or warty, keratinised surface.
- It is of low grade, very well-differentiated squamous cell carcinoma, which is locally malignant without any lymphatic spread.
- It is a curable malignancy.
- After biopsy treatment is wide excision. Radiotherapy is not given as it may lead to anaplastic transformation.

#### Biological Behaviour of Carcinoma Cheek
- Carcinoma cheek is common in posterior half of cheek than anterior.
- It spreads into the deeper plane to involve buccinator, pterygoids; into the retromolar trigone, base of the skull, pharynx.
- It spreads outwards to involve the skin causing fungation, ulceration, orocutaneous fistula formation.
- Mandible is commonly involved either by direct extension or through subperiosteal...
lymphatic plexus which communicates freely with oral lymphatics.

- Lymph nodes commonly involved are submental, submandibular, deep cervical and often lateral pharyngeal groups.
- Infection of the tumour area and soft tissues around is common, causing fever, foul smelling ulcer, halitosis.
- Respiratory infection is common in these patients.
- Once tumour extends into the retromolar region, soft palate, pharynx, dysphagia will occur.

**Clinical Features**

1. **Ulcer** in the cheek which gradually increases in size in a patient with H/O chewing pan, smoking.
2. **Pain** occurs when it involves the skin, bone or if secondarily infected. Referred pain into the ear signifies involvement of lingual nerve.
3. **Involvement of retromolar trigone** indicates that it is a advanced disease, as the lymphatics here communicate freely with the pharyngeal lymphatics.
4. **Everted edge, induration** are the typical features of the ulcer.
5. Mandible is examined bidigitally, for thickening, tenderness, and sites of fracture.
6. **Trismus and dysphagia** signifies involvement of pterygoids, or posterior extension.
7. Occasionally it may extend into the upper alveolus and to the maxilla causing swelling, pain and tenderness.
8. Submandibular lymph nodes and upper deep cervical lymph nodes are involved which are hard, nodular, and initially mobile and later get fixed to each other and then to deeper structure.

- Once lymph nodes get fixed it may infiltrate into hypoglossal nerve (tongue will deviate towards the same side), spinal accessory nerve (defective shrugging of shoulder) and cervical sympathetic chain (*Horner’s syndrome*).

- **Eventually it causes fungation and bleeding from major vessels**—**carotid blow out**.

**Staging**

TNM Staging.

- **T1** - Tumour size < 2cm.
- **T2** - Tumour size 2-4 cm.
- **T3** - Tumour > 4 cm.
- **T4** - Tumour is of any size involving bone, soft tissues, muscles.

- **N1** - Lymph node size < 3 cm.
- **N2** - Lymph node size 3-6 cm or bilateral lymph nodes.
- **N3** - Lymph node size > 6 cm.

**Features of Advanced Carcinoma Cheek**

1. Involvement of retromolar trigone.
2. Extension into the base of skull and pharynx.
3. Fixed neck lymph nodes.
4. Extension to the opposite side.

**Investigations**

- **Edge biopsy** usually taken from two sites. Biopsy has to be taken from the edge as it contains active cells; not from the centre as it is the area of necrosis.

  - Malignant squamous cells with epithelial pearls (Keratin pearls) are the histological features.

  **Broder’s histological grading**:

  1. Well-differentiated—> 75% epithelial pearls,
  2. Moderately differentiated—50-75% epithelial pearls.

- **FNAC from lymph nodes**. (No biopsy from lymph nodes).

- **CT scan**—to assess the extension of tumour and its secondaries.

- **Orthopantomogram to look for the involvement of mandible**—destruction and fracture sites.

**Treatment**

Treatment may be curative or palliative.
Treatment Strategy

- Surgery—Wide excision, hemimandibulectomy, neck lymph node block dissection.
- Radiotherapy—Curative or palliative; external or brachytherapy.
- Chemotherapy—Intra-arterial, IV or orally.
- Early growth without bone involvement:
  1. Curative radiotherapy using $^{137}$Caesium needles or $^{192}$Iridium wires, i.e. Brachytherapy.
     Advantages are that surgery is avoided; no surgical mutilation and parts are retained—as it is squamous cell carcinoma, primary is radiosensitive.
  2. Other option is wide excision with 3 cm clearance. Often, the approach to the tumour is by raising the cheek flap (outside). After the wide excision, the flap is placed back. (Patterson operation).
  3. Presently advanced technology in radiotherapy, facilitates the use of external radiotherapy also. The incidence of dreaded complication like osteoradionecrosis of mandible has reduced due to better RT methods.
- Growth with mandible involvement: Here along with wide excision of the primary tumour, hemimandibulectomy or segmental resection of the mandible or marginal mandibulectomy (using rotary electric saw) is done.
- Operable growth with mandible involvement and mobile lymph nodes on same side: (confirmed by FNAC): Along with wide excision of the primary, hemimandibulectomy and radical neck lymph node dissection is done. (Commondo like operation).
- Operable growth with mandible involvement; mobile lymph nodes on same side and opposite side: Along with wide excision of the tumour, hemimandibulectomy, radical neck lymph node dissection on same side and functional block dissection on opposite side are done, retaining the internal jugular vein, sternomastoid, spinal accessory nerve.
- Operable primary tumour with mobile lymph nodes on same side but without mandibular involvement: Wide excision of primary tumour and radical neck lymph node dissection on same side are done. Mandible is not removed.
- Fixed primary tumour or advanced neck lymph node secondaries: Only palliative external radiotherapy is given to palliate (pain, fungation and to prevent anticipated torrential haemorrhage).
- Preoperative radiotherapy is often used in fixed lymph nodes to downstage the disease so as to make it operable.
- Postoperative radiotherapy is given in $T_3$ and $T_4$ tumours; $N_2$ and $N_3$ nodal status to reduce the recurrence and to improve the prognosis.
- Prophylactic block dissection has become popular.
- Reasons are even though clinically, lymph nodes are negative there may be microscopic involvement of lymph nodes (25-65%). Clinically detectable disease in lymph nodes of the patient signifies extracapsular spread which has got poor prognosis. Recurrence rate is less after prophylactic block compared to block dissection with clinically positive nodes because there is no extracapsular spread in the former even if there is microscopic spread of tumour in many cases. Block dissection is an acceptable surgery as there is negligible mortality and less morbidity.
- If growth is extending to upper alveolus: Partial maxillectomy or total maxillectomy may be required.
- Role of chemotherapy
  - Drugs used are Methotrexate, Vincristine, Bleomycin, and Adriamycin.
  - Often it is given intra-arterially through external carotid artery using arterial pump or by increasing the height of the drip more than 13 ft. so as to attain a pressure more than systolic pressure. Chemotherapy can also be given IV or orally.

Reconstruction after Surgery

- Split skin graft.
- Deltopectoral cutaneous flap.
• Forehead flap.
• Pectoralis major myocutaneous flap.
• Mandible reconstruction by cortical bone graft or rib, fibula or synthetic material.

Problems with Surgery
• (Surgical) Mutilation.
• Anaesthesia complications.
• Requirement for reconstruction.
• Mortality.
• Morbidity.

Problems with Radiotherapy
• When mandible is irradiated, chances of the dreaded problem of osteoradionecrosis are high which requires the removal of mandible.
• Loss of taste and dryness.
• Infection.
• Skin excoriation.
• Trismus may get aggravated.
• Can itself cause dysphagia, laryngeal oedema.

Problems with Chemotherapy
• Bone marrow suppression.
• Megaloblastic anaemia.
• GIT symptoms.
• Hepatotoxicity and renal toxicity.
• Alopecia.

Neoplasm of Lip
Minor salivary gland tumours are common in upper lip. They are usually pleomorphic adenomas.

Carcinoma Lip
• It is common in men. Common in lower lip (90%); upper lip 5%.
• Commonly due to exposure to sunlight (ultraviolet rays).
• Initially starts as a red, granular dry lesion which eventually gets ulcerated and forms an ulcero-proliferative lesion. Occasionally it occurs at the angle of mouth.
• Causes: U\V rays, smoking.
• It spreads to submental nodes and later to other neck nodes on both sides.

Fig. 2.61: Carcinoma lower lip

• Usually it is a well-differentiated squamous cell carcinoma.
• Differential diagnosis
  Keratoacanthoma
  Basal cell carcinoma
  Minor salivary gland tumours.
  Often carcinoma of lip is an extension from carcinoma of cheek.
• Diagnosis: Edge biopsy, FNAC of lymph nodes.
• Treatment:
  • If lesion is less than 2 cm, then curative radiotherapy, either brachytherapy or external beam radiotherapy. It gives a good cure.
    If tumour is more than 2 cms, wide excision is done. Excision of lower lip up to one third can be sutured primarily in layers keeping vermilion border in proper apposition without causing any microstomia.
  • Excision of more than one third of the lip requires reconstruction using different flaps.

Methods
1. Estlander’s rotating flap from the upper lip based on upper labial artery.
2. Fries’ modified Bernard facial flap-reconstruction using lateral facial flaps.
Lymph nodes are dealt with by radical neck dissection on one side and functional block or suprahyoid block dissection on other side.

Postoperative radiotherapy is given if tumour is large or if lymph nodes are involved.

- **Prognosis:** Good. 5 year survival is 70%.

### Differential diagnosis for tongue ulcers.
- Dental ulcers
- Aphthous ulcers
- Ulcers in lichen planus
- Sphilitic ulcers
- Tuberculous ulcers
- Malignant ulcers

### Benign Tumours of the Tongue
1. Papilloma.
2. Fibroepithelial polyp.
3. Haemangioma and lymphangioma.
5. Lipoma.
6. Granular cell myoblastoma.

### CARCINOMA TONGUE

Incidence is equal in both sexes. Presently its incidence is increasing in females due to increase in number of female smokers.

- **Aetiology**
  - Leucoplakia.
  - Erythroplakia.
  - All’s.
  - Premalignant conditions mentioned earlier.

### Types

- **Gross**
  1. Papillary.
  2. Ulcerative or ulceroproliferative.
  3. Fissure with induration.
  4. Lobulated, indurated mass.

- **Histologically**
  - Squamous cell carcinoma—commonest.
  - Adenocarcinoma may be from minor salivary glands or mucus glands.
  - Melanomas.

### Sites
1. Lateral margin—Commonest—47-50%.
2. Posterior third—20%.
3. Dorsum—6.5%.
4. Ventral surface—9%.

Figs 2.62A and B: Carcinoma tongue is more common in lateral aspect of the tongue.

### Clinical Features
- **Pain** in the tongue due to infection or ulceration or due to the involvement of lingual nerve (pain is referred to ear). Pain on swallowing, in case of carcinoma of posterior third of tongue.
- Excessive salivation.
- **Dysphagia** either due to fixed tongue or due to the involvement of genioglossus or growth in the posterior third of the tongue.

- **Visible ulcer** in anterior two thirds of tongue. Growth or ulcer in posterior third, is usually not visible

- **Ankyloglossia**.

- Inability to articulate.

- **Foetor** (Halitosis). Due to infection and necrosis in the oral cavity.

- **Change in voice**: Occurs in posterior third tumours. Tumour in posterior third area is more aggressive.

- Palpable **lymph nodes** in the neck which are hard, nodular and may get fixed in advanced stages.

- Features of bronchopneumonia.

### Spread of Carcinoma Tongue

- **Local spread**: In case of anterior two thirds of tongue, the spread occurs to genioglossus muscle, floor of the mouth, opposite side and mandible. In case of posterior third of tongue it spread locally to tonsil, side of pharynx, soft palate, epiglottis, larynx and cervical spine.

- **Lymphatic spread**: From tip of tongue it spreads to submental nodes. From lateral margin it spreads to submandibular lymph nodes and later to deep cervical lymph nodes. Lymphatics in the tongue are freely communicating, and so involvement of bilateral neck lymph nodes is common. From posterior third it spreads to pharyngeal nodes and upper deep cervical lymph nodes.

### Investigations

1. Edge biopsy.
2. FNAC of lymph nodes.
3. Indirect and direct laryngoscopy to see posterior third growth.
4. CT scan to see the extension of posterior third growth, or to see the status of advanced secondaries.
5. Chest X-ray to see bronchopneumonia.

### Treatment

**Surgery**

- Early growth < 2 cm in size requires, **wide excision** and growth >2 cm in size requires **hemiglossectomy**.

- Larger primary tumour can be given preoperative radiotherapy, and then later hemiglossectomy is done.

- Same side palpable, mobile lymph nodes are removed by **radical neck block dissection**.

- Bilateral mobile lymph nodes are dealt with one side radical block and other side functional block dissection with essentially retaining internal jugular vein (on opposite side) to maintain the cerebral venous blood flow. Other option is same side radical neck dissection and on opposite side suprathyroid block dissection can be done.

- Wide excision when growth is in the tip.

- Posterior third growth can be approached by lip split and mandible resection, so as to have **total glossectomy**.

- When mandible is involved **hemimandibulectomy** is done.

- The procedure that involves wide excision or hemiglossectomy, hemimandibulectomy and radical neck dissection together is called as **Commando Operation**.

- Reconstruction of tongue and other area after surgery: By deltopectoral flap, forehead flap, pectoralis major muscle flap, skin grafting.

- Prophylactic block dissection is becoming popular at present.

### Postoperative management:

- Control of infection
- Oedema
- Regular mouth wash
- Maintaining the airway
- Prevention of aspiration.

### Radiotherapy

1. In small primary tumour—Curative radiotherapy (Brachytherapy using caesium or iridium needles).

2. Large primary tumour—Initial radiotherapy is given to reduce the tumour size so that the resection will be better later.
3. Advanced primary as well as secondaries in the neck can be controlled by palliative external radiotherapy.
4. Postoperative radiotherapy is given in large tumours to reduce the chances of relapse.
5. In case of growths in the posterior third of tongue, radiotherapy is of curative as well as palliative mode.

Complications of radiotherapy:
- Loss of sensation like taste.
- Trismus and ankyloglossia.
- Infection.
- Pharyngeal and laryngeal oedema.
- Dermatitis and skin infection.

Chemotherapy
- Given in postoperative period and also for palliation.
- Price-Hill regimen is commonly used. Drugs are Methotrexate, Vincristine, Adriamycin, Bleomycin and Mercaptopurine.
- It is given either intra-arterially, as regional chemotherapy through external carotid artery using arterial pump or through IV. It can also be given orally.
- Complications:
  - Megaloblastic anaemia,
  - Bone marrow suppression.
  - Alopecia.
  - Sepsis.
- For Melanoma, Melphalon and DTIC are used.

Terminal events:
- Inhalational bronchopneumonia.
- Haemorrhage from erosion of lingual artery. In posterior third of the tongue, erosion of internal carotid artery can occur.
- Cancer cachexia.
- Asphyxia due to pressure on air passages or due to edema glottis.

Prognosis
- 5 years survival for females is 50%, for males is 25%.

Prognostic Factors
- Size of the tumour.
- Site of tumour (Posterior third has got poor prognosis).
- Tumour crossing the midline.
- Lymph nodes status.
- Differentiation
- Bone involvement.

Nasopharyngeal Carcinoma
- Nasopharynx lies above the level of the soft palate which divides it from oropharynx below.
- It is also called as postnasal space or epipharynx. Eustachian tube opens on its antero-lateral wall. Fossa of Rosenmuller is located above and behind the opening of the Eustachian tube as a small depression.

Clinical Features
- Epistaxis, nasal speech, postnasal discharge and nasal obstruction.
- Pain in the ear with unilateral deafness due to compression of eustachian tube with fluid collection in the middle ear.
- Elevation and immobility of soft palate on the same side.
- Pain in the area of distribution of trigeminal nerve due to direct infiltration of the nerve at foramen lacerum.
5. Palpable secondaries in upper deep cervical lymph nodes (70%).

Trotter’s triad
- Unilateral deafness
- Immobile elevated soft palate
- Pain in the distribution of trigeminal nerve

Differential Diagnosis
- Lymphoma.
- Lympho-epithelioma.
- Minor salivary gland tumour.

Investigations
- Biopsy from the primary site.
- FNAC from the neck lymph nodes.
- X-ray of the skull to visualize erosions. CT scan skull.
Histological Type
Squamous cell carcinoma.

Treatment
• External irradiation for primary.
• Radical block dissection of cervical lymph nodes.
• Chemotherapy: Methotrexate, Vincristine.

Ranula
(Rana = Frog, Ranula looks like belly of frog, hence the name.)
• Ranula is an extravasation cyst arising from sublingual gland or mucus glands of Nuhn or glands of Blandin in the floor of the mouth.

Clinical Features
• As a bluish smooth, soft, fluctuant, brilliantly transilluminant swelling in the lateral aspect of the floor of the mouth.
• It often extends into the submandibular region through the deeper part of the posterior margin of mylohyoid muscle and is called as plunging ranula.

Clinical features of ranula
- Bluish swelling in the floor of the mouth
- Laterally placed and nontender
- Fluctuant and cross fluctuant
- Brilliantly transilluminant

• Ranula has a delicate fibrous capsule and is lined by a layer of macrophages.
• It contains clear fluid.

Treatment
• Marsupilisation can be done initially and later once the wall of the ranula is thickened it is excised.
• If ranula is small it can be excised.

Differential Diagnosis
• Lymph cyst
• Sublingual dermoid.

Sublingual Dermoids
They are sequestration dermoids lined by squamous epithelium containing keratin.

Types
1. Median sublingual dermoid: It is derived from epithelial cell rests at the level of fusion of two mandibular arches. It is located between two genial muscles, above the level of mylohyoid muscle. It is a midline swelling which is smooth, soft, cystic, nontender, nontransilluminant.
   Treatment is excision through per oral approach. Complication is abscess formation.
2. Lateral sublingual dermoid: It develops in relation to submandibular duct, lingual nerve and stylohyoid ligament. It is derived from first branchial arch. It forms a swelling in the lateral aspect of the floor of the mouth.
   Treatment: Small one is removed per orally. Larger one is excised through submandibular incision.
Jaw Tumours

Classification

Swelling arising from the gums (Epulis):
- Congenital epulis.
- Fibrous epulis.
- Pregnancy epulis.
- Giant cell epulis.
- Myelomatous epulis.
- Sarcomatous epulis.

Swelling arising from the dental epithelium (Odontomes):
- Ameloblastoma.
- Compound odontoma.
- Enameloma.
- Cementoma.
- Dentinoma.
- Odontogenic fibroma and myxoma.

Cysts arising in relation to dental epithelium:
- Dental cyst.
- Dentigerous cyst.

Swelling arising from the mandible or maxilla:
- Osteoma and osteoblastoma.
- Torus palatinus and mandibularis.
- Fibrous dysplasia.
- Osteoclastoma.
- Osteosarcoma.
- Secondaries.

Surface tumours:
Tumours from the surface which extend into the jaw.

Epulis
Swelling arising from the gums.

**Congenital Epulis**
- It is a benign condition seen in a newborn arising from gum pads.
- It is a variant of granular cell myoblastoma originating from gums.
- It is more common in girls. It is more common in upper jaw.
- It is not a malignant condition.

**Clinical features:**
Well localized swelling from the gum which is firm and bleeds on touch.

**Treatment:**
Excision.

**Fibrous Epulis**
- It is a benign condition, can occur in any individual with caries tooth.
- It is seen in the gum, adjacent to the caries tooth.

**Clinical features:**
- Painful, well-localized, hard, tender swelling in the gum which bleeds on touch.
- Caries tooth adjacent to the lesion.

**Differential diagnosis:**
Squamous cell carcinoma from the gum.

**Investigations:**
- X-ray jaw.
- Orthopantomogram.
- Biopsy from the lesion.
Treatment:
Excision with extraction of the adjacent tooth.

Pregnancy Epulis
- It occurs in pregnant women due to inflammatory gingivitis usually during 3rd month of pregnancy.
- Clinically it resembles fibrous epulis or pyogenic granuloma.
- It usually resolves after delivery. Otherwise it should be excised.

Myelomatous Epulis
- It is seen in leukaemic patients.
Investigated for leukaemia by peripheral smear, bone marrow, biopsy.
Treatment: For leukaemia.

Ameloblastoma (Adamantinoma, Eve’s Disease, Multilocular Cystic Disease of the Jaw)
- It arises from the dental epithelium probably from the enamel.
- It occurs commonly in mandible or maxilla.
- Occasionally it is seen in the base of the skull in relation to Rathke’s pouch or in tibia.
- Histologically it is a variant of basal cell carcinoma.
- It is a locally malignant tumour.
- It neither spreads through lymph node nor through blood. Hence it is curable.
- It is usually unilateral.
- It can occur in a pre-existing dentigerous cyst.

Clinical Features
- Swelling in the jaw usually in the mandible near the angle which attains a large size.
- It is gradually progressive, painless, smooth and hard with intact inner table.
- Lymph nodes are not enlarged.

Differential Diagnosis
- Osteoclastoma of the mandible: Here inner table is not intact.
- Dentigerous cyst.
- Dental abscess.

Investigations
- Orthopantomogram (OPG) shows multiloculated lesion.
- Biopsy from the swelling.

Treatment
- Segmental resection of the mandible. OR
- Hemimandibulectomy with reconstruction of the mandible.
- Curettage and bone grafting should not be done.
  It is a curable condition.
  Recurrent adamantinoma can spread through blood.

Dentigerous Cyst (Follicular Odontome)
- It is a unilocular cystic swelling arising in relation to the dental epithelium from an unerupted tooth.
- Common in lower jaw, but can also occur in upper jaw.
- It occurs over the crown of unerupted tooth. Commonly seen in relation to premolars or molars.
- It causes expansion of outer table of the mandible.

Fig. 2.66: Dentigerous cyst

Clinical Features
Painless swelling in the jaw which is smooth and hard.
**Differential Diagnosis**
- Adamantinoma.
- Dental cyst.
- Osteoclastoma.

**Complication**
It can turn into *adamantinoma*.

**Investigations**
Orthopantomogram.

**Fig. 2.67**: Orthopantomogram showing dentigerous cyst

**Treatment**
- If it is small, excision of the cyst is done.
- If it is large, initial marsupilisation and later excision is done.
- Unerupted tooth should be extracted.

**Dental Cyst (Radicular Cyst, Periapical Cyst)**
- It occurs under the root of the chronically infected dead erupted tooth.
- It is lined by squamous epithelium derived by epithelial debris of *Mallassez*.

**Clinical Features**
*As a smooth, tender swelling in the jaw in relation to caries tooth which causes expansion of the jaw bone.*

**Differences between dental cyst and dentigerous cyst**

<table>
<thead>
<tr>
<th></th>
<th>Dental cyst</th>
<th>Dentigerous cyst</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site of occurrence</td>
<td>Erupted tooth under the root.</td>
<td>Over the crown of an unerupted tooth.</td>
</tr>
<tr>
<td>Infection</td>
<td>Common</td>
<td>Not common</td>
</tr>
<tr>
<td>Complication</td>
<td>Osteomyelitis</td>
<td>Adamantinoma</td>
</tr>
<tr>
<td>Treatment</td>
<td>Excision and extraction of tooth</td>
<td>Marsupilisation, excision and then extraction of tooth</td>
</tr>
</tbody>
</table>

**Complication**
It can cause osteomyelitis of the jaw.

**Differential Diagnosis**
Dentigerous cyst.

**Investigation**
Orthopantomogram.

**Treatment**
- Antibiotics.
- Drainage or excision of the cyst with extraction of the infected tooth is done.

**Curable malignancies**
- Adamantinoma
- Basal cell carcinoma
- Verrucous carcinoma
- Papillary carcinoma thyroid
- Marjolin’s ulcer
- Carcinoma colon
EXAMINATION OF SALIVARY GLAND

1. History
   • Swelling-duration-progress.
   • Pain-duration/type/severity/radiation.
   • Fever.
   • Difficulty in opening mouth.
   • Excess salivation during meals/more pain during meals/swelling become more prominent during meals.
   • Recent increase in size.

2. Examination
   i. Inspection
      • Swelling in detail.
      • Deep lobe of parotid enlargement is checked by inspecting the oral cavity for any bulge in the tonsil and lateral wall of pharynx.
      • Stenson’s parotid duct should be inspected opposite 2nd upper molar.
      • Skin over the swelling should be inspected.

   ii. Palpation
      • Tenderness/temperature/extent/size/surface/consistency/mobility/fixity/plane of the swelling/masseter involvement/facial nerve involvement/skin over the swelling
      • Parotid duct palpation – by rolling the finger across the masseter muscle while patient is clinching the teeth to make masseter taut. Terminal part of the duct is palpated bidigitally using index finger inside and thumb outside.
      • Palpation of oral cavity/bidigital examination for deep lobe with one finger inside the mouth behind the tonsillar fossa and the other outside in parotid region.

   • All features of facial nerve palsy—inability to close eye/difficulty in blowing/altered nasolabial groove/clinching of teeth
   • Neck nodes should be examined
   • Examination of other salivary glands should be done
   • Relevant findings should be elicited in case of submandibular salivary gland enlargement

Features of parotid swelling
   • Ear lobule raise
   • Swelling in parotid region
   • Swelling occupying the groove between posterior part of the mandible and mastoid process
   • Moves upwards upto zygomatic bone—Curtain’s sign

Features of facial nerve palsy
   • Difficulty in chewing food as food accumulates in vestibule due to buccinator weakness
   • Deviation of angle of mouth while talking, laughing, blowing, whistling due to paralysis of orbicularis oris
   • Failure of closure of eyelids or easy opening of the eyelids after closure – paralysis of orbicularis oculi
   • Absence of furrows while looking upwards–paralysis of frontal belly of occipitofrontalis
   • Absence of corrugation in the forehead during frowning – paralysis of corrugator supercilii
   • Deviation of angle of mouth towards opposite side – paralysis of levator anguli oris
   • Loss of contraction of platysma in the neck while stretching the neck – paralysis of platysma
   • Inability to blow the air by the check and on palpation reduced tone of buccinator – paralysis of buccinator
   • Inability to whistle – paralysis of orbicularis oris

Proper diagnosis and investigations should be mentioned.

Salivary Neoplasms

Classification
   a. Epithelial:
      1. Adenomas
         - Pleomorphic adenoma.
         - Monomorphic adenomas.
         - Adenolymphoma (Warthin’s tumour).
         - Oxyphil adenomas.
Fig. 2.69: Deviation of angle of mouth towards opposite side while clenching the teeth—paralysis of levator anguli oris

Fig. 2.70: Loss of contraction of platysma in the neck while stretching the neck—paralysis of platysma

Fig. 2.71: Absence of corrugation in the forehead during frowning—paralysis of corrugator supercili

2. Carcinomas
   - Mucoepidermoid carcinoma — Commonest malignancy.
   - Acinic cell carcinoma.
   - Adenoid cystic carcinoma. — Very aggressive.
   - Adeno carcinoma.
   - Squamous cell carcinoma.
   - Carcinoma in ex. Pleomorphic adenoma.
   - Undifferentiated carcinoma.

b. Nonepithelial:
   • Haemangioma - commonly seen in infants, usually in parotids. Spontaneous regression is common.
   • Lymphangioma.
   • Neurofibromas and neurilemmomas.

c. Malignant lymphomas.
Figs 2.73A to C: Failure of closure of eyelids or easily opening of the eyelids after closure—paralysis of orbicularis oculi

Fig. 2.74: Inability to whistle—paralysis of orbicularis oris

Figs 2.75A and B: Checking the mobility and skin fixation of the parotid swelling
Figs 2.76A and B: Stenson's parotid duct should be examined opposite 2nd upper molar

Figs 2.77A and B: Palpation of neck nodes—submandibular and upper deep cervical

Incidence
- 75-80% salivary neoplasms are in the parotids of which 80% are benign.
- 80% of these are pleomorphic adenomas.
- 15% of salivary tumours are in the submandibular salivary gland. Of which 60% are benign.
- 95% of these are pleomorphic adenomas.
- 10% of salivary neoplasms are in the minor salivary glands—palate, lips, cheeks, and sublingual glands. Of these only 40% are benign.

Pleomorphic Adenomas (Mixed salivary tumour)
- Commonest of the salivary gland tumour.
- It is 80% common.
- More common in parotids.
- It is mesenchymal, myoepithelial and duct reserve cell origin.

Fig. 2.78: Facial nerve palsy
• **Grossly:** It contains cartilages, cystic spaces, solid tissues.

- **Histologically:** It shows
  - Epithelial cells.
  - Myoepithelial cells.
  - Mucoid material with myxomatous changes
  - Cartilages.

- Eventhough it is capsulated, tumour may come out as pseudopods and may extend beyond the main limit of the tumour tissue. When disease occurs in parotid, commonly it involves superficial lobe or superficial and deep lobe together. But sometimes only deep lobe is involved and then it presents as swelling in the lateral wall of the pharynx, soft palate and posterior pillar of the fauces.

- There may not be any visible swelling in the preauricular region.—*Dumb bell tumour.*

- This tumour is in relation to styloid process, mandible, stylohyoid, styloglossus, stylopharyngeus muscles.

**Clinical Features**
- 1:1 male to female ratio. 80% common
- Occurs in any age group. Usually unilateral.
- Present as a single painless, smooth, firm lobulated, mobile swelling in front of the parotid with *positive curtain sign* (As the deep fascia is attached above to the zygomatic bone, it acts as a curtain, not allowing the parotid swelling to move above that level. Any swelling superficial to the deep fascia will move above the zygomatic bone).
- The ear lobe is lifted.
- When deep lobe is involved, swelling is commonly located in the lateral wall of pharynx, posterior pillar and over the soft palate.
- Facial nerve is not involved.
- Long standing pleomorphic adenoma may turn into carcinoma (carcinoma in pleomorphic adenoma). Its features are—
  - Recent increase in size.
  - Pain and nodularity.
  - Involvement of skin.
  - Involvement of masseter.
  - Involvement facial nerve — Lower facial nerve palsy—(Difficulty in closing eyelid, difficulty in blowing and clenching teeth)
  - Involvement of neck lymph node.

**Investigations**
- FNAC is very important and diagnostic.
- CT scan to know the status of deep lobe.

**Treatment**
- Surgery—1st line treatment.
- If only superficial lobe is involved, then superficial parotidectomy is done wherein parotid superficial to facial nerve is removed.
• If both lobes are involved, then total conservative parotidectomy is done by retaining facial nerve.
• Enucleation is avoided as the recurrence is high.

Adenolymphoma (Warthin’s Tumour, Papillary cystadenolymphomatous)
• It is a benign tumour that occurs only in parotid, usually in the lower pole.
• Common in males. It is often bilateral.
• It is said to be due to trapping of jugular lymph sacs in parotid during developmental period.
• It composed of double layered of columnar epithelium, with papillary projections into cystic spaces with lymphoid tissues in the stroma.

Clinical Features
• It presents as a slow growing, smooth, soft, cystic, fluctuant swelling, in the lower pole, often bilateral, and is nontender.
• It is common in males. It is 10% common.

Investigations
• Adenolymphoma produces a ‘hot spot’ in 99Technetium pertechnetate scan—it is diagnostic.
• FNAC.
  Adenolymphoma does not turn malignant.

Treatment
Superficial parotidectomy.

Mucoepidermoid Tumour
• It is the commonest malignant salivary gland tumour (in major salivary glands)
• It is slowly progressive, often attains a large size, and spreads to neck lymph nodes.
• It contains malignant epidermoid and mucus secreting cells.

Types
• Low grade.
• High grade.

Facial nerve involvement is rare or very late in mucoepidermoid carcinoma of parotid.

Clinical Features
• Swelling in the salivary (parotid or submandibular) region, slowly increasing in size, eventually attaining a large size, which is hard, nodular, often with involvement of skin and lymph nodes.
• Facial nerve is usually not involved.

Adenoid Cystic Carcinoma
• It is common in minor salivary glands.
• It consists of myoepithelial cells and duct epithelial cells with cribriform or lace like appearance.
• It involves facial nerve very early, spreads through the perineural sheath and infiltrates into the perineural tissues and bone marrow over a long distance more proximally.
• It also invades periosteum and bone medulla early and spreads extensively.
• Prognosis is poor.

Acinic Cell Tumour
• It is a rare, slow growing tumour that occurs almost always in parotid and is composed of cells alike serous acini. It is more common in women. It occurs in adult and elderly.
• It can involve facial nerve or neck lymph nodes.
• Clinically it is of variable consistency with soft and cystic areas.

General Features of Malignant Salivary Tumours:
• Fixation
• Resorption of adjacent bone
• Pain and anaesthesia in the skin and mucosa
• Muscle paralysis
• Skin involvement and nodularity
• Involvement of jaw and masticatory muscle.
• Nerve involvement (facial nerve in parotid or hypoglossal nerve in submandibular salivary gland).
Submandibular salivary gland tumours:

- **Benign tumours** commonly pleomorphic adenomas are smooth, firm or hard, bidigitally palpable, without involving adjacent muscles or hypoglossal nerve or mandible bone.
  - Diagnosis is by FNAC, Orthopantomogram (OPG), and CT scan.
  - Excision of both superficial and deep lobes of the gland is done.

- **Malignant tumours** of submandibular salivary gland:
  - They are hard, nodular, often fixed to skin, muscles, hypoglossal nerve, and mandible.
  - Diagnosis is by FNAC of primary tumour and of lymph nodes when involved, CT scan and OPG.
  - **Treatment**: Wide excision, with removal of adjacent muscle, soft tissues, and mandible.
  - If lymph nodes are involved, block dissection of neck (Classical neck dissection) is done.

### TNM staging of malignant salivary tumours

<table>
<thead>
<tr>
<th>T</th>
<th>N</th>
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<tbody>
<tr>
<td>T — Tumour</td>
<td>N — Lymph node</td>
</tr>
<tr>
<td>TX — Tumour cannot be assessed</td>
<td>Nx — Nodes not assessed</td>
</tr>
<tr>
<td>T0 — No evidence of primary tumour</td>
<td>N0 — Regional nodes not involved</td>
</tr>
<tr>
<td>T1 — Tumour &lt;2 cm without extraparenchymal spread</td>
<td>N1 — Single ipsilateral node &lt;3 cm</td>
</tr>
<tr>
<td>T2 — Tumour 2-4 cm</td>
<td>N2a — Single ipsilateral node 3-6 cm</td>
</tr>
<tr>
<td>T3 — Tumour 4-6 cm</td>
<td>N2b — Multiple ipsilateral nodes &lt; 6 cm</td>
</tr>
<tr>
<td>— or with extraparenchymal spread</td>
<td>N2c — Bilateral or contralateral nodes &lt; 6 cm</td>
</tr>
<tr>
<td>— but no facial nerve spread</td>
<td></td>
</tr>
<tr>
<td>T4 — Tumour &gt;6 cm</td>
<td>N3 — Single node spread &gt;6 cm</td>
</tr>
<tr>
<td>— or facial nerve spread</td>
<td>M — Metastases</td>
</tr>
<tr>
<td>— or base of skull spread</td>
<td>M0 — No blood spread</td>
</tr>
<tr>
<td></td>
<td>M1 — Blood spread present.</td>
</tr>
</tbody>
</table>

**Specific Investigations**

- FNAC.
- CT scan to see the deep lobe of the parotid; to look for the involvement of bone, extension into the base of the skull; relation of tumour to internal carotid artery, styloid process etc.
- OPG
- Blood grouping and cross matching; required amount of blood is keep ready.
- FNAC of lymph node.
- MRI shows better soft tissue definition than CT scan.

Sialogram is not useful in assessment of tumour.

### Treatment

**In parotid:**

- **Surgery**: Radical parotidectomy is done which includes removal of both lobes of parotid,
soft tissues, part of the mandible with facial nerve.
- Facial nerve is reconstructed using greater auricular nerve, or sural nerve.
- Often lateral tarsorrhaphy or temporal sling reconstruction is done.

Complications of surgery:
1. Haemorrhage.
2. Infection.
3. Fistula.
5. Facial nerve palsy.
- Postoperative radiotherapy is quiet useful to reduce the chances of relapse. Usually external radiotherapy is given. It is given in all carcinomas, but more useful in adenoid cystic and squamous cell carcinomas.
- Chemotherapy is also given. Drugs given here depend on tumour type. Intrarterial chemotherapy is beneficial.
- Preoperative radiotherapy is given in large tumours to reduce the size and make it better operable. i.e. to down stage the disease.
- If lymph nodes are involved, which is confirmed by FNAC, radical neck dissection is done.

Indications for radiotherapy in malignant salivary gland tumours
- All adenoid cystic and adenocarcinomas.
- T3 and T4 tumours
- Recurrent tumours
- Poorly differentiate tumours
- Tumours with lymph node involvement
- As preoperative radiotherapy
- Recurrent benign pleomorphic adenomas
- Spillage during surgery in case of pleomorphic adenomas.

Minor Salivary Gland Tumours
- It is 10% of salivary tumours.
- It is common in - palate (40%), - lip - cheek - sublingual glands.
- palate is the commonest site.
- 10% are benign—commonly pleomorphic adenomas.
- 90% are malignant—Commonly adenoid cystic carcinomas.
- They present as swelling with ulcer over the summit.
- If it is malignant, then extension into the palate, maxilla, pterygoids can occur often with involvement of lymph node.

Differential Diagnosis
Squamous cell carcinoma of oral cavity.

Investigations
1. Incision biopsy.
2. CT scan
3. X-ray maxilla.
4. FNAC of lymph node.

Treatment
- Wide excision often with palatal excision or maxillectomy is done.
- Reconstruction by dental plates, skin grafting, or flaps are done.
- Lymph node block dissection of the neck is done if involved.
Salivary gland tumours are usually benign in adult
It is rare in children but when it occurs, it is commonly malignant
Clinical and FNAC are diagnostic methods
Open biopsy is contraindicated
Sialogram is not useful in salivary tumours
CT or MRI are often needed
Nerve should be preserved in benign lesions
Nerve can be sacrificed to achieve clearance in malignancies

Frey’s Syndrome (Auriculotemporal Syndrome)
- Occurs in 10% of cases.
- It is due to injury to the auriculotemporal nerve, where in postganglionic parasympathetic fibres from the otic ganglion become united to sympathetic nerves from the superior cervical ganglion (Pseudosynapsis).

Causes
- Surgeries or accidental injuries to the parotid.
- Surgeries or accidental injuries to temporo-mandibular joint.

Features
- Flushing, sweating, pain and hyperaesthesia in the skin over the face innervated by the auriculotemporal nerve, whenever salivation is stimulated (i.e. during mastication).
- Condition causes real inconvenience to the patient.
- Starch iodine test will show the area blue

Treatment
- Initially conservative and reassurance. Most of the time they recover.
- Occasionally they require surgical division of the tympanic branch of the glossopharyngeal nerve below the round window of middle ear (i.e. Intratympanic parasympathetic neurectomy, Jacobsen nerve).
- Injection of botulinum toxin to the affected skin
- Antiperspirants like aluminium chloride

Parotidectomy

Types
1. Superficial parotidectomy: It is the removal of superficial lobe of the parotid (superficial to facial nerve.). It is done in case of benign diseases of superficial lobe of the parotid.
2. Total conservative parotidectomy: It is done in benign diseases of parotid involving either only deep lobe or both superficial and deep lobes. Here both lobes are removed with preservation of facial nerve.
3. Radical parotidectomy: Both lobes of parotid are removed along with facial nerve, fat, fascia, muscles, and lymph nodes. It is done in case of carcinoma parotid. Later facial nerve reconstruction is done using hypoglossal or greater auricular nerve.

Complications of Parotidectomy
1. Facial nerve injury.
2. Haemorrhage.
4. Infection.
5. Frey’s syndrome.

Conservative surgeries are becoming popular for malignancy but they are not universally accepted.
Cervical Rib

Definition
- It is an extension of transverse process of C7 vertebra more than 2.5 cm (normal).
- Syndrome caused by it is called as cervical rib syndrome, thoracic inlet syndrome, thoracic outlet syndrome, scalene syndrome.
- It is 0.46% common, common in females, more frequently on right side.
- It can be unilateral or bilateral; can be asymptomatic or symptomatic.

Types
1. Complete bony: Cervical rib is radio-opaque, anteriorly ends over the first rib or manubrium.
2. Fibrous: Cannot be demonstrated radiologically.
4. Partial bony: With free end expanding as bony mass.

Pathology
Cervical rib narrows the scalene triangle (bounded by scalenus anterior, scalenus medius and first thoracic rib below)

- Compression of subclavian artery; C₈ and T₁ nerve roots due to cervical rib.
- Angulation of subclavian artery occurs
- Causes constriction of artery at the site where artery crosses the cervical rib
- ‘Eddie’s current’ created in the blood flow causes sudden release of pressure distal to the narrowing
- Poststenotic dilatation due to spasm of vasa vasorum of localized segment of the artery-Venturi phenomenon

  - Stasis of blood occur
  - Thrombosis → Embolus
  - Features of ischaemia in the hand and forearm. Later digital gangrene occurs.

  Compression of C₈ and T₁ will cause tingling and numbness along its distribution, i.e. in the little finger, medial side of hand and forearm.

Clinical Features
Majority of patients are asymptomatic.

1. Vascular manifestations:
   - Pain is due to ischaemia in the muscle. It is more during work, exercise and is relieved by rest.
   - Roos test is raising the arm above the shoulder. The side where cervical rib is present, patient cannot continue and so drops the hand down.
   - EAST- Elevated arm stress test (Modified Roos test): Arm is elevated above the shoulder, with elbow stretched fully. Rapid movements of fingers will cause fatigue on the side where cervical rib is present.
   - Adson’s test: The hand is raised above after feeling the radial pulse. The patient is asked to take a deep inspiration and turn the head to the same side. Any change in pulse, i.e. either becoming feeble or absent is noted.
   - Modified Adson’s test is same as Adson’s, but neck is turned towards the opposite side.

   - Wasting of thenar, hypothenar and forearm muscles.
   - Often digital gangrene.
   - Limb is colder and pallor than the opposite side.

2. Neurological features: is due to compression of T₁ and C₈ causing tingling and numbness in the little finger, medial side of hand and forearm.

3. Features in the neck:
   a. Hard, fixed, bony mass in the supraclavicular region.
   b. Palpable thrill above the clavicle in the subclavian artery.
   c. Bruit on auscultation.
**Differential Diagnosis**
1. Cervical spondylosis—to differentiate, X-ray neck—lateral view should be taken.
2. Carpal tunnel syndrome.
3. Tumours or swellings compressing over the vessel or nerves in the neck.

**Investigations**
- Chest X-ray PA-view and lateral view including neck-only (radio-opaque) bony rib can be identified.
- Nerve conduction studies to confirm neurological compression and also to rule out carpal tunnel syndrome or cervical spondylosis.
- Arterial doppler of subclavian artery and of the upper limb.
- Subclavian angiogram

**Treatment**
1. In symptomatic cervical rib without arterial compression of subclavian artery, along with scalenotomy (cutting scalenus anterior muscle), extraperiosteal resection of cervical rib with often resection of first rib is done to increase the thoracoaxillary channel and so as to reduce RE compression.
2. In symptomatic cervical rib with significant subclavian artery, compression of along with scalenotomy, extraperiosteal resection of cervical rib, resection of first rib, subclavian artery reconstruction with or without a graft has to be done.
3. Along with scalenotomy, extraperiosteal resection of cervical rib, resection of first rib, reconstruction of subclavian artery, cervical sympathectomy has to be done to improve the circulation to the ischaemic upper limb.

**Branchial Cyst**
It arises from the remnants of second branchial cleft. Normally 2nd, 3rd, 4th clefts disappear to form a smooth neck. Persistent 2nd cleft is called as cervical sinus which eventually gets sequestered to form branchial cyst.

**Features**
- Swelling in the neck beneath the anterior border of upper third of the sternomastoid muscle.
- It is smooth, soft, fluctuant, often transilluminant.
- It contains cholesterol crystals.
- Histologically, it is lined by squamous epithelium.
- Differential diagnosis: Cold abscess, lymph cyst.
- It may get infected to form an abscess.
- FNAC shows cholesterol crystals.

**Treatment**
- **Excision** under G/A. Cyst is in relation to carotids, hypoglossal nerve, glossopharyngeal nerve, and spinal accessory nerve, posterior belly of digastric and pharyngeal wall. Medially it is close to the posterior pillar of tonsils. During dissection, all these structures should be taken care off.

**Branchial Fistula**
- It is a persistent second branchial cleft with a communication outside to the exterior. It is commonly a congenital fistula. Occasionally the condition is secondary to incised, infected branchial cyst. Often it is bilateral.
- **External orifice** of the fistula is situated in the lower third of the neck near the anterior border of the sternomastoid muscle. **Internal orifice** is located on the anterior aspect of the posterior pillar of the fauces, just behind the tonsils. Sometimes fistula ends internally as blind end. Track is lined by ciliated columnar epithelium with patches of lymphoid tissues beneath it, causing recurrent inflammation. **Discharge** is mucoid or mucopurulent.
• **Investigations:** Discharge study, fistulogram.
• **Treatment:** Always surgery: Under G/A after passing a probe, fistula is excised across its full length, up to its internal opening. Care should be taken to safeguard carotids, jugular vein, hypoglossal nerve, glossopharyngeal nerve, and spinal accessory nerve. Track should be excised fully.

**Pharyngeal Pouch**
- It is a protrusion of mucosa through Killian’s dehiscence, a weak area of the posterior pharyngeal wall between thyropharyngeus (oblique fibres) and cricopharyngeus (transverse fibres) of the inferior constrictor muscle of the pharynx.
- Imperfect relaxation of the cricopharyngeus increases the pressure in the pharynx, mainly during swallowing which leads to protrusion of mucosa through the Killian’s dehiscence causing pharyngeal pouch. The protrusion is usually towards left.

**Stages**
1. Small diverticulum.
2. Large, globular diverticulum causing regurgitation, cough, dysphagia, respiratory infection.
3. Large pouch which is visible in the neck as a globular swelling often tender, smooth and soft. They present with dysphagia, features of respiratory infection like pneumonia and lung abscess, weight loss and cachexia. Pouch may itself get infected and may form an abscess. Often the pouch descends downward and enters the superior mediastinum.

**Clinical Features**
- Pain, dysphagia, recurrent respiratory infection, swelling in the neck on the left side which is smooth, soft and tender.

**Investigations**
- **Barium swallow**—lateral view shows pharyngeal pouch.
- Chest X-ray shows pneumonia.

**Treatment**
Antibiotics has to be started. 
Pharyngeal pouch is excised by an oblique neck incision (approach from neck). As there is cricopharyngeal spasm, *cricopharyngeal myotomy* (i.e. cutting of cricopharyngeal circular muscle fibres without opening mucosa) is done to prevent the recurrence.

**Complications**
1. Infection either *mediastinitis* or *lung infection* (Pneumonia or lung abscess).
2. Pharyngeal fistula.
3. Abscess in the neck.

**Laryngocele**
- It is a unilateral narrow necked, air containing diverticulum resulting from herniation of laryngeal mucosa.
- It is situated in the anterior third of the laryngeal ventricle, between the false cords and thyroid cartilage, herniates through the thyrohyoid membrane.
- It occurs in professional *trumpet players, glass blowers, and in people with chronic cough.*
- Swelling in the neck in relation to larynx adjacent to thyrohyoid membrane which is smooth, soft, resonant and is more prominent while blowing.
- Infection is quite common in the sac of laryngocele, leading to the blockade of opening of the sac causing an abscess.
- Pus often may be discharged into the pharynx repeatedly.
- Diagnosis: Clinical features, X-ray neck, laryngoscopy, CT scan.
- Treatment: Excision through neck incision. Neck of the sac should be ligated.

**Cystic Hygroma (Cavernous Lymphangioma)**
- It is a cystic swelling due to sequestration of a portion of jugular lymph sac from the lymphatic system, during the developmental period in utero.
- Present during birth and so may cause obstructed labour. Occasionally present in early infancy.
Sites
1. Posterior triangle of the neck—commonest site. Eventually may extend upwards in the neck.
2. Cheek.
3. Axilla.
4. Tongue—lymphangiogenetic macroglossia.
5. Groin.
7. Often multiple sites.

Pathology
It contains aggregation of cysts looking like soap bubbles. Cysts have mosaic appearance with larger cysts near the surface and smaller cysts in the deeper planes. Each cyst contains clear lymph with endothelial lining.

Clinical Features
- Swelling is present since birth in the posterior triangle of neck causing obstructed labour.
- Swelling is smooth, soft, fluctuant (cystic), compressible, brilliantly transilluminant.
- Swelling may rapidly increase in size causing respiratory obstruction—dangerous sign.
- It may get infected forming an abscess which is a tender, warm, soft swelling. It may cause septicaemia which may be life-threatening.

Treatment
- Aspiration of the contents. Later once the sac or capsule gets thickened by fibrous tissue, it is excised.
- When it causes respiratory obstruction, aspiration and tracheostomy has to be done.
- Under proper antibiotics coverage, drainage of abscess is done. Later sac is excised.

Complications
1. Respiratory distress.
2. Infection → Abscess → Septicaemia.
3. Surgery itself may cause torrential haemorrhage.

Carotid Body Tumour (Potato Tumour, Chemodectoma, Nonchromaffin Paraganglioma)
- It arises from the carotid body, which is located at the bifurcation of the carotid artery.
- Cells of the carotid body are sensitive to the changes in pH and temperature of the blood.
- They are commonly locally malignant tumours, but in 20% cases spread can occur to the regional lymph nodes.
- Blood supply to the tumour is from external carotid artery. Tumour does not secrete epinephrine or any endocrine substances.
- They can be familial.

Clinical Features
- Usually unilateral, more common in middle age.
- Swelling in the carotid region of the neck which is smooth, firm, and pulsatile (due to pulsatile vessel overlying its surface) and moves only side to side but not in vertical direction.
- Features of transient ischaemic attacks due to compression over the carotids.
- Thrill may be felt and bruit may be heard. Often tumour may extend into the cranial cavity along the internal carotid artery as dumbbell tumour.
**Investigations**
- Doppler.
- Angiogram to see the ‘tumour blush’.
- CT scan.
- No FNAC: No partial excision.

**Differential Diagnosis**
- Carotid aneurysm.
- Soft tissue tumour (Sarcoma).
- Lymph node enlargement.

**Treatment**
- If it is small, it can be excised easily as the tumour is in the adventitia.
- When it is large, as commonly observed, complete excision has to be done followed by placing a vascular graft.
- Carotid body tumour is not radiosensitive.

**Sternomastoid Tumour**
- It is due to birth injury to the sternomastoid muscle.
- It is a misnomer. It is not a tumour.

**Pathogenesis**
During child birth injury to sternomastoid muscle causes haematoma in the muscle which gets organized to form sternomastoid tumour.

**Clinical Features**
- It is seen in infants of 3-4 weeks age.
- Swelling in the sternomastoid muscle which is smooth, hard, nontender and adherent to the muscle.
- Chin pointing towards opposite side. Head towards same side (Scoliosis capitis).
- In later age groups it causes hemifacial atrophy due to less blood supply because of the compressed external carotid artery by sternomastoid tumour.
- Compensatory cervical scoliosis.
- Compensatory squint.
- Differential diagnosis: Other causes for torticollis.
- Treatment: Division of the lower end of the sternomastoid muscle or excision of the muscle.

**Cold Abscess**
- It is due to tuberculosis. It is commonly observed in neck in relation to caseating

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**Differential diagnosis for neck lymph node enlargement**
- Tuberculous lymphadenitis
- Secondaries in lymph nodes
- HIV infection
- Lymphomas
- Chronic lymphatic leukaemia
- Nonspecific lymphadenitis
- Infectious mononucleosis
- Sarcoidosis

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**Fig. 2.85: Staging of tuberculous lymphadenitis**
tuberculous cervical lymphadenitis. It can occur in relation to spine, like psoas abscess, paraspinal region or any other area. In tuberculous lymphadenitis—there are five stages—stage of lymphadenitis; stage of matting; stage of cold abscess formation; stage of collar stud abscess formation and stage of sinus formation.

- Cold abscess does not show any signs of acute inflammation. It will be soft, smooth, nontender well localized swelling. Relevant lymph nodes, oral cavity/tonsils, cervical/thoracic spines, lungs should be examined.
- Investigations are—ESR, chest X-ray, FNAC shows epithelioid cells and Langhans’ giant cells, X-ray spine
- Treatment—antitubercular drugs, nondependent aspiration, nondependent incision and drainage with closure of the wound without placing a drain.
- Complications are—sinus formation, systemic spread, secondary infection, resistance tuberculosis.

(Please refer chapter surgical pathology for detail)

**Secondaries in Neck Lymph Nodes**

**Levels in Neck Nodes (Memorial Sloan-Kettering cancer center leveling of neck nodes).**

Level I—Submandibular lymph nodes and submental lymph nodes.

Level II—Lymph nodes in upper deep cervical region. (It extends from base of skull to hyoid bone and from lateral margin of sternothyroid to posterior margin of sternomastoid muscle.

Level III—Lymph nodes in middle cervical region. (From hyoid bone to omohyoid muscle or cricothyroid membrane).

Level IV—Lymph nodes in lower cervical region. (From omohyoid muscle to clavicle).

Level V—Lymph nodes in posterior triangle including supraclavicular region.

Level VI—Lymph nodes in the midline neck—pretracheal and prelaryngeal.

Level VII—Lymph nodes in the mediastinum.

![Figs 2.86A and B: Cold abscess in a young girl. Collar stud abscess in an old lady.](image)
• It is commonly from squamous cell carcinoma, but can be from adenocarcinoma, or melanoma.
• Squamous cell carcinoma is mainly from oral cavity, pharynx.
• Adenocarcinoma is usually from GIT, commonly involving left supraclavicular lymph-nodes.

**Features of Secondaries in Neck**
• Nodular surface, hard, often fixed when it is advanced.
• Secondaries from *papillary carcinoma of thyroid* can be soft, cystic and contains brownish black fluid.
• Secondaries can infiltrate into carotids, sternomastoid, posterior vertebral muscles, spinal accessory nerve (shrugging of shoulder is affected), hypoglossal nerve (tongue will deviate towards the same side), cervical sympathetic chain (*Horner’s syndrome*).
• Secondaries spread into adjacent soft tissues and also to the skin causing fungation and ulceration. Often because of tumour necrosis, softer area develops in the hard node.
• In advanced cases tumour may infiltrate into the major vessels like carotids, or branches of external carotid artery causing torrential haemorrhage.

**Types of Secondaries in the Neck**

1. *Secondaries in the neck with known primary:*
   • Here secondaries are present and primary has been identified clinically in the oral cavity, pharynx, larynx, thyroid, or other areas.
   • Biopsy from the primary and FNAC from the secondaries has to be taken.
   • Primary is treated accordingly either by curative radiotherapy or by surgery (wide excision).
   • Secondaries when mobile are treated by radical lymph node block dissection in the neck.

2. *Secondaries in the neck with clinically unidentified primary:*
   • Hard, neck lymph nodes are the secondaries, but primary has not been identified clinically.
   • FNAC of the neck node has to be done and secondaries have to be confirmed. Then search for the primary has to be done by various investigations.
   They are:
   a. Nasopharyngoscopy.
b. Laryngoscopy.
c. Oesophagoscopy.
d. Bronchoscopy.
e. Blind biopsies from the fossa of Rosenmuller, lateral wall of pharynx, pyriform fossa, larynx.
f. FNAC of thyroid and suspected areas.
g. CT scan.

Once the biopsy confirms the primary, it is treated either by surgery or by curative radiotherapy.

Secondary in the neck is treated by radical neck dissection.

3. **Secondaries in the neck with an occult primary:**
   - Here secondaries in the neck lymph nodes are confirmed by FNAC, but primary has not been revealed by any available investigations.
   - When all the investigations mentioned above are done do not show any evidence of primary, only then it is called as occult primary.
   - Initially the secondaries in the neck are treated by radical neck dissection, then regular follow up is done (at three monthly intervals) until the primary reveals.
   - Once primary is revealed it is confirmed by biopsy and treated accordingly, either by curative radiotherapy or by wide excision depending on location of revealed primary.
   - This type is usually less aggressive and has got better prognosis. *Primary branchiogenic carcinoma may be a differential diagnosis for this.*

**Investigations for Secondaries in Neck**
1. FNAC of secondary.
2. Biopsy from primary.
3. Blind biopsies from suspected areas.
5. CT scan.

**Differential Diagnosis**
1. Lymphomas.
2. Tuberculous lymphadenitis.

**Treatment**
- Primary has to be treated depending on the site, either by wide excision (surgery) or by curative radiotherapy. Then the secondaries have to be treated.
- Secondaries when are mobile are treated by radical neck dissection.
- When fixed it is inoperable. Palliative external radiotherapy has to be given to palliate the pain and to prevent the anticipated bleeding.
- Sometimes initially, external radiotherapy has to be given to downstage the disease so that it becomes operable and later classical block dissection can be done.

**Types of Block Dissection**
1. **Classic radical neck dissection:**
   - It is resection of lymph nodes, fat, fascia, sternomastoid muscle, strap muscles, internal jugular vein, accessory nerve, submandibular salivary gland, lower part of parotid - ‘en-block’ (Criles’ operation).
   - Incision that is commonly made is Mc’Fee incision which are two parallel incisions, one at submandibular region, another at supraclavicular region. Blood supply of the flap remains intact and so healing will be better without flap necrosis.

2. **Conservative functional block dissection:** *(Modified radical neck dissection; MRND)*
   - It is done only in selected cases where tumour is very well-differentiated and less aggressive. Structures preserved here are sternomastoid muscle, internal jugular vein and spinal accessory nerve.
   - Only spinal accessory nerve is preserved—MRND type I.
   - Accessory nerve and sternomastoid are preserved—MRND type II.
   - Accessory nerve, sternomastoid and internal jugular veins are preserved—MRND type III.

3. **Suprahyoid block**
   - Only fat, fascia, lymph nodes, muscles, submandibular salivary gland, with dissection
above the omohyoid muscle is done. Done only in selected individuals with well-differentiated tumour and involvement of few submandibular lymph nodes. (Levels I, II, III are removed).

4. *Bilateral neck dissection*: Internal jugular vein has to be preserved on one side. *Always the side where the vein is preserved is operated first.* (If both the jugulars are ligated, cerebral congestion occurs leading to cerebral oedema which is dangerous. During surgery if it occurs, the patient has to be kept in propped position; antibiotics, diuretics, steroids are given, repeated CSF taps are done to control the cerebral oedema).

5. *Commando operation (Combined mandibular dissection and neck dissection)*: It is *en-block removal*, which includes wide excision of primary tumour with hemimandibulectomy and neck block dissection (*e.g.* in tongue)

<table>
<thead>
<tr>
<th>Complications of block dissection</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Haemorrhage</td>
</tr>
<tr>
<td>• Infection</td>
</tr>
<tr>
<td>• Lymph ooze</td>
</tr>
<tr>
<td>• Carotid blow out</td>
</tr>
</tbody>
</table>

**Other Treatment**

**Chemotherapy**

- Drugs used are—Methotrexate, Vincristine, Bleomycin, Adriamycin.
- It can be given by *intra-arterial route through external carotid artery.* (Never through internal carotid as it will cause cerebral damage).
- Site of arterial catheters should be confirmed by Doppler and angiogram. Drug is usually administered through an arterial pump. Other method is to increase the height of the drip stand to get a pressure above the level of the systolic pressure of the patient. (*i.e.* more than 13 ft).
- Drugs can also be given IV or orally.

**SARCOMAS**

**Features**

- Sarcomas are much lesser in incidence compared to carcinomas.
- It occurs in younger age group compared to carcinomas.
- They can arise from bone (osteosarcoma) or from any soft tissues (soft tissue sarcomas). (Mesenchymal tissue).
- They are much more aggressive compared to carcinomas.
- They are rapidly growing tumours with fleshy appearance.
- They are not encapsulated but are having pseudocapsule.
- They spread through blood especially to lungs often also to other organs.
- Lymphatic spread is not common with certain exceptions.
- They are not radiosensitive.
- Main method of treatment is surgery, *i.e.* wide excision, amputation.
- In inoperable cases debulking is the accepted method of treatment.
- Chemotherapy is the adjuvant therapy.
- Commonest sarcoma of bone is *osteosarcoma.*
- Commonest soft tissue sarcoma is *liposarcoma.*
- *Usual clinical features* are: Diffuse swelling which is smooth, hard, warm and very vascular.

<table>
<thead>
<tr>
<th>Important features of sarcoma</th>
</tr>
</thead>
<tbody>
<tr>
<td>• More aggressive</td>
</tr>
<tr>
<td>• Rapidly spreading</td>
</tr>
<tr>
<td>• Not very much radiosensitive</td>
</tr>
<tr>
<td>• Blood spread</td>
</tr>
<tr>
<td>• Painless soft tissue mass is the presentation.</td>
</tr>
<tr>
<td>• Very vascular</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Soft tissue sarcoma</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 1% of adult malignancy</td>
</tr>
<tr>
<td>• 15% of paediatric malignancies</td>
</tr>
<tr>
<td>• Incidence</td>
</tr>
<tr>
<td>- 35% occurs in lower limb (commonest site)</td>
</tr>
<tr>
<td>- 15% upper limb, 15% retroperitoneum</td>
</tr>
<tr>
<td>- 10% trunk, 10% viscera, 10% other areas.</td>
</tr>
<tr>
<td>• Soft tissue tumour &gt; 5 cm should be biopsied in suspicious of sarcoma.</td>
</tr>
</tbody>
</table>
Aetiology
• **Genetic**
  - Von-Recklinghausen disease
  - Gardner’s syndrome
  - Tuberous sclerosis
  - Basal cell naevus syndrome
  - Li-Fraumeni syndrome
• **Chemicals**—PVC, tetrachlorodibenzodioxin, arsenic
• **Viral**—HIV in Kaposi’s sarcoma.
• **Ionizing radiation**—Malignant fibrous histiocytoma (p53)

Clinical Features of Soft Tissue Sarcoma
• Painless swelling of short duration with progressive increase in size—soft tissue mass.
• Compression of adjacent structures
• Smooth, hard, warm and vascular
• Features of secondaries in lung—cough, haemoptysis and chest pain.

Fig. 2.88: Chondrosarcoma leg. It was removed by wide excision as a limb salvaging procedure

Investigations
• **Incision biopsy** is the main method of diagnosis.
• Excision biopsy is done if the tumour size is <3 cm.
• CT scan or MRI of the part to see the extent and invasion.

• MRI is the investigation of choice as it determines the vascularity, relation to vessel and fascial planes.
• Chest X-ray is done to look for secondaries.
• CT chest is ideal to see early lung secondaries. It is done in all deep seated, high grade tumour and tumour more than 5 cm in size.
• Angiogram may be required to find out the tumour vascularity.
• Radionuclide scintigraphy (Gallium-67)
• p-MRS (p-Magnetic Resonance Spectroscopy) and FDG (Fluor-2-Deoxy Glucose) PET are done to assess the metabolic activity of tumour.

Incision biopsy for soft tissue sarcoma
• It is the ideal tool to conclude sarcoma histologically
• Incision should be placed in such a way that it can be included in wide tumour excision at later period
• Incision should be longitudinal in limbs
• Injury to vessels and nerves should be avoided
• Flaps should not be undermined
• Adequate haemostasis is needed, as tumours are vascular
• Immunohistochemistry and cytogenetics are possible

FNAC is less useful for sarcomas. Core/Trucut biopsy can be done but not equal to incision biopsy.

Staging of the soft tissue tumour is done depending on the tumour size, nodal status, metastasis and histological grading of the tumour. (GTNM staging).

Grading of sarcomas
<table>
<thead>
<tr>
<th>Grade</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Desmoid, dermatofibrosarcoma, liposarcoma</td>
</tr>
<tr>
<td>High</td>
<td>Synovial, rhabdomyosarcoma, angiosarcoma</td>
</tr>
<tr>
<td></td>
<td>Malignant fibrous histiocytoma, Extraosseous chondrosarcoma</td>
</tr>
<tr>
<td>Undetermined</td>
<td>Fibrosarcoma, leiomyosarcoma</td>
</tr>
</tbody>
</table>
Differential diagnosis for soft tissue sarcoma

- Haematoma
- Abscess
- Aneurysm
- Myositis

Treatment

- **Wide excision** is the treatment of choice with 3-5 cm clearance with adequate depth.
- **Compartment resection** is a radical limb saving procedure. Here muscle group of one compartment (anterior, posterior or medial) is resected entirely from its origin to insertion with the tumour. It is done only when tumour is intracompartmental. It is not suitable when tumour is extracompartmental or many compartments are involved or encased to major neurovascular bundle.
- Amputation is done in large tumours of upper or lower limbs.

Indications for amputations in soft tissue sarcoma:

- Major neurovascular encasement
- Bone involvement
- Multiple compartment involvement
- Limb itself is diseased like lymphoedema
- Recurrence with multicentricity.

Debulking surgery is useful in large advanced tumours like retroperitoneal sarcomas.

Preoperative radiotherapy or chemotherapy followed by wide excision.

**Postoperative radiotherapy** is commonly used because of less tumour burden and less wound problems. Titanium clips are placed during surgery at high risk areas to identify the site to concentrate proper RT.

- **Brachytherapy** is very effective in local control of the tumour. Initially precise mapping of the area is done in the operation theatre. Loading catheters are placed in surgical field peroperatively. Later these catheters are loaded with iridium 192.
- Permanent radioactive sources also can be placed to the area.
- Palliative external radiotherapy can be given to prevent bleeding, fungation and to reduce pain in advanced cases. It is also used in secondaries in brain, bone.

Primary radiotherapy alone (radical) is of less beneficial in soft tissue sarcoma.

Chemotherapy drugs—**VAC** (Vincristine, Adriamycin, Cyclophosphamide) are commonly used. Other drugs ifosamide, dacarbazine are used in combination with above drugs. **Mesna** is used as a protection for haemorrhagic cystitis. Chemotherapy is used when tumour
is more than 5 cm or high grade. Usually postoperative chemotherapy is given.

- **Neoadjuvant chemotherapy** is used to make the primary tumour better operable.
- **Isolated limb perfusion using cytotoxic drugs and tumour necrosis factor** with hyperthermia is also often used.
- **Pulmonary metastasis** can be treated with wedge resection, segmentectomy, lobectomy, pneumonectomy. Surgery is done only when primary is well-controlled. Radiotherapy and chemotherapy are also tried. More than 3 number metastases in lung signify poor prognosis.

### Prognostic factors

- Size >5 cm
- High grade
- More than one compartment involvement.
- Deep tumours and multicentric
- Neurovascular invasion
- Lung secondaries

### Sarcomas which also spread through lymph nodes

- Synovial sarcoma
- Lymphangiosarcoma
- Rhabdomyosarcoma—alveolar type
- Ewing’s sarcoma
- Angiosarcoma
- Epitheloid sarcoma
- Carcinosarcoma of uterus

### EXAMINATION OF SWELLING IN GROIN AND SCROTUM, AND OTHER COMPLICATIONS

#### Hydrocele

Hydrocele is a common disease seen in clinical practice. It is usually kept as a short case in undergraduate clinical examination. It should be differentiated from hernia and other swellings in groin and scrotum.

1. **History**
   - **Age**—Epididymo-orchitis is common in younger age group. Torsion testis is common in younger age group.
   - **Pain**—It is important feature in scrotal swelling. Pain may be in the testis, in the epididymis, in the vas deferens. In funiculitis, pain is in the groin. In tuberculosis which involves epididymis (not commonly testis) pain is in groin. In torsion testis sudden pain is seen in scrotum which radiates upwards towards umbilicus. It may mimic appendicitis in right testicular torsion. Dragging pain is seen in varicocele.
   - **Swelling**—Duration, progress, reducibility especially on lying down are important. Hernia gets reduced on lying down. Varicocele also disappears slowly in lying down. Scrotum may be empty in undescended testis and history of swelling in the groin since childhood signifies undescended testis.
   - **Fever**—is often seen in acute epididymo-orchitis, pyocele, and infected hydrocele.

2. **Local examination**

   - **Inspection**
     - It is done initially in standing position later in lying down position.
     - Position and extent of the swelling above/below.
     - Skin over the swelling.
     - Impulse on coughing should be checked for hernia.

   - **Palpation**
     - Position and extent is confirmed.
     - Impulse on coughing.
     - Warmness, tenderness, skin over the swelling
     - Get above the swelling—in scrotal swelling one can get above the swelling. Root of the scrotum is held between thumb in front and other fingers behind. Cord structures are felt. If only cord structures are felt and not any other structures like hernial sac or content that means one can get above the swelling. It is purely scrotal. In hydrocele, it is possible to
• Get above the swelling. In hernia/inguinoscrotal swelling one cannot get above the swelling.
• Size, surface, consistency, margin of the swelling.
• Presence of scrotal oedema should be confirmed.
• Fluctuation should be elicited. The scrotum is fixed using hand and fingers, swelling is fixed and made prominent. With one index finger one side of the swelling is pressed to indent and fluid movement is felt by the other finger placed on the opposite direction. It should be repeated in diagonally perpendicular direction. One should remember that fluctuation should always be done in two directions (not in just one direction). Hydrocele is fluctuant.
• Transillumination test—It is checked by lighting a pen torch on side and front part of the swelling side wards (not from behind as testis prevents passage of light); illumination is observed on opposite side in front using a scotoscope. Often red glow is visible. Hydrocele and epididymal cyst are transilluminant.
• Reducibility—Hydrocele is not reducible except congenital hydrocele which communicates into the peritoneal cavity.
• Palpation of testis—For size, surface, consistency and testicular sensation. It is felt by applying pressure sensation over the testis and patient feels sickening sensation in epigastric region. It is absent in malignancy, syphilis, leprosy, chronic haematocele.
• Palpation of epididymis/vas deferens/groin lymph nodes are important.
• Palpation of epigastrium for para-aortic nodes and supraclavicular region for lymph nodes
• Traction test—Apply traction on the testis by holding it and pulling downwards. In encysted hydrocele of the cord, mobility of swelling gets restricted.
• Opposite side examination.
• Examination of abdomen and lungs are also equally important.

— Hydrocele is collection of fluid in the scrotum between two layers of the tunica vaginalis testis. It can be primary idiopathic, secondary due to filarial infection, trauma, tuberculosis, syphilis or malignancy.
— Hydrocele fluid is amber colored which contains water, salt, albumin and fibrinogen. Fluid per se does not clot but if comes in contact with the blood it gets clotted.
— Primary vaginal hydrocele occurs in middle age.
— Hydrocele is smooth, soft, fluctuant and often transilluminant. When root of the scrotum is held only cord structures are felt, nothing else. There is no impulse on coughing. It is by this method hydrocele is differentiated from inguinal hernia. In hernia one cannot get above the swelling and there is impulse on coughing.

Figs 2.89A and B: Hydrocele is scrotal swelling. Get above the swelling is the clinical method used to differentiate from hernia.
3. Types

- **Vaginal hydrocele** limits to only scrotum.
- **Congenital hydrocele** communicates to peritoneal cavity.
- **Infantile hydrocele**—Here tunica and processus vaginalis (hydrocele) are distended up to internal ring, but sac has no connection with the general peritoneal cavity.
- **Encysted hydrocele of the cord**—It is a smooth, oval, swelling associated with the spermatic cord. On gentle traction to the testis, the swelling becomes less mobile (*traction test*).
- **Hydrocele en bisac**: (Bilocular hydrocele):
  - Hydrocele has got two intercommunicating sacs, one above and one below the neck of the scrotum.

### Secondary Hydrocele

**Causes**

- Infection: Filariasis.
- Tuberculosis of epididymis.
- Syphilis.
- Injury: Trauma, Postherniorrhaphy hydrocele
- Tumour: Malignancy.

It is usually small, lax and testis is usually palpable (unlike primary hydrocele). Exception is secondary hydrocele due to filariasis.

**Filarial Hydrocele and Chylocele**

- Occurs commonly in coastal region and in and around the Equator.
- Usually occurs after repeated attacks of filarial epididymitis.
- Hydrocele is usually of large size and the sac is thickened.
- Fluid contains fat, rich in cholesterol, derived from ruptured lymph varix into the tunica.
- It is often difficult to differentiate from primary hydrocele.

## Complications of hydrocele
- Infection
- Pyocele
- Haematocele
- Atrophy of testis
- Infertility

### Treatment for Hydrocele: Surgery
2. Partial excision and eversion. Jabouley’s
3. Evacuation and eversion.
4. Lord’s plication.
5. Sharma and Jowar’s procedure.

### Procedure
- Under G/A or spinal or L/A, after cleaning and draping, vertical incision of about 6-8 cm in length is made over the scrotum, anteriorly 1 cm lateral to the median raphe.
- Skin, dartos, external spermatic fascia, internal spermatic fascia are incised.
  - Bluish hydrocele sac is identified (i.e. parietal layer of the tunica vaginalis of the testis).
  - Fluid is evacuated using trocar and cannula. Sac is opened.
- If the sac is small, thin and contains clear fluid, either Lord’s plication (i.e. tunica is bunched into a ‘ruff’ by placing series of multiple interrupted chromic catgut sutures so as to make the sac to form fibrous tissue) (it is relatively avascular and so haematoma will not occur).
- Or evacuation and eversion of the sac behind the testis (after eversion, everted sac is sutured with chromic catgut by continuous sutures) is done.
- If the sac is thick, in large hydrocele and chylocele, subtotal excision of the sac is done (as tunica vaginalis is reflected on to the cord structures and epididymis posteriorly, total excision leads to orchidectomy with division of cord.).
- Aspiration must be avoided as much as possible as it is only a temporary measure (recurrence occurs very early) and chances of haematocele, and infection are higher.
- A drain is placed near the root of the scrotum on the lateral aspect because it becomes the most dependent portion once

### Fig. 2.91: Hydrocele—could be primary vaginal hydrocele

### Fig. 2.92: Hydrocele sac is blue in color. Content is amber coloured fluid.
scrotal support is given. Scrotal support is given to reduce the scrotal oedema for 10 days.
• Wound is closed in layers.
• Drain is removed in 48 hours.

Complications of surgery
• Reactionary haemorrhage
• Haematocele
• Infection
• Pyocele
• Sinus formation
• Recurrent hydrocele.

Cyst of the Epididymis
• It is due to the cystic degeneration of:
  1. Paradidymis (organ of Geraldes)—is the commonest cause.
  2. Appendix of the epididymis.
  3. Appendix of the testis
  4. The vas aberrans of Haller.
• Even though it is of congenital origin, it occurs in middle age.
• It is tensely cystic, contains clear fluid.
• They are often bilateral.
• They are aggregation of number of small cysts and so multiloculated.
• They feel like ‘bunch of tiny grapes’ situated behind the body of the testis.
• Because of numerous septae they are finely tessellated and so are brilliantly transilluminant, appear like ‘chinese lantern pattern’.

Differential Diagnosis
• Spermatocele
• Encysted hydrocele of the cord.

Treatment
• Avoid excision as much as possible as it will result in infertility due to blockage.
• In old age, excision can be done.

Spermatocele
• It is a unilocular acquired retention cyst derived from some portion of the sperm conducting mechanism of the epididymis. It is situated in the head of the epididymis, above and behind the body of the testis.

• Swelling contains barley water like fluid which contains spermatozoa.
• It is soft, cystic and transilluminant. It is often considered by the patient like having additional testis.
• Aspiration cytology confirms the diagnosis.
• Treatment: It can be left alone. If it is large, excision is done.
• Differential diagnosis: Epididymal cyst, hydrocele.

Varicocele
• It is dilatation and tortuosity of the pampiniform plexus of veins and so also the testicular veins. Normally there will be plenty of plexus of veins (pampiniform) in the scrotum, which all join together to form about 4-8 veins in the inguinal canal. Above, in the abdominal cavity, in the posterior abdominal wall all join to form a single testicular vein. On left side, it drains into the left renal vein; on the right side it drains in to the inferior venacava.
• Varicocele is common in tall, thin young men.
• More common on the left side, but often can be bilateral.
• Commonly it is idiopathic, may be due to absence or incompetent valve at the junction of left testicular vein and left renal vein causing inefficient drainage of blood.
• Other reason is, due to perpendicular (right angle) entry of the left testicular vein into the left renal vein.
• In left sided renal cell carcinoma, tumour proliferates into the left renal vein and blocks the entry of left testicular vein causing varicocele on left sided which is irreducible.
• Varicocele causes increased temperature in the scrotum which depresses the spermato genesis and so causes infertility (correction infertility).

Clinical Features
• Swelling in the root of the scrotum.
• Dragging pain in the groin and scrotum.
• ‘Bag of worms’ feeling.
• Impulse on coughing.
• On lying down it gets reduced (except in renal cell carcinoma).
Grading of Varicocele
   I Small.
   II Moderate.
   III Large.
   IV Severely tortuous.

Differential Diagnosis
   • Hydrocele.
   • Inguinal hernia.

Investigations
   • Venous Doppler of the scrotum and groin.
   • U/S abdomen to look for kidney.
   • Semen analysis.

Treatment
   • Palamo’s operation — Supra inguinal extra peritoneal ligation of the testicular vein.
   • Inguinal approach: Easier and safer.
   • Scrotal approach: In case of grade IV, veins have to be excised through this approach.
   • Laparoscopic approach – Presently accepted good approach.

Indications for Surgery
1. Pain
2. Oligospermia—Usually in 6-12 weeks oligospermia improves very well and also the conception rate.

Carcinoma Penis
It is commonly squamous cell carcinoma, but melanoma, adenocarcinoma from Tyson’s gland, basal cell carcinoma and secondaries may also occur.

Etiology
1. Chronic balanoposthitis.
2. Sexually transmitted diseases.
3. Leucoplakia of glans.
4. Long standing genital warts.
5. Paget’s disease of penis (Erythroplasia of Quevat is persistent rawness of glans penis).

Circumcision during infancy confers total immunity against carcinoma penis.

Pathology
1. Infiltrating type occurs in a pre-existing leuckoplakia.
2. Papilliferous type eventually attains a large size forming fungating foul smelling lesion which often gets infected.
3. Ulcerative type
   Glans penis is the commonest site (coronal sulcus for basal cell carcinoma).

Spread
   • Through lymphatics it spreads to the horizontal group of inguinal lymph nodes which become nodular and hard. Lymph nodes on both sides can get involved. Later external iliac group are involved (above and on medial aspect of the inguinal ligament).
   • Once inguinal lymph nodes are fixed it causes severe excruciating pain and lymphoedema. Fixed lymph node status indicates the advancement of the disease. It may erode into the femoral vessels causing torrential haemorrhage and death.
   • Carcinoma from penis and glans spread to inguinal lymph nodes and then to external iliac lymph nodes. From glans it also spreads to Cloquet lymph node which is located in femoral canal.
   • Carcinoma from shaft of penis can spread directly to the external iliac lymph nodes.
   • It spreads proximally to the body of penis causing induration.
   • Urethral meatus may get involved causing alteration in urinary stream. It is a locoregional malignant disease.
   • Blood spread is rare.

Clinical Features
   • In an adult, recent onset of phimosis should arise the suspicion of carcinoma penis.
   • Lesion is painless initially but later becomes painful due to secondary infection often accompanied by discharge which is foul smelling, purulent and irritating.
   • Altered urinary stream.
   • Fungation and induration, often extending into the body of penis.
• Palpable hard, nodular inguinal lymph nodes on both sides may be present. External iliac lymph nodes may be palpable.
• Pain, oedema, tenderness, redness develops once infection occurs.

**Investigations**
- *Edge biopsy* from the lesion shows squamous cell carcinoma with epithelial pearls.
  **Broder’s classification:** Grading:
  - Well-differentiated (75% epithelial pearls)
  - Moderately differentiated (50-75%)
  - Undifferentiated (25-50%).
  - Dedifferentiated < 25% keratin pearls.
- *Only FNAC of lymph node.* (No open biopsy for lymph nodes).
- U/S abdomen to see external iliac lymph nodes.

**Treatment**
- If growth is involving only glans without extending into the body of the penis, then *partial amputation* of penis is done.
- If induration extends into the body of penis then *total amputation of penis* is done with perineal urethroscopy.
- In case of mobile inguinal lymph nodes bilateral *inguinal block* dissection is done.
- Partial amputation of penis with bilateral inguinal block dissection is called as *Young’s operation*.
- When scrotum is removed along with total amputation of penis then it is called as *Piersey Gold* operation.
- In early carcinoma prepuce, after circumcision, *curative radiotherapy* using penile mould is tried so as to retain the penis.
- In ilio-inguinal block dissection, inguinal lymph nodes, external iliac lymph nodes, fat, fascia in inguinal region, saphenous vein are removed en-block.
- Primary inguinal block means block dissection is done within 4 weeks of surgery for primary lesion.
- Secondary inguinal block means block dissection is done after 4 weeks of surgery for primary lesion.

**Complications of inguinal block dissection**
- Haemorrhage
- Lymphorrhoea
- Lymphoedema
- Infection
- Flap necrosis common

- *Postoperative radiotherapy* to inguinal region is often given.
- In advanced fixed inguinal lymph nodes *palliative external radiotherapy* is given to palliate pain and anticipated erosion into the femoral vessels.
- Chemotherapeutic drugs are 5 FU, Bleomycin, Vincristine.
- *Topical 5FU cream or Nd: YAG Laser photo-irradiation* is useful in *carcinoma in situ cases*.

**Prognosis**
*Stage I:* Only glans and or prepuce are involved.
5-year survival is 90%.

*Stage II:* Body of penis 70%.

*Stage III:* Only inguinal lymph nodes are involved—50%.

*Stage III:* With external iliac nodes 20%.
Stage IV: Fixed lymph nodes or scrotal extension of primary tumour or distant spread: < 5%.
(Please refer chapter surgical pathology for detail)

**Buschke-Lowenstein Tumour**
It is verrucous carcinoma of penis (5-15% common).

- It is a curable malignancy
- It is locally destructive, locally invasive
- It is often large, exophytic, dry, verrucae like growth
- Neither spreads through lymphatics nor blood.
- After biopsy and confirmation, surgical excision or partial amputation is the treatment of choice
- Radiotherapy should not be given.

Fig. 2.94: Patient underwent earlier total amputation of penis. Now he has developed secondaries in inguinal lymph nodes which has ulcerated and fungated – advanced disease.
Surgical pathology is indeed important and interesting aspect, to know how exactly a diseased area looks like and also to think its possible causes and prognosis. Specimen should be sent properly, labeled with markers. Suspected area should be marked. Whenever nodes are removed it should be sent by mentioning in detail of its location and nature. In many centers specimen moulds/keeping trays are used for particular organs. Detailed history and clinical findings should be sent to the pathologists.

**SPECIMEN OF APPENDIX**

Commonest anatomical position of appendix is retrocaecal (75%). Rarest site is preileal (1%). Second common position is pelvic (21%).

Appendicitis is more common in white races, young males, and in people with meat rich intake.

- **Non obstructive type** commonly responds to drug treatment. But recurrent, non-obstructive type may eventually turn into obstructive type of appendicitis. Gangrene and perforation is initially rare in non-obstructive appendicitis.
- **Obstructive type** results in collection of pus in the lumen and later infective thrombosis of appendicular artery and gangrene—finally leading to perforation and peritonitis. Usually pneumoperitoneum will not occur in appendicular perforation. Lumen of appendix is narrow (1-3 mm) and so gets obstructed easily. As there is no muscle layer in appendix perforation is easier than other part of the bowel. Children, old age, faecolith, laxative abuse, diabetes mellitus, immunosuppression and pelvic appendix are high risk factors for perforation in appendicitis.

Appendicular mass is initially treated with Ochsner Sherren regime. After 6 weeks interval appendicectomy is done.

Commonest bacterium involved is *Escherichia coli*. Others are anaerobic bacteria, enterococci, bacteroides, etc.

Figs 3.1A to C: Specimen showing inflamed appendix with mesoappendix. Appendix is distended and turgid. It is a cul de sac like structure with serosa and mesentery attached to it. In second picture perforated appendix is seen with areas of necrosis. Third picture shows mesentery containing enlarged lymph nodes. After appendicectomy, the specimen should always be sent for histology to find out the severity of inflammation and also to rule out carcinoid tumour.
Faecolith, tumour (carcinoïd, adenocarcinoma caecum), worms, fibrosis, are the aetiologies for appendicitis.

Appendicitis may have different sequelae like – resolution, fibrosis, gangrene, suppuration, obstruction, perforation, peritonitis, mass formation or abscess formation.

Alvarado scoring system is used using migrating pain, anorexia, nausea and vomiting, tenderness in right iliac fossa, rebound tenderness, elevated temperature, leucocytosis, and shift to left with neutrophilia.

**SPECIMEN OF FIBROADENOMA OF BREAST**

Figs 3.2A and B: Specimen of fibroadenoma of breast—a benign tumour.

**SPECIMEN OF CARCINOMA OF BREAST**

Figs 3.3A and B: Specimen of breast showing nipple—areolar complex with axillary dissected nodes. It is a specimen of total mastectomy with axillary clearance. Whitish un-encapsulated tumour is visible. It invades the breast tissue all over. It is fibrous, whitish/grey in colour, cut surface is concave and gritty in sensation. Axillary nodes are seen in axillary dissection area.

**SPECIMEN OF STOMACH**

**Benign Gastric Ulcer**

- Johnson’s classification of gastric ulcer is Type I – ulcer in the antrum; Type II—both gastric ulcer and duodenal ulcer; Type III – pre-pyloric ulcer; Type IV – gastric ulcer in proximal stomach or cardia.
Fig. 3.4: Cut section of breast showing gritty whitish tumour area without any capsule surrounded by normal breast tissue. It is scirrhouus carcinoma of breast. Histologically it shows spheroidal ductal malignant epithelial cells with abundant fibrous stroma. Medullary carcinoma is soft, encephaloid, bulky showing malignant columnar cells, with intense lymphocytic infiltration.

Fig. 3.5: Resected mastectomy specimen showing carcinoma involving nipple—areola complex with axillary dissection.

Fig. 3.6: Patey’s mastectomy specimen showing tumour with breast tissue, nipple-areolar complex, pectoralis minor muscle and axillary dissected lymph nodes.

Fig. 3.7: Specimen of stomach (identified by the mucosal pattern and rugae) showing deep ulcer near lesser curvature. Margin of the ulcer is clear, not everted with gastric mucosal folds converging towards the base of the ulcer. 95% of benign gastric ulcer occurs towards lesser curve. Benign gastric ulcer is more common in lesser curvature, as it takes more burden of passage of food and so more of wear and tear. Benign gastric ulcer is rare in greater curvature, fundus and cardia. Histologically it shows destruction of epithelial lining; proliferation of margin; destruction of the part of the muscle layer; granulation tissue in the floor; infiltration with chronic inflammatory cells; endarteritis and fibrosis in the base.

Fig. 3.8: Specimen showing hour glass contracture as a complication of benign gastric ulcer.

- Pain, periodicity, haematemesis, induction of vomiting to relieve pain, normal appetite but decreased weight are the features.
- Barium meal X-ray shows niche and notch effect. Gastroscopy with biopsy is mandatory.
- Complications are—perforation; bleeding; hour-glass contracture; tea-pot deformity; malignant transformation and penetration into pancreas.
Benign gastric ulcer | Malignant gastric ulcer
---|---
Mucosal folds | Converging mucosal folds up to the margin | Effacing mucosal folds
Site | 95% lesser curve | Greater curvature
Margin | Regular margin | Irregular margin
Floor | Granulation tissue in floor | Necrotic slough in floor
Edge | Not everted; punched or sloping | Everted edge
Surrounding area | Normal surrounding area and rugae | Surrounding area shows nodules, ulcers and irregularities
Size and extent | Small, deep up to part of muscle layer | Large and deep

- Treatment is partial gastrectomy with Billroth I gastroduodenostomy.
- Gastric ulcer > 3 cm is giant gastric ulcer. It has got 6-23% chances of turning into carcinoma.

**Carcinoma Stomach**

**Pathology of Carcinoma of Stomach**

**Classification:**

**Gross types:**
- Cauliflower type.
- Ulcerative type.
- Leather-bottle (Linitis-plastica).

*Lauren’s classification:*
- **Diffuse type**—It has got poor prognosis. Linitis plastica and ulcerative types are of diffuse variety. Common in blood group A individuals.
- **Intestinal type**—Has got favourable prognosis. Polypoid and superficial types are of intestinal varieties. Common in *H. pylori* infection.
- **Others**
Fig. 3.12: Specimen of stomach showing thickening of pylorus—feature of carcinoma stomach. In Asian countries pylorus is the commonest site. In western countries proximal stomach is the commonest site.

Fig. 3.13: Specimen showing features of Linitis plastica—a diffuse type of carcinoma stomach mainly involving submucosa and deeper layer (mother of pearl appearance). It carries poor prognosis. It is type IV gastric carcinoma. It may be generalized or localized. It is 7-10% common. It is also called as leather—bottle stomach.

Depending on the depth of the lesion

a. Early gastric cancer is defined as involvement of mucosa and or submucosa only with or without any involvement of lymph nodes.

b. Advanced gastric cancer is defined as involvement of muscularis and or serosa with or without any involvement of lymph nodes.

Borrmann’s classification:

I. Circumscribed, single, polypoid carcinoma without ulceration.
Histological types

Adenocarcinoma—commonest. It could be intestinal (well differentiated), papillary, tubular/glandular. It can be diffuse—poorly differentiated. Mucinous or signet ring type can occur.

Aetiologies for gastric cancer

‘It is the captains of men of death’. It is more common in Japan.

Risk factors:

- Familial—10%. Napoleon and many members of his family died of carcinoma stomach.
- Gastric mucosa of people with blood group’ A’ is more susceptible for carcinogens.
- Gastric polyps.
- Pernicious anaemia—High-risk.
- Gastric remnant- 15 years after gastrectomy.
- Diet—High salt diet, food with more nitrosamines increases the risk.
- Fruits and vegetables rich in Vit. C protect from carcinoma stomach.
- Chronic gastritis (Atrophic, Autoimmune).
- Gastric dysplasia.
- Smoking, Alcohol.
- Helicobacter pylori infection—Cag A strain—high-risk.
- Agammaglobulinaemia—High-risk.
- Chronic benign gastric ulcer—risk is 0.1 to 1%. But it depends on size and chronicity of the ulcer and based on that it may be as high as 6-23%. Cancer developing in a previous benign gastric ulcer is called as ulcer cancer.
- Giant hyperplasia of gastric mucosal folds (Menetrier’s disease).
- Genetic factors—mutations of H ras oncogene and over expression of c-erb B2 gene may be involved in gastric cancers. APC gene involved in familial polyposis coli is also involved in 25% of gastric cancers. Increased incidence of gastric cancers are observed in hereditary non polyposis colorectal cancer (HNPCC).
TNM staging for gastric cancer (carcinoma stomach)

T  Tumour
T0 No primary tumour
Tis Carcinoma in situ
T1 Tumour involving mucosa and submucosa
T2 Tumour invading muscularis propria and subserosa
T3 Tumour invading the serosa but not adjacent organs
T4 Tumour invading the adjacent organs
N  Nodes
N0 No regional nodes
N1 Spread up to 1-6 nodes
N2 Spread up to 7-15 nodes
N3 Spread more than 15 nodes
M  Metastasis
M0 Metastasis not present
M1 Metastasis present

Intestinal metaplasia is of three types—
Type I: Mature; goblet cells secrete sialomucin.
Type II: Cells in different levels of dedifferentiation. Cells secrete sialomucin and an abnormal sialomucin (sulphomucin)—a small quantity.
Type III: Marked dedifferentiation of cells, secreting mainly sulphomucin.

SPECIMEN OF COLON—MULTIPLE POLYPOSIS OF COLON

Classification of Intestinal Polyps

a. Inflammatory.
b. Hyperplastic (Metaplastic).
c. Hamartomatous: Peutz-Jeghers’ polyp, Juvenile polyp, Cronkhite Canada syndrome
d. Adenomatous: (Neoplastic).
   Tubular (Pedunculated), tubulovillous, villous (sessile), FAP.
e. Others: Haemangiomia. Lipomas.

Figs 3.18A and B: Colectomy specimen showing multiple polyps.

Peutz-Jegher’s Polyp
- It is common in small intestine (jejunum) but can also occur in large intestine.
- Features are multiple, familial, hamartomatous intestinal polyps.
- Associated with melanosis of the oral mucosa, lips and occasionally digits.
- Microscopically it contains tree like branching filaments of mucosa with smooth muscle wall.
- It rarely turns into malignancy.

Complications: Bleeding or intussusception, when occurs requires surgery either resection—anastomosis or colonoscopic removal.

Adenoma of Colon
- It can be tubular, villous, tubulo-villous.
- It also can be solitary or multiple.
- They present with diarrhoea, mucus discharge, hypokalaemia, bleeding.
• It is potentially a malignant condition. Potentiality increase with—
  - The size of the adenoma.
  - Sessile nature.
  - Villous architecture.
  - Dysplasia.

Any adenoma more than 5 mm should be resected colonoscopically. Huge villous adenoma may require open surgical removal.

Familial Adenomatous Poly (FAP)
It is inherited as an autosomal dominant neoplastic condition. (Chromosome no.5- long arm—APC gene).

• Incidence is equal in both sex, commonly involving the large intestine but can also occur in stomach, duodenum and small intestine.
• It is familial with a high potential for malignant transformation.
• It can be associated with duodenal or ampullary carcinomas, Gardner’s syndrome (Desmoid tumour in the abdomen, osteomas (75%) and epidermoid cysts) and also Turcot’s syndrome (FAP + brain tumour (medulloblastoma or gliomas)—(autosomal recessive)).
• It presents in younger age group (15-20 years).
• Usually multiple (over 100).
• Presents with lower abdominal pain, loose stools with blood and mucus, weight loss.
• If there is no adenoma at the age of 30 years, then it is not FAP of colon.
• If not treated chance of turning into malignancy is almost 100%. Mean age of cancer development is 40 years.
• Investigations are double contrast barium enema and colonoscopy guided biopsy.
• Screening of all the members of the family is a must. Looking for pigment spots in retina (CHIRPES) and DNA tests for F.A.P are good screening methods, but cost and availability limits its use. Screening by colonoscopy begins at the age of 10 years and then yearly for up to the age of 20 years. If there are no polyps at the age of 20, then colonoscopy is done once in 5 years up to the age of 50 years.
• Treatment—Total proctocolectomy with permanent colostomy or total proctocolectomy with ileoanal anastomosis with ileal pouch is the treatment of choice. Pouchitis is the common problem in ileal pouch. Alternatively a conservative total colectomy with ileo rectal anastomosis can be done, but with a regular follow up with sigmoidoscopy for any rectal polyps. If polyps are present snaring of polyps should be done. Sulindac (a NSAID) given to these patients causes disappearance of polyps in the rectum.

Gardner’s syndrome:
FAP association is 10%. Presents with bone, skin, soft tissue and dental abnormalities. Jaw osteomas are very common. Other features are epidermoid cysts (> 50%), exostoses, fibromas, lipomas. Associated with desmoid tumours seen in the scar, abdomen, intra-abdominal region and mesenteric fibromatosis. Congenital hypertrophy of pigment layer of retina (seen as pigment spots)– Commonly seen. Often associated with MEN II b syndrome.

Turcot’s syndrome
• FAP
• Brain tumour—medulloblastoma/gliomas
• Autosomal recessive

Cronkhite-Canada syndrome
Not genetically related
Occurs in old age—60 years
Generalized GI polyposis—stomach and colon
Nail dystrophy, alopecia
Skin hyperpigmentation

SPECIMEN OF COLON—ILEO CAECAL TUBERCULOSIS
Abdominal tuberculosis is common in India and developing countries. It is 6th most common type of extra pulmonary tuberculosis. Incidence of abdominal tuberculosis and its severity is more in patients infected with HIV.
Fig. 3.19: Specimen of ileum and caecum showing multiple undermined ulcers—Tuberculous ulcers.

Routes of infection in abdominal tuberculosis
- Ingestion of infected sputum
- Blood spread
- Direct spread
- From lymph nodes through lymphatic channels
- Through fallopian tubes

Types
1. Intestinal
   Ileo-caecal region; commonly observed—Ulcerative (60%), hyperplastic, ulcero-hyperplastic.
   Ileal region; commonly observed—Stricture type.
2. Peritoneal tuberculosis—
   a. Acute.
   b. Chronic.
      1. Ascitic type.
      2. Encysted (loculated) type.
      3. Plastic (Fibrous/adhesive) type.
      4. Purulent type.
3. Tuberculosis of mesentery and its lymph nodes.
4. Anorecto-sigmoidal: Present as fistula, fissure, abscess, and mass.
5. Involvement of liver, spleen and other organs as a part of miliary tuberculosis.
6. Tuberculosis of the omentum.

Note:
- Chronic peritoneal tuberculosis may be associated with pleural effusion and pericardial effusion.
- Tuberculosis is not common in stomach, duodenum and jejunum.
- Diffuse tuberculous colitis is less commonly seen and it mimics ulcerative colitis in every respect even in colonoscopy. Patient recovers well with antituberculous drugs.
- Intestinal tuberculosis is called as Koenig's syndrome (1892).

Ileocaecal Tuberculosis
It is most common site of abdominal tuberculosis due to presence of abundant Peyer’s patches and stasis of luminal contents favored by ileo-caecal valve.

Causative organism
**Mycobacterium tuberculosis**
- Acid fast 20% H₂SO₄
- Alcohol fast
- Gram neutral

Histology
- Epithelioid cells—diagnostic
- Langhans giant cells
- Features of granuloma
- Caseating necrosis

It is presently due to *Mycobacterium tuberculosis*, earlier used to be due to *Mycobacterium bovis*. Mode of infection may be direct or blood spread, usually from lungs.

Types of Ileocaecal Tuberculosis
- Ulcerative—commonest (60%). Circumferential, transverse, often multiple 'girdle' ulcers—with skip lesions.
• Hyperplastic (10%): Fibroblast reaction in submucosa and subserosa causing thickening of bowel wall and enlargement lymph node, leading to nodular mass (tumour-like) formation. It is common in young individual; it is due to infection by less virulent, less volume organism; in presence of adequate host resistance.

• Ulcero-hyperplastic—30%—features of both

Clinical features of ileocaecal tuberculosis

• Anaemia, loss of weight and appetite.
• Diarrhoea—10-20%.
• Fever—50-70%.
• Mass in right iliac fossa, (35%) which is hard, nodular, non-mobile, nontender with impaired resonance, which may mimic carcinoma caecum. Subacute obstruction can occur.

Ileocaecal region is common site due to—

• Stasis of the content
• Abundant Peyer’s patches—organism gets trapped easily
• Contact time of bacteria with mucosa is greater
• M cells in Peyer’s patches phagocytose bacilli and transfer to host cells
• Liquid content in the region
• More absorption of fluid and electrolytes here

Differential diagnosis of ileocaecal tuberculosis

• Carcinoma caecum
• Amoeboma
• Appendicular mass
• Ectopic kidney
• Retroperitoneal tumour
• Lymph node mass
• Psoas abscess
• Crohn’s disease

Ileocaecal tuberculosis can be associated with adeno carcinoma of caecum, or large bowel lymphoma or HIV.

Often ileocaecal TB can cause intestinal obstruction.

Note: Abdominal pain (90%) is the most common symptom—(dull colicky pain) colicky in intestinal type; dull in mesenteric type.

Investigations

• Chest X-ray to find out primary focus.
• Mantoux test; ELISA; SAFA (Soluble Antigen Fluorescent Antibody) test; serum immunoglobulin assay.
• ESR is raised.
• Ultrasound abdomen to see ascites, caecal thickening, nodal status and other organs.
• Plain X-ray abdomen, if presentation is of intestinal obstruction. It often shows calcification.
• Anticord factor antibody analysis to differentiate from Crohn’s disease.

Barium study X-ray (Enteroclysis followed by barium enema or barium meal follow through X-ray)

1. Increased transit time; flocculation of barium—early sign
2. Pulled up caecum and goose neck deformity due to fibrosis, shortening and retraction of the ascending colon and ileocaecal segment
3. Obtuse ileocaecal angle
4. Hurrying of barium due to rapid flow (Stierlin’s sign) and lack of barium in inflamed bowel
5. Narrow ileum with thickened ileocaecal valve (Fleischner sign)(Inverted umbrella sign)
6. Calcifications
7. Incompetent ileocaecal valve.
8. Ulcers and strictures in the terminal ileum and caecum—Napkin lesions.
9. String sign—persistent narrow stream with proximal mega ileum
10. Hypersegmentation of the intestine—chicken intestine

• Colonoscopy is of value to rule out carcinoma. It is easiest and most direct method in establishing the diagnosis.
• Laparoscopy is very useful method of investigation. Biopsy can be taken from omentum, peritoneum, nodes and suspected areas. Ascitic fluid can be collected for analysis.
• Abdominal CT scan is better and more reliable. Very useful.
• PCR assay of endoscopically biopsied tissue or of ascitic fluid.
• Stool culture for AFB.
• Blind percutaneous needle peritoneal biopsy using Cope’s/Abraham’s needle is also practiced.
• Capsule endoscopy to see small bowel.
• Transabdominal peritoneoscopy using regular endoscope (gastroscope) and biopsy.
• Ascitic tap fluid analysis.

**Ascitic fluid in abdominal tuberculosis**
- Exudative with protein level > 2.5 g/dl; specific gravity more than 1.016
- Serum-ascitic fluid albumin gradient is < 1.1
- Lymphocyte predominant cells with count as high as 4000/mm³ (> 250 cu mm³)
- Glucose < 30 mg%
- AFB in ascitic fluid is seen in only < 3% cases
- ADA (Adenosine De-aminase) activity in ascitic fluid (95% specificity and 98% sensitivity)

**Ultrasound features observed in abdominal tuberculosis**
- Thickened bowel wall, mesentery, omentum, and peritoneum
- Loculated ascites with fine septae within
- Interloop ascites with alternate echogenic and echofree areas—Club-sandwich appearance
- Bowel loop radiates from its mesenteric root—Stellate sign
- Mesenteric thickness more than 15 mm concentric and uniform thickening in tuberculosis whereas in Crohn’s mesentery is eccentric

**CT findings in abdominal tuberculosis**
- Performed after oral diluted barium – CT enteroclysis; intravenous water soluble dye also injected to get still better contrast
- Diagnostic yield is as equal as barium study
- Thickening of bowel wall, its site, extent and severity
- Thickening of ileocaecal valve
- Mesenteric nodes; mesenteric thickening
- Adhesions, ascites, obstruction
- Peritoneal nodules—multiple
- Solid organ granulomas
- CT guided FNAC is possible

**Treatment**
- Anti-tuberculous drugs—INH, Rifampicin, Ethambutol, Pyrazinamide is started.
- During the period of treatment, patient might go in for intestinal obstruction due to fibrosis and stricture formation. So ideally after 3 weeks of starting of ATD, often limited ileo-caecal resection with 5 cm normal adjacent gut or segmental resection is done; rarely hemicolec- tomy is required.
- Occasionally ileo-transverse anastomosis is done to bypass the caecal region. But this is not a good surgery compared to resection, as tuberculous focus is still retained.
- **Stricturoplasty** is also very useful procedure.

**Complications of abdominal/ileocaecal tuberculosis**
- Obstruction
- Malabsorption, blind loop syndrome.
- Dissemination of tuberculosis to other areas of abdomen as well as extra abdominal sites
- Faecal fistula
- Cold abscess formation.
- Haemorrhage, perforation (rare)
- **Note:** Perforation is rare in GIT tuberculosis but can occur
## Differences between ulcerative and hyperplastic types of ileocaecal tuberculosis

<table>
<thead>
<tr>
<th>Ulcerative type</th>
<th>Hyperplastic type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Secondary to pulmonary tuberculosis</td>
<td>1. Primary GIT tuberculosis, could be due to bovine bacilli</td>
</tr>
<tr>
<td>2. Virulent organism</td>
<td>2. Less virulent organism</td>
</tr>
<tr>
<td>3. Poor body resistance, old people</td>
<td>3. Good body resistance, young individual</td>
</tr>
<tr>
<td>4. Multiple transverse ulcers commonly in the ileum, often in the caecum region</td>
<td>4. Chronic granulomatous lesion in the ileocaecal region</td>
</tr>
<tr>
<td>5. Clinically presents with diarrhoea, bleeding P/R, loss of appetite and reduced weight</td>
<td>5. Presents as a mass in right iliac fossa</td>
</tr>
<tr>
<td>7. Chest X-ray shows primary lesion</td>
<td>7. No primary lesion in chest X-ray</td>
</tr>
<tr>
<td>8. Barium study shows ileal strictures with hypermotility</td>
<td>8. Barium study—Pulled up caecum, obtuse ileocaecal angle</td>
</tr>
</tbody>
</table>

### Ileal tuberculosis
- It is usually **stricture** type
- It may be multiple
- It usually presents with intestinal obstruction
- Bowel adhesion, localization, fibrosis, secondary infections are quiet common
- Perforation though rare culminates in peritonitis
- Plain X-ray shows multiple air fluid levels.
- Treatment is **resection and anastomosis and to continue anti TB drugs**
  Often **stricturoplasty** is beneficial

### Peritoneal Tuberculosis
- Post-primary.
- Becoming more common.
- Activation of long-standing latent focus.
- Blood spread.
- Can develop from diseased mesenteric lymph node, intestine or fallopian tubes.

### Pathology in Peritoneal Tuberculosis
- Enormous thickening of the parietal peritoneum with multiple tiny yellowish tubercles.
- Dense adhesions involving peritoneum and omentum with small bowel as content inside looking like **abdominal cocoon**. It may precipitate intestinal obstruction.
- Multiple dense adhesions between bowel loops; between bowel and peritoneum and omentum.
- Thickening of bowel wall with adhesions
- Infection may be from blood, contiguous spread or from fallopian tubes

### Types of Peritoneal Tuberculosis

**Acute type**—mimics acute abdomen.
Exploratory laparotomy reveals straw-colored fluid with tubercles in the peritoneum, greater omentum and bowel wall. It is an on-table diagnosis. Fluid is evacuated and collected for AFB study and culture. Omental biopsy is taken. Abdomen is closed (without a drain) with tension sutures to prevent burst abdomen. ATD is started.

### Acute peritoneal tuberculosis
- Rare
- On-table diagnosis
- Features of peritonitis
- Due to perforation, or rupture of mesenteric tuberculous lymph nodes
Chronic type: Tuberculous peritonitis. Present as abdominal pain, fever, ascites, loss of weight and appetite, abdominal mass, doughy abdomen (10%). Peritoneum is thickened with multiple tubercles. Omentum is thick, fibrosed, rolled up.

Infection is usually from mesenteric lymph nodes, ileocecal tuberculosis, from fallopian tubes rarely blood born (from lungs).

Diagnostic laparoscopy is very useful.

Ascitic form
- Ascitic form shows enormous distension of abdomen with dilated veins.
- It presents with congenital hydrocele in male with patent processus vaginalis, umbilical hernia, rolled up omentum, shifting dullness, fluid thrill, and mass abdomen.
- Ascitic tap reveals straw colored fluid from which AFB can be isolated. Fluid is pale yellow, clear, rich in lymphocytes, with high specific gravity.
- Chest X-ray, Mantoux tests are other required investigations to be done.
- ATD’s for one year is required. Repeat tapping may be initially required as part of the treatment.

Encysted (Loculated) Ascites
- Ascites gets loculated because of the fibrinous deposition.
- Dullness, which is not shifting, is the typical feature.
- They may present as intra abdominal mass, which may mimic ovarian cyst, retroperitoneal cyst or mesenteric cyst.
- Treatment is ultrasound guided aspiration along with ATD’s.

Plastic type
- Here there are wide spread adhesions between the coils of the intestine (ileum commonly), abdominal wall, omentum, with distension of the small bowel, leading to blind loop, ileus, intestinal obstruction (subacute, acute), thickened parietal peritoneum.
- They get recurrent colicky abdominal pain, diarrhoea, wasting, and loss of weight, mass abdomen, and doughy abdomen.
- Differential diagnosis: Peritoneal carcinomatosis. Open/laparoscopic peritoneal biopsy is very useful tool to diagnose.
- They respond well for drug treatment. Surgery is indicated if obstruction occurs.

Purulent form
- It is invariably due to tuberculous salpingitis, presenting as a mass in the lower abdomen containing pus, omentum, and fallopian tubes, small and large bowel.
- Cold abscess gets adherent to the abdominal wall, umbilicus and may form an umbilical fistula.
- Patient commonly has got genitourinary tuberculosis.
- Ultrasound, discharge study, X-ray abdomen and other investigations are useful.
- Treatment: ATD’s are started; exploration of umbilicus, exploration of fistula and bowel by pass is done.
- Prognosis is poor in this type.

Tuberculous Mesenteric Lymphadenitis
- Infection is usually through the Peyer’s patches of the intestine (i.e. through oral cavity). Usually several lymph nodes are involved often causing massive lymph node enlargement. Commonly right-sided lymph nodes are involved, but left sided nodes can also get involved.
- It presents with general symptoms (fever, malaise, weight loss).
- Pain in umbilical region and right iliac fossa, mass in right iliac fossa, which is matted, nonmobile.
- It may present with features of acute appendicitis.
- Often coils of intestine get adherent to the caseated mesenteric lymph nodes leading to intestinal obstruction.
- Most often caseating material may collect between the layers of the mesentery, forming
a cold abscess, mimicking a mesenteric cyst (Pseudo-mesenteric cyst).
• Massive enlargement of mesenteric lymph nodes due to tuberculosis is called as tabes mesenterica.

**Presentations of mesenteric tuberculous lymphadenitis**
• Mesenteric tuberculous adenitis—acute/chronic in right iliac fossa
• Pseudomesenteric cyst
• Cold abscess within the mesentery
• Tabes mesenterica

**Tuberculosis of the omentum**
• It usually occurs as a part of the other types of abdominal tuberculosis
• Rolled up omentum with thickening is characteristic
• Often cold abscess can develop per se in the omentum
If it is so it can be dealt with laparoscopy safely under the cover of ATD’s.

**SPECIMEN OF INTESTINE SHOWING CROHN’S DISEASE**

It is a granulomatous, noncaseating inflammatory condition of the ileum commonly and of the colon often.

**Aetiology**
Unknown, but a familial and infective nature is thought of.

**Clinical Features**

a. *Acute presentations*: (5%) of Crohn’s disease mimics acute appendicitis with severe diarrhoea. Often there will be localized or diffuse peritonitis.

b. *Chronic Crohn’s*
• First stage - Mild diarrhoea, colicky pain, fever and tender, firm, nonmobile mass in right iliac fossa with recurrent perianal abscess.
• Second stage is either acute or chronic intestinal obstruction due to cicatrisation with narrowing.
• Third stage - Fistula formation - enterocolic, enteroenteric, enterovesical, enterocutaneous, etc.

Crohn’s disease is independent of age, sex, social and economic status and geographic area. It is often familial.
It is pre-cancerous condition but not as much as ulcerative colitis.

Investigations

**Barium meal follow through shows**
- Straightening of valvulae conniventes
- Multiple defects (cobble-stone appearance)
- Cicatrisation of ileum (string sign of Kantor)
- Rose thorn appearance of the bowel wall
Radiologically Crohn’s disease is classified as **non-stenosing type or stenosing type**

Treatment

**Medical**
- Bed rest, high protein diet, vitamin supplement.
- Antibiotics—Sulphathalidine; Salazopyrine
- Steroids, azathioprine.

**Surgery**

**Indications**
- Failure of medical treatment.
- Intestinal obstruction.
- Fistula formation.

**Surgeries:**
- Right hemicolecction (Common procedure done because commonly ileocaecal region is involved).
- Segmental resection.
- Total colectomy and ileo-rectal anastomosis.
- Strictureplasty.
- Temporary ileostomy.
*Per se* appendectomy should not be done in Crohn’s, as it may lead on to external fistula.

Complications of Crohn’s
- Intestinal obstruction
- Stricture
- Bleeding
- Fistula formation
- Carcinoma
- Perianal abscess
- Peritonitis
- Pericolic abscess

Differential Diagnosis
- Intestinal tuberculosis.
- Carcinoma ileum or caecum.
- Differential diagnosis for mass in the right iliac fossa (carcinoma caecum, actinomycosis, appendicular mass, ileocaecal TB, ectopic kidney, mesenteric lymphadenitis, etc).

SPECIMEN OF COLON—ULCERATIVE COLITIS

An inflammatory condition of rectum and colon of unknown etiology perhaps related to stress, westernized diet, autoimmune factor, familial tendency, allergic factor.

**Fig. 3.21:** Specimen showing multiple pseudopolyps in the colon—a typical feature of ulcerative colitis.
Disease commonly starts in the rectum, spreads proximally to the colon and often into the ileum as back wash ileitis.

Pathology

| To begin with, multiple minute ulcers occurs, with proctitis and colitis |
| These ulcers extends into the deeper layer |
| Spasm of the bowel |
| Stricture of the colon |
| Permanently contracted colon |
| In between ulcers, epithelial thickening occurs which appears like polyps |

Pseudopolyposis

Clinical Features
- More common in females, begins in 3rd decade.
- Watery diarrhoea, mucus or blood stained discharge per rectum.
- Colicky pain, spasms.
- Decreased appetite and loss of weight.
- Relapses and remissions at regular intervals.

Presentation
Two types of presentations:

a. **Fulminant type** 5% common.
   - It is a severe form, with continuous diarrhoea with passage of blood, mucus and pus.
   - Patient is ill and dehydrated.
   - Mimics fulminant amoebic colitis; severe typhoid and dysentery.
   - Abdominal distension occurs.
   - May go for acute toxic dilatation (1.5%) in transverse colon where in the diameter of transverse colon > 6 cm. It has high mortality and requires emergency surgery i.e. either colostomy or resection with ileostomy and later ileo-anal anastomosis.

b. **Chronic type** (95%) Lasts for months and years with diarrhoea, blood loss, anaemia, invalidism, abdominal discomfort and pain.

Investigations
- Barium enema - shows loss of haustations, narrow contracted colon (hose pipe colon), mucosal changes, and pseudo polyps. **It is avoided in fulminant cases.**
- Sigmoidoscopy and biopsy.
- Colonoscopy also is required.
  - Due to very high incidence of malignant transformation in ulcerative colitis (10-20%), multiple biopsies should be taken from suspected areas of the colon. **Risk increases with age of the patient and duration of the disease (20%).**

Complications
1. Pseudopolyposis
2. Turning into malignancy
3. Stricture formation commonly in recto sigmoid and anal canal
4. Toxic megacolon in transverse colon
5. Massive haemorrhage
6. Fistula in ano, piles
7. Liver cirrhosis (50%)
8. Skin lesions
9. Arthritis; iritis, ankylosing spondylitis
10. Sclerosing cholangitis, carcinoma of gall bladder.

Treatment
- General: Fluid and electrolyte supplementation.
- Nutrition (high protein, carbohydrate, vitamin, but low fat).
- Sedatives and tranquilizers.
- Drugs: Salazopyrine; Sulphathalazine; Steroids (as retention enema and systemic therapy).
- Mebeverine HCl (Colospa).

Indications for Surgery
- Toxic dilatation.
- Perforation.
- Haemorrhage.
• Risk of malignant transformation.
• Early age group onset.
• Chronic invalidism.

**Surgeries**
2. Total proctocolectomy with ileostomy (permanent).
3. *Total colectomy* with colorectal anastomosis. Proper follow up at regular intervals by regular sigmoidoscopy evaluation should be done as rectum is also diseased and vulnerable for complications.

**SPECIMEN OF COLON**

**Carcinoma Colon**
Adeno carcinoma—commonest type.
Sigmoid colon (21%) is the commonest site of malignancy after rectum (38%).
In caecum it is 12% common.

*Gross types:* Annular; Tubular; Ulcerative; Cauliflower like.

**Annular (Stenosing) Type**
It is more common on left side. Here the growth spreads round the internal wall and so it often presents with intestinal obstruction.

---

**Fig. 3.22:** Specimen of ascending colon, caecum, ileum and appendix – right hemicolecotony specimen. It shows proliferative localized lesion in the caecum.

**Fig. 3.23:** Specimen of ascending colon, ileum showing large proliferative lesion with narrowing feature of carcinoma colon.

**Fig. 3.24:** Specimen showing growth in the transverse colon with narrowing.

**Fig. 3.25:** Specimen of descending colon showing small proliferative tumor—carcinoma colon. Usually it is of constrictive type with obstructive presentation.
Ulcerative Type
It is common on right side. Anaemia, loss of appetite and mass in right iliac fossa are the presentations.

Histology
It is commonly adenocarcinoma. Rarely adenosquamous, and squamous carcinoma can occur.

Aetiologies of Carcinoma Colon
- **Diet:** Frequent intake of red meat and saturated fat increases the incidence of colonic cancer. Cholesterol increases the bile acid concentration in the intestinal lumen which acts as cocarcinogen. High fiber diet protects the colon against cancer.
- **Genetic:** Carcinoma colon is more common in individuals with adenoma colon or with familial adenomatous polyposis (FAP).
- Long standing ulcerative colitis – risk is 1% per year after 10 years of onset of the disease.
- Alcohol and cigarette smoking increases the risk.

### Staging of carcinoma colon

<table>
<thead>
<tr>
<th>DUKE’S</th>
<th>Astler—Coller’s</th>
<th>TNM staging</th>
<th>LVR staging</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Confined to bowel wall, mucosa and submucosa</td>
<td>A. Intramucosal</td>
<td>Tis Carcinoma in situ</td>
<td>L Lymphatic vessel invasion</td>
</tr>
<tr>
<td>B. Extends across the bowel wall to the muscularis propria with no lymph nodes involved</td>
<td>B1 Involvement up to muscularis propria</td>
<td>T1 Submuosal invasion</td>
<td>L0 Lymphatic vessel not involved</td>
</tr>
<tr>
<td>C. Lymph nodes are involved</td>
<td>B2 Spread through the wall in to peritoneum</td>
<td>T2 Muscularis invasion</td>
<td>L1 Lymphatic vessel involved</td>
</tr>
<tr>
<td>Modified Duke’s</td>
<td>B1 Invading muscularis mucosa</td>
<td>T3 Invasion into pericolic fat</td>
<td>V—Venous invasion</td>
</tr>
<tr>
<td>A Growth limited to rectal wall</td>
<td>B2 Invading in to or through the serosa</td>
<td>T4 Extraperitoneal involvement/adjacent organs</td>
<td>V0 No venous invasion</td>
</tr>
<tr>
<td>B Growth extending in to extra-rectal tissues but no lymph node spread</td>
<td>C Lymph node secondaries</td>
<td>N0 No nodes</td>
<td>V1 Venous invasion present</td>
</tr>
<tr>
<td>B1 Invading muscularis mucosa</td>
<td>D Distant spread to liver, lungs, bone, and brain</td>
<td>N1 Up to 3 nodes</td>
<td>R—Residual tumor after surgery</td>
</tr>
<tr>
<td>B2 Invading in to or through the serosa</td>
<td></td>
<td>N2 4 or more nodes</td>
<td>R0 Residual tumour not present</td>
</tr>
<tr>
<td>C Lymph node secondaries</td>
<td></td>
<td>M0 No metastasis</td>
<td>R1 Resected tumour margin is positive or residual tumour is present</td>
</tr>
<tr>
<td>D Distant spread to liver, lungs, bone, and brain</td>
<td></td>
<td>N1 Metastasis present</td>
<td></td>
</tr>
</tbody>
</table>
Hereditary Nonpolyposis Colonic Cancer (HNCC)  
- Autosomal dominant.  
- No polyps.  
- Three members of the family have colonic cancers.  
- Two first degree relatives have the same cancer.  
- Two consecutive generations observed.  
- One relative, less than 50 years age will have colonic cancer.  
- Lynch syndrome I is site specific; commonly on right side colon; 40% are metachronous; early age onset is common.  
- Lynch syndrome II has associated other malignancies in stomach, breast, ovary, endometrium and urinary bladder. It is cancer family syndrome.

Note: Aspirin and other NSAID’s protect against colonic cancer.

Types  
- Patient can have denovo, multiple, primary carcinomas in different parts of the colon at same time, i.e. synchronous (5%).  
- Patient can present with growth in different parts of the colon in different periods i.e. metachronous (2-5%).

SPECIMEN OF CARCINOMA OF RECTUM

See Figures 3.26A and B.

SPECIMEN OF CARCINOMA OF PENIS

- Premalignant conditions of carcinoma penis – leukoplakia, condyloma acuminata (by human papilloma virus), erythroplasia of Querat, balanitis xerotica obliterans, phimosis and balanoposthitis.  
- Buschke Lowenstein locally invasive verrucous carcinoma is a large exophytic tumour which does not spread through the lymph nodes.
Jackson’s staging of carcinoma penis

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
<th>Survival Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Tumour involving only glans/prepuce/both</td>
<td>90% five-year survival</td>
</tr>
<tr>
<td>II</td>
<td>Tumour extending into body of penis</td>
<td>70%</td>
</tr>
<tr>
<td>III</td>
<td>Tumour having mobile inguinal nodes</td>
<td>50%</td>
</tr>
<tr>
<td>IV</td>
<td>Tumour spreading to adjacent structures/fixed nodes</td>
<td>5%</td>
</tr>
</tbody>
</table>

TNM staging

- **T0**: No primary tumour
- **Tis**: Carcinoma in situ
- **T1**: Tumour < 2 cm without deep invasion
- **T2**: Tumour between 2-5 cm with minimal deep invasion
- **T3**: Tumour > 5 cm with deep invasion/urethral spread
- **T4**: Tumour spread to adjacent tissues

- **N0**: No nodal spread
- **N1**: Mobile regional nodes—unilateral
- **N2**: Mobile regional nodes—bilateral
- **N3**: Fixed regional nodes

- **M0**: No distant spread
- **M1**: Distant spread present

---

Fig. 3.27: Specimen showing features of carcinoma penis. Proliferative lesion in the corona is seen with involvement of glans penis. Tumour involves almost circumferentially. Everted edge is obvious. Commonly it is squamous cell carcinoma. But adenocarcinoma from Tyson’s glands, basal cell carcinoma, melanoma and secondaries (from prostate and urinary bladder) can occur rarely.

- Carcinoma penis spreads through the horizontal inguinal nodes, to deep Cloquet nodes, and eventually to external iliac nodes. Nodes may get fixed to cause lymphoedema, erosion of femoral vessels. Fungation at the site of nodal spread also can occur.

- Presents as painless indurated/ulcerative/proliferative lesion which is hard and often infected. Altered urinary stream can occur.

- Edge biopsy of penile lesion; FNAC of inguinal lymph node; ultrasound of abdomen to see external iliac nodes; SLNB (Sentinel Lymph Node Biopsy) of Cabanas node are the investigations required.

- If growth involves the glans without extending into the proximal part of the shaft of the penis, then partial amputation of the penis is done. A length of 2.5 cm stump is retained. Clearance of 2 cm from the proximal extended part of the tumour is needed. Advantage is proper streaming of the urine is possible.

- Partial amputation of penis with bilateral ilioinguinal lymph node block dissection is called as Young’s operation.

- If tumour involves the proximal part of the body of penis or if it is anaplastic/poorly differentiated tumour total amputation of penis is done with perineal urethrostomy. Problems with perineal urethrostomy are scrotal ammoniacal dermatitis and stricture at urethrostomy site. Dermatitis is prevented by asking the patient to urinate in sitting position with lifting the scrotum upwards. Stricture needs dilatation.
• Total scrotectomy with orchidectomy is done along with total amputation of the penis – *Sir Piersey Gold operation*. It prevents frequent dermatitis of the scrotal skin because of the perineal urethrostomy and also reduces the sexual desire.

• When lymph nodes are involved and are mobile, bilateral ilioinguinal nodal dissection is done. *Primary inguinal block* is doing block dissection within 4 weeks of surgery for primary tumour. *Secondary inguinal block* is doing block dissection after 4 weeks of surgery for primary disease. Complications of ilioinguinal block dissection are flap necrosis, lymphoedema of lower limb, femoral blow out, infection, lymphorrhoea and haemorrhage. If primary tumour is poorly differentiated, and if tumour is T2 or above chances of inguinal nodal spread is more than 50% and so a prophylactic inguinal nodal dissection is done.

• Half the time, involvement of inguinal nodes may be due to infection. So often a trial of antibiotic therapy is given for 4-6 weeks to reduce the size of the inguinal node.

• In case of carcinoma *in situ*, T1 lesion of glans penis or well differentiated tumour in young individual, circumcision and curative radiotherapy to the penis can be given using radioactive tantalum wire implantation (6000 cGy in 7 days) or by wearing radium penile mould continuously or intermittently (6000 cGy in 7 days) or by linear accelerator external beam radiotherapy (6000 cGy in 5 weeks). Involvement of nodes in these patients is less than 10%.

  *Dresslers quadrangle* – upper border is line joining anterior superior iliac spine and pubic tubercle; laterally line joining anterior superior iliac spine and a point 20 cm below it; medially pubic tubercle and a point 15 cm below it. Nodal block dissection for carcinoma penis should cover this area adequately.

• *Elective prophylactic inguinal block* is done in high risk group – invasive carcinoma; T2 and T3 tumours; with vascular invasion.

• *Therapeutic inguinal block* is done whenever FNAC of node shows positive tumour.

• *Superficial lymph node block* is dissection superficial to fascia lata in N0 disease.

• *Standard inguinal lymphadenectomy/block* is classical block dissection.

• *Modified inguinal block dissection* is—small incision, limited dissection, preservation of saphenous vein.

### HYDROCELE, HAEMATOCELE AND PYOCELE

See Figures 3.28 to 3.33.

Figs 3.28A and B: Picture showing hydrocele fluid which is amber colored. It contains water, salt, albumin and fibrinogen. It clots only if the fluid comes in contact with blood because of the calcium in the blood. It often contains cholesterol and tyrosine crystals. Hydrocele can be vaginal, congenital, infantile, encysted, bilocular or hydrocele of hernial sac.
Fig. 3.29: Haematocele showing brownish coloured fluid in the sac. It can be acute and recent or it can be chronic and clotted. In acute, recent type exploration is done under general anaesthesia followed by evacuation. In old haematocele testis may not be viable and so orchidectomy is needed.

Fig. 3.30: Chylocele fluid is whitish lymph rich in cholesterol. It is non-transilluminant and gets infected very easily. It is seen in filarial disease.

Fig. 3.31: Pyocele of the scrotum. It is pus collection in the tunica vaginalis testis. Because of tension and infective thrombosis of the testicular artery, viability of the testis is often lost. Patient presents with fever, toxicity and tenderness in the scrotum. Early surgical exploration and drainage of pus is required. Scrotal sac is kept open and later when infection comes under control secondary suturing is done. Often needs orchidectomy if testis is not viable.

Fig. 3.32A: Large sebaceous cyst—excised specimen with sebum inside.

Fig. 3.32B: Specimen showing uterus and cut section of ovary. Cut section of ovary shows sebum—a feature of teratomatous ovary.

**SPECIMEN OF PANCREAS**

See Figure 3.33.

**SPECIMEN OF PERIAMPELLARY CARCINOMA OF PANCREAS**

Periampullary Carcinoma is Tumour Arising at or Near the Ampulla

It could be:

- Adenocarcinoma from head of pancreas close to the ampulla—50%.
Cystadenocarcinoma is common in the body of pancreas. Usually present as mass in epigastrium, which does not move with respiration, non mobile, resonant on percussion with palpable stomach in front. It may often present with back pain. Jaundice is not common. CT scan is diagnostic. Treatment is distal pancreatectomy. It should be differentiated from pseudocyst of pancreas, retroperitoneal tumor/cyst.

Different presentations in periampullary carcinoma are:

- Obstructive jaundice – progressive, short duration, severe and initially painless.
- Pain – is more in carcinoma head of pancreas; in the epigastrium; and is due to duct dilatation and infiltration of pancreatic capsule. It radiates to back and is also severe when retropancreatic nerves (greater splanchnic nerves) are involved.
- Loss of appetite and weight loss.
- Steatorrhoea/clay colored stool; silvery stool is common in periampullary carcinoma as blood bled from necrosed periampullary tumour mixes with the clay stool.
- Palpable gall bladder—globular, smooth, soft, nontender, moves with respiration, dull on percussion (palpable in 30% of carcinoma head of pancreas, 50% of periampullary carcinoma of pancreas).
- Palpable liver—smooth and soft if it is due to hydrohepatosis (bile stasis); hard and nodular if it is due to secondaries.
- Itching marks all over the body is present due to increased bile salts; more prominent on the dorsal aspect of forearms, hands and back.
- Dark coloured urine—tea colored urine; migratory thrombophlebitis – 10% (Trousseau’s sign).
- If tumour is from head of pancreas, occasionally primary tumour may be palpable as deep, hard, nodular, non mobile, resonant mass in upper abdomen adjacent to umbilicus.
- Splenomegaly due to splenic vein thrombosis (10%) or secondary biliary cirrhosis can occur.
- Ascites, palpable supraclavicular lymph node (Virchow’s), secondaries on rectal examination (Blumer’s shelf), Sister Mary Joseph nodule in the umbilicus are the features of advanced tumour.
- Courvoisier law—in a patient with jaundice if there is palpable gall bladder it is not due to stones. It is probably due to carcinoma periampullary region/head of pancreas/distal bile duct. Stones cause recurrent cholecystitis, followed by fibrosis and so gall bladder is not capable to distend. Double impacted stone is the exception to law.
- Rarely as upper gastrointestinal haemorrhage either due to portal hypertension or due to duodenal wall invasion by the tumour. Major aetiologies are smoking, alcohol,
**ERCP signs**
- Abrupt block of pancreatic duct
- Pancreatic duct encasement
- Double duct sign
- Parenchymal filling
- Scrambled egg appearance

**Important investigations**
- Spiral CT/3D CT is ideal – to detect operability, portal vein invasion, size, extent, nodal status
- ERCP to take biopsy/brush cytology, stenting, to see the luminal extent of the tumour

**Barium meal X-ray**
- Is rarely done in periampullary carcinoma
- Rose thorn appearance in hypotonic duodenography
- Reverse 3 sign in periampullary carcinoma
- Pad sign—widened C loop of duodenum in carcinoma head of pancreas
- Gastric outlet obstruction features

<table>
<thead>
<tr>
<th>TNM staging of pancreatic carcinoma (UICC – Union International Center for Cancer)</th>
<th>Preoperative preparation in carcinoma pancreas</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 Primary limited to pancreas – T1a &lt; 2 cm; T1b - &gt; 2 cm</td>
<td><strong>Adequate hydration</strong> and prevention of dehydration postoperatively is important. Dehydration is common in obstructive jaundice</td>
</tr>
<tr>
<td>T2 Primary tumour extension to duodenum, bile duct, peripancreatic tissue</td>
<td><strong>Glycogen reserve in liver will be inadequate which should be replenished by giving preoperative glucose orally or intravenously</strong></td>
</tr>
<tr>
<td>T3 Primary tumour extending into stomach, spleen, colon, major vessels</td>
<td></td>
</tr>
<tr>
<td>N0 No involvement of lymph nodes</td>
<td></td>
</tr>
<tr>
<td>N1 Lymph nodal spread present</td>
<td></td>
</tr>
<tr>
<td>M0 No distant spread</td>
<td></td>
</tr>
<tr>
<td>M1 Distant blood spread present</td>
<td></td>
</tr>
<tr>
<td>R0 No residual tumour found after resection</td>
<td></td>
</tr>
<tr>
<td>R1 Microscopic residual tumour after resection</td>
<td></td>
</tr>
<tr>
<td>R2 Macroscopic residual tumour after resection</td>
<td></td>
</tr>
<tr>
<td>R3 Inoperable</td>
<td></td>
</tr>
</tbody>
</table>
• Patient is prone for hepatorenal syndrome leading into renal failure postoperatively due to sludging of the bile salts, due to toxins and sepsis and so mannitol should be given intravenously for 3 days prior to surgery to flush the kidney (200 ml IV twice a day)
• ERCP stenting is done to drain bile if serum bilirubin is high. Surgery is done after 2-3 weeks once bilirubin level drops down adequately. If ERCP is not possible then percutaneous transiliary drainage (PTBD) or cholecystostomy using Foley’s or Malecot’s catheter is done
• Antibiotics one day prior to surgery – cephalosporins/aminoglycosides
• Often TPN may be required preoperatively also which is continued postoperatively
• Pulmonary function study and respiratory physiotherapy to have adequate post operative pulmonary function

Treatment of carcinoma pancreas
10-15% of pancreatic carcinomas (head) are operable. 40-50% are locally advanced. Another 40-50% have distant spread to liver or lungs.

Criteria for resection
• Tumour size less than 3 cm
• Peri ampullary tumours
• Growth not adherent to portal system

In operable cases
• Whipple’s operation is done by removing tumour with head and neck of pancreas, C loop of duodenum, 40% distal stomach, 10 cm proximal jejunum, lower end of the common bile duct, gallbladder, peripancreatic, pericholedochal, paraduodenal and perihepatic nodes. Continuity is maintained by choledochojejunostomy, pancreaticojejunostomy and gastrojejunostomy. Few do pancreaticogastrostomy into posterior wall of the stomach. Mortality in Whipple’s operation is 2-8%. Original Whipple’s operation (1935) was two staged – initial by pass and a second stage resection with closure of pancreatic stump. In 1941, Trimble did one stage pancreaticojejunostomy.
• Traverso–Longmire pylorus preserving pancreaticoduodenectomy (1978)—Here 2 cm distal to the pylorus duodenum is cut and continuity is maintained by anastomosing with jejunum.
• Fortner’s regional pancreatectomy (extended Whipple’s). Here in addition to Whipple’s resection, segment of superior mesenteric vein is resected along with clearance of all regional nodes; and continuity of portal vein is maintained by a synthetic vascular graft. Even though technically it gives adequate clearance, results are only equivocal.
• Total pancreatectomy is presently said to be better. Reasons are – possibility of multicentric nature of the disease, higher chance of recurrence after Whipple’s operation, malignant cells may be present in pancreatic duct, morbidity by pancreatic fistula or pancreatitis after Whipple’s operation. Mortality in total pancreatectomy is higher (10-20%). Severe resistant diabetes mellitus may be seen after total pancreatectomy.

In inoperable cases
• Roux en Y choledochojejunostomy is an ideal palliative procedure along with gastrojejunostomy after doing cholecystectomy. 30% of periampullary carcinoma/carcinoma of head of pancreas develop eventual gastric (duodenal) outlet obstruction and so gastrojejunostomy is undertaken.
• ERCP and stenting is done to drain bile. Problem here are recurrent cholangitis, stent blockage and displacement, requirement of repeated stenting procedure.
• Adjuvant chemotherapy using gemcitabine – better but costly; dose is 1000 mg/m² surface area; 5 Fluorouracil; mitomycin; vincristine.
• Radioactive iodine seeds I¹²⁵ to the field are on trial.
• Immunotherapy — specific type to increase the effectiveness of chemotherapy and to improve the cure rate.
Postoperative management in carcinoma pancreas

- Maintenance of proper fluid and electrolyte balance
- Observation for bleeding and its control by transfusion of blood, fresh frozen plasma (FFP); prevention of DIC during initial period
- Injection vitamin K intramuscular
- Respiratory care—ideally postoperative ICU care is better. Often ventilator is needed for 24 hours
- Maintaining adequate urine output—mannitol should be continued
- Injection octreotide infusion for 5 days to suppress pancreatic secretion so as to prevent the leak
- Antibiotics, nasogastric aspiration
- Continuous monitoring the patient with pulse/blood pressure/oxygen saturation/urine output hourly/drain site inspection/abdomen distension/by doing HB%, LFT, serum creatinine, bilirubin, arterial blood gas analysis if needed, platelet count, prothrombin time

Pain control in carcinoma pancreas

- CT guided 50% 20 ml ethanol injection in to celiac ganglion.
- Epidural anaesthesia.
- Opioids administration.
- Transthoracic splanchnicectomy—greater splanchnic nerve.
- Palliative radiotherapy—4000 cGy units.

Prognostic factors in carcinoma pancreas—poor prognosis

- Mean survival rate 6-9 months
- Growth more than 3 cm
- Nodal involvement
- Resection status—R0/R1/R2
- Portal vein infiltration
- Liver/lung secondaries
- Ascites/Trousseau’s sign/left supraclavicular lymph nodal spread

- White bile on table carries poor prognosis
- Associated problems like pancreatitis, diabetes mellitus
- Liver dysfunction

SPECIMEN OF GALLBLADDER

Fig. 3.35: Specimen of gallbladder which is black and gangrenous.

Fig. 3.36: Gallbladder showing cholecystitis with cholesterol stone. Note the color of the stone—radiating crystalline appearance; usually single and radiolucent. Note also the thickened, shrunken and pale gallbladder. Proliferation of mucus membrane causes deep clefts in the muscular coat called as Rokitansky—Aschoff’s sinuses. Fibrosis and thickening of the muscular coat of the gallbladder with chronic inflammation are typical features.
Figs 3.37A to G: Gallbladder specimens with different types of stones – pigmented/mixed stone in Hartmann’s pouch/single/multiple. Note the Hartmann’s pouch. It is always pathological. In normal individual it is called as infundibulum of the gallbladder. Note the faceting nature of the multiple stones. Faceting is due to equal pressure of the stones. Mixed stones are the commonest type – 90%. They contain cholesterol; calcium bilirubinate; calcium palmitate; calcium phosphate and calcium carbonate. Pigment stones can be black or brown. Black stones are usually calcium bilirubinate stones – they are commonly seen in gall bladder in association with haemolytic diseases; can also occur independently. Mucins secreted by biliary lining glands (MUC A, MUC C5) are the causes for development of pigment (black) stones. Brown pigment stones are commonly observed in biliary tree - CBD, hepatic ducts and ductules. These stones are commonly associated with bacterial infection like E. coli as the nidus. These bacteria release beta glucuronidase which transforms bilirubin to calcium bilirubinate. Other components may be calcium palmitate and cholesterol.
Factors responsible for formation of gallstone:

- Bile with altered cholesterol, lecithin and bile salts ratio is called as lithogenic bile (normal ratio – bile salt + lecithin: cholesterol is 13:1). Within this ratio, micelle formation takes place keeping cholesterol in solution. Above this ratio, super-saturation develops (supramicellar zone) causing formation of lithogenic bile and later to gallstone formation – *(Admiron’s triangular hypothesis)*.

Formation and aggregation of cholesterol monohydrate crystals is called as nucleation which eventually forms stone.

- Other factors are obesity, oral contraceptives, clofibrate, cholestyramine, ileal disease, ileal resection, altered entero-hepatic circulation

- Bacterial infection (*E. coli*, *Salmonella*), parasites like *Clonorchis sinensis* and *Ascaris lumbricoides*.

- Hemolytic disorders like hereditary spherocytosis, thalassaemia, etc.

**Modes of infection in cholecystitis are** – haematogenous through cystic artery, through bile, through portal vein.

**Cholesteroses:** It is chronic inflammatory condition of gallbladder where there is deposition of lipoid content in the wall of the gall bladder as large ‘foamy cells’ with phagocytosed cholesterol within it. It is due to defective transport of the absorbed cholesterol which gets accumulated in mucosa. It is called as strawberry gallbladder. There is also increased absorption of cholesterol. It is a premalignant condition. Cholecystectomy should always be done in these patients.

**SPECIMEN OF CARCINOMA GALLBLADDER**

**Fig. 3.38**: Mucocele of gallbladder. Note the mucus content of the gallbladder. It is due obstruction at the cystic duct leading to accumulation of mucus in the lumen of gallbladder which is secreted by lining of the gallbladder. Bile will not be present as there is obstruction of the cystic duct. Mucocele should be treated with cholecystectomy otherwise it leads to empyema of gallbladder following sepsis. Patient presents with soft, smooth, globular, nontender mass in the abdomen, to the right of the upper part of the rectus abdominis muscle, in the right hypochondrium. It is dull on percussion, moves with respiration and horizontally mobile.

**Figs 3.39A and B**: Gallbladder specimens showing proliferative lesion near the fundus in first picture and thickened scirrhous type of carcinoma in the second. Note the gallstones in second specimen and also remaining mucosa shows features of cholederases.
Aetiologies for carcinoma of gallbladder:

- 3% of gallstones with cholecystitis may develop carcinoma of gallbladder.
- 90% of carcinoma of gallbladder is associated with gallstones. Risk of developing carcinoma in gallstone disease is 7-10 times more than general population. Relative risk is less if stone size is less than 2 cm; it is 2.5 if stone size is 2-3 cm in size; it is 10 or more if stone size is more than 3 cm.
- Choledochal cyst, anomalous pancreatico biliary duct junction (20%), cholesteroses of gallbladder, gallbladder polyp more than 1 cm in size or more than 3 in number or adenomatous polyp, porcelain gallbladder.
- Chronic typhoid carriers, carcinogens, inflammatory bowel disease, hepatitis B and hepatitis C virus infection.

Gross types of carcinoma gallbladder—polypoid, scirrhous and proliferative.

Microscopically—commonly adenocarcinoma; occasionally squamous cell carcinoma, adenosquamous or carcinoid tumour can occur.

Spread of carcinoma gallbladder—direct spread to liver (segment IV and V), bile duct, duodenum, colon and kidney. Lymphatic spread to—lymph node of Lund, periportal nodes, peripancreatic and periduodenal nodes. Blood spread—to liver, lungs and bones. It can also spread perineurally.

Features of carcinoma of gallbladder

- It is common in places where there is more prevalence of gallstone disease—Patna—Bihar.
- It is common in females.
- Pain in right hypochondrium, mass in right upper abdomen which is hard and non tender.
- Jaundice.
- Acute presentation of cholecystitis.
- Palpable nodular liver secondaries, ascites.

Staging of carcinoma gallbladder

**Nevin’s staging**

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Intramural</td>
</tr>
<tr>
<td>II</td>
<td>Spread to muscularis propria</td>
</tr>
<tr>
<td>III</td>
<td>Spread to serosa</td>
</tr>
<tr>
<td>IV</td>
<td>Spread to cystic lymph node of Lund</td>
</tr>
<tr>
<td>V</td>
<td>Direct spread to adjacent organs/ metastases</td>
</tr>
</tbody>
</table>

**TNM staging**

**Tumour**

<table>
<thead>
<tr>
<th>T</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tis</td>
<td>Carcinoma in situ</td>
</tr>
<tr>
<td>T1</td>
<td>Spread to mucosa or muscle layer</td>
</tr>
<tr>
<td>T1a</td>
<td>Only mucosal involvement</td>
</tr>
<tr>
<td>T1b</td>
<td>Muscle layer spread</td>
</tr>
<tr>
<td>T2</td>
<td>Spread to subserosa not beyond serosa</td>
</tr>
<tr>
<td>T3</td>
<td>Spread beyond serosa or one adjacent organ or &lt; 2 cm to liver</td>
</tr>
<tr>
<td>T4</td>
<td>Spread &gt; 2 cm to liver, 2 or more than 2 adjacent organs—CBD, stomach, duodenum, colon, omentum</td>
</tr>
</tbody>
</table>

**Nodal spread**

<table>
<thead>
<tr>
<th>N</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>N0</td>
<td>No nodes</td>
</tr>
<tr>
<td>N1</td>
<td>Cystic/nodes in porta/hepatoduodenal ligament—spread</td>
</tr>
<tr>
<td>N2</td>
<td>Peripancreatic/celiac/periduodenal/superior mesenteric nodes—spread</td>
</tr>
</tbody>
</table>

**Metastases**

<table>
<thead>
<tr>
<th>M</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M0</td>
<td>No distant spread</td>
</tr>
<tr>
<td>M1</td>
<td>Presence of distant spread</td>
</tr>
</tbody>
</table>
• Incidental confirmation of carcinoma gallbladder histologically after cholecystectomy for chronic cholecystitis.

**Investigations for carcinoma gallbladder**
- Ultrasound abdomen.
- CT abdomen.
- Liver function tests.

**Treatment of carcinoma gallbladder**
- Cholecystectomy along with resection of liver segments IV and V and perihepatic nodal clearance.
- Chemotherapy and radiotherapy as adjuvant but poor success rate.
- Overall prognosis for carcinoma gallbladder is poor.

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### SPECIMEN OF HEMIMANDIBULECTOMY DONE FOR CARCINOMA CHEEK

**Premalignant conditions of oral cavity**—leukoplakia; erythroplakia; submucosal fibrosis; hyperplastic candidiasis.

**Precipitating factors for oral carcinoma**—smoking; spirit; sepsis; syphilis; sharp tooth; spices; betel nut chewing (very important factor).

**Gross types**—ulcerative; proliferative; verrucous.

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**Fig. 3.40:** Hemimandibulectomy specimen showing ulceroproliferative lesion on the inner aspect of the cheek.

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### Malignancies of the oral cavity
- **Squamous cell carcinoma**—commonest. Malignant cells with epithelial/keratin pearls are typical
- Minor salivary gland tumours
- Melanomas
- Adenocarcinomas—rare
- Sarcomas—rare

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### Sites of carcinoma in oral cavity in order of occurrence

<table>
<thead>
<tr>
<th>In India</th>
<th>In western countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cheek—commonest</td>
<td>Tongue</td>
</tr>
<tr>
<td>Tongue</td>
<td>Floor of the mouth</td>
</tr>
<tr>
<td>Floor of the mouth</td>
<td>Lips</td>
</tr>
<tr>
<td>Palate</td>
<td>Cheek</td>
</tr>
<tr>
<td>Lips</td>
<td></td>
</tr>
</tbody>
</table>

**Features**
- Carcinoma is common in posterior half of cheek.
- It can involve buccinator, pterygoids, retromolar trigone, base of skull, pharynx.
- It spreads through the cheek deeply into skin causing fungation, ulceration, fistula formation.
- Mandible can get involved by direct extension or through subperiosteal lymphatic spread.
- Infection and halitosis can occur.
- Respiratory infection—bronchopneumonia are common.
- Pain, referred pain to ear can occur once lingual nerve is involved.
- Everted edge and induration are observed.
- On bidigital palpation of mandible—irregularity; thickening; tenderness; and site of fracture can be made out.
- Trismus (if three fingers can not be passed vertically into the mouth, then it suggests as trismus) and dysphagia may be present.
- Submandibular and upper deep cervical nodes are involved—when fixed can cause Horner’s syndrome; hypoglossal nerve palsy (tongue deviates to same side); spinal accessory nerve involvement (defective shrugging of shoulder); and may cause
compression of external carotid artery leading to absence of superficial temporal artery pulsation.

- Features of advanced carcinoma – retromolar trigone involvement; extension into base of skull and pharynx; fixed neck lymph nodes; and extension to opposite side.

- Problems with oral carcinoma – upper airway obstruction and bronchopneumonia; severe feeding difficulties and malnutrition; immunosuppression; sepsis and bleeding from tumour or from erosion of vessels; fungation; fixity of secondary nodes and its problems.

- Investigations are edge biopsy; orthopantomogram of mandible; FNAC of lymph node; CT neck and base of skull to assess spread. Open biopsy of lymph node is avoided as it may spread into further level of lymph nodes. If ulceration or fungation has occurred open biopsy of ulcer edge can be done.

- Treatment is radiotherapy for early localised tumour; Patterson operation – wide excision after raising a cheek flap; hemimandibulectomy/segmental resection/marginal mandibulectomy. Radical neck dissection one side and with modified neck dissection on opposite side with retaining of internal jugular vein; postoperative chemotherapy can be given; chemotherapy can also be given initially to downstage and later after surgery.

- Bony gap after hemimandibulectomy is bridged using free rib graft/fibular bone graft/stainless steel plate.

- Problems with surgery – bleeding; infection; flap necrosis; reconstruction problems; morbidity.

- Problems of radiotherapy – osteoradionecrosis; dryness and loss of taste sensation; mucositis; skin excoriation; trismus; laryngeal oedema; dysphagia due to pharyngeal oedema.

**Prognostic factors in oral carcinomas**

- Stage of the disease
  - Stage I and II has got 80% 5 years survival
  - Stage III and IV has got less than 20% 5 years survival rate
  - T3 and T4 lesions has got poor survival rate
  - Carcinoma lip has got best prognosis
  - Carcinoma posterior 1/3rd tongue has got worst prognosis
  - Cheek, floor of the mouth and palate has got intermediate prognosis
  - Histologically positive nodes decrease the survival rate by 50%
  - Level III and IV, node > 3 cm, bilateral nodes extracapsular nodal spread are poor prognostic factors
  - Grading (differentiation) of the tumour
  - Tumour thickness > 6 mm has got poor prognosis
  - Exophytic tumour is better than infiltrating type

**TNM staging for all oral cancers**

- Tis—Carcinoma in situ
- T0—No evidence of primary tumour
- T1—Tumour < 2 cm
- T2—Tumour 2-4 cm
- T3—Tumour > 4 cm
- T 4—Tumour involving adjacent soft tissues/bone
- N0—No nodes
- N1—Node < 3 cm
- N2—Node size up to 6 cm; N2a — Same side single node; N2b – Same side multiple nodes less than 6 cm; N2c – Bilateral or opposite nodes less than 6 cm
- N3—Nodal spread more than 6 cm size
- M0—Distant spread not present
- M1—Presence of distant spread

**Nodal prognostic factors**

- Positive histology in node reduces the survival
- Level III and IV has poor prognosis
- Bilateral/contralateral nodes carry poor prognosis
- Extracapsular spread/size > 3 cm carry poor survival
- Involvement of > 3 nodes is poor sign
Broder’s histological grading
Grade 1: Well differentiated > 75% keratin pearls
Grade 2: Moderately differentiated 50-75% keratin pearls
Grade 3: Poorly differentiated 25-50% keratin pearls
Grade 4: Very poorly differentiated < 25% keratin pearls

Definition of hydronephrosis (HN): It is an aseptic dilatation of pelvicalyceal system due to partial or intermittent obstruction to the outflow of urine.

Congenital PUJ is the commonest cause of HN. Often it is bilateral and presentation on one side is earlier than the other side.

Figs 3.41A to D: Specimen of kidney showing dilated thin renal pelvis which is extrarenal; dilated calyces; and thin renal parenchyma. In second picture ureter and PUJ (Pelvi Ureter Junction) are also seen. Here hydronephrosis is due to congenital PUJ obstruction. Nephrectomy is done if the thickness of renal parenchyma is less than 2 cm, if DTPA scan shows less than 20% function, or hydronephrosis is infected. Nephrectomy is also done if kidney function does not improve after pyeloplasty or surgical correction.
**Aetiology**

It can be unilateral or bilateral

<table>
<thead>
<tr>
<th>Unilateral</th>
<th>Bilateral</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Extramural</strong></td>
<td><strong>A. Congenital</strong></td>
</tr>
<tr>
<td>2. Compression by growth (ca cervix, ca rectum)</td>
<td>2. Congenital posterior urethral valve.</td>
</tr>
<tr>
<td>3. Retroperitoneal fibrosis</td>
<td>4. Retrocaval ureter</td>
</tr>
<tr>
<td>4. Retrocaval ureter</td>
<td></td>
</tr>
<tr>
<td><strong>B. Intramural</strong></td>
<td></td>
</tr>
<tr>
<td>1. Congenital PUJ obstruction</td>
<td></td>
</tr>
<tr>
<td>2. Ureterocele</td>
<td></td>
</tr>
<tr>
<td>3. Neoplasm of ureter</td>
<td></td>
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<tr>
<td>4. Narrow ureteric orifice</td>
<td></td>
</tr>
<tr>
<td>5. Stricture ureter following removal of stone, pelvic surgeries or tuberculosis of ureter.</td>
<td></td>
</tr>
<tr>
<td><strong>C. Intraluminal</strong></td>
<td></td>
</tr>
<tr>
<td>1. Stone in the renal pelvis or ureter.</td>
<td></td>
</tr>
<tr>
<td>2. Sloughed papilla in papillary necrosis.</td>
<td></td>
</tr>
</tbody>
</table>

- **Aberrant renal artery or vein** in the lower pole of kidney can compress the PUJ causing HN. Renal angiogram confirms the diagnosis. Treatment: If it is a vein it can be ligated safely. But if it is an artery, it exclusively supplies the lower pole of the kidney and so cannot be ligated. So kidney is mobilised; upper and lower poles are approximated together so that artery is made to slip away from the site of compression—*Hamilton Stewart operation*.

- **In pregnancy** dilatation of ureters and both pelves occur due to atony of ureteric musculature by progesterone. It starts as early as in the first few weeks of pregnancy and lasts until few weeks after delivery. Involution occurs 2-12 weeks after delivery.

- **Pathology**: Initially pressure burden is taken up by the pelvis; later calyces and renal parenchyma. Gradually, parenchyma thins out due to destruction and it dilates causing eventually to compromised secretory function. Parenchymal thickness of less than 2 mm is unlikely to function. In bilateral cases such

**Classification I**

1. Unilateral HN.
2. Bilateral HN without renal failure.

**Classification II**

1. Intermittent HN: Obstruction occurs; swelling and pain appear in the loin. After sometime patient passes large amount of urine following which swelling and pain disappear—*Dietl's crisis*.
2. Persistent HN due to persistent partial obstruction.

**Classification III**

1. HN only.
2. HN with hydroureter.

**Classification IV**

1. Extrarenal pelvic HN (80%).
2. Intrarenal pelvic HN (20%) - Destruction of kidney is earlier and severe in case of intrarenal pelvic HN as compared to extrarenal pelvic HN.
patients will go for renal failure. Initial stages of obstruction, formation of urine continues but it gets reabsorbed through the tubular epithelium, venous channels and lymphatics.

Clinical Features
A. In unilateral cases
• Congenital PUJ obstruction and calculus are the most common causes.
• Right side kidney is more commonly affected.
• Loin pain which may be dull aching, with dragging sensation or heaviness.
• Mass in the loin which is smooth, mobile, ballotable, moves with respiration, percussion shows dull renal angle with a band of colonic resonance in front.
• Attacks of acute renal colic.
• Often patient may be having Dietl’s crisis – After an acute attack of renal colic, swelling is seen in the loin which disappears after sometime following passage of large volume of urine.
• If infected dysuria, haematuria, fever and tenderness in renal angle.
• Occasionally hypertension.
B. In bilateral cases
From lower urinary tract obstruction
• Loin pain.
• Features of bladder outlet obstruction - frequency, hesitancy, poor stream.
• If renal failure develops early kidneys are often not palpable.

From bilateral upper urinary tract obstruction
• Loin pain, mass in the loin, attacks of renal colic.
• In bilateral cases, when it is severe, features of renal failure like oliguria, oedema, and hiccough may be present.

Complications
• Pyonephrosis.
• Perinephric abscess.
• Renal failure in bilateral cases.
• Haematuria.
• Stone formation.

Investigations
• Blood urea and serum creatinine.
• Urine for microscopy.
• Ultrasound abdomen: Investigation of choice. Parenchymal thickness less than 2 cm is critical. Cause of HN also can be identified. Type of pelvis, thickness of parenchyma, site of obstruction and cause of obstruction (e.g. stones) can be made out.
• IVU: To find out the function of diseased as well as opposite kidney. Normal calyx is cup shaped. It gets flattened and later club shaped which eventually becomes broadened in hydronephrosis.
• Whitaker test: Pass a fine needle into the renal pelvis through loin. Pelvis is perfused with saline at a rate of 10ml/minute. Normally, initially the pressure increases and later it will become constant. Persistent increase in pressure suggests HN.

Isotope renography (DTPA SCAN) is also useful to study the function of the kidney before and after the surgical treatment and also to see the efficacy of surgery as far as function is considered.

Treatment:
Always conservative surgeries which are aimed at conserving the kidneys are done. Nephrectomy is not done unless indicated.
1. Treat the cause—Stone, congenital anomaly, aberrant renal vessels.
2. Anderson—Hyne’s operation: (Dismembered pyeloplasty): In congenital PUJ obstruction, the spasmodic segment and redundant pelvis is excised. New pelvis is created and is anastomosed to the cut end of the ureter in dependent position.
3. Davis T-tube ureterostomy: By making longitudinal incision T-tube is placed in the ureter.
4. Non dismembered pyeloplasty: Here PUJ is not transected. Reconstruction is done without PUJ transection by different methods. For example Foley’s Y-V plasty.
5. In bilateral cases, without renal failure, kidney with better function should be operated first. Otherside kidney is dealt after three months.
6. In HN with renal failure, initially bilateral nephrostomy and haemodialysis support is required. After 3-6 weeks IVU is done and the functions of both kidneys are assessed. If their function is adequate, then treated accordingly by Anderson Hyne’s operation. If kidney function is inadequate (renal function <20% on isotope study) then nephrectomy and renal transplantation is the only option left.

7. Laparoscopic or retroperitoneoscopic pyeloplasty is becoming popular but is expensive and time consuming. It gives good result.

8. Endoscopic pyelolysis, though technically easier results are not assured.

**Pyonephrosis**

It is collection of pus in pelvicalyceal system, which is converted into a multiloculated sac.

Occurs due to:
- a. Infection in preexisting hydronephrosis.
- b. Following acute pyelonephritis, or
- c. As a complication of renal calculus - either pelvic stone or staghorn calculus.

**Clinical Features**

- **Triad**
  - Anaemia
  - Fever
  - Loin swelling

- Tender mass in the loin which is smooth, soft, not mobile, not moving with respiration.
- Patient may also have cystitis, pyuria, burning micturition.
- Features of toxicity such as fever with chills and rigors.

**Investigations**

- Plain X-ray KUB may show renal calculus.
- IVU shows HN.
- Cystoscopy reveals cystitis with efflux of purulent pus through the ureteric orifice.
- Ultrasound shows dilatation.
- DTPA scan, blood urea and serum creatinine.

**Treatment**

After starting antibiotics, pus is immediately drained from the kidney through a loin incision and nephrostomy tube (Cabot’s)/(Malecot catheter) is placed. If kidney is totally destroyed, subcapsular nephrectomy is done. This also prevents other kidney from getting infected through perirenal lymphatic connections. In bilateral pyonephrosis, bilateral nephrostomy is the only choice. ‘J’ stenting is done often to keep the ureters patent.

**SPECIMEN OF RENAL TUBERCULOSIS**

Commonly it is secondary. Primary may be in the lung. Through blood, bacteria reach the glomeruli causing caseating granuloma with

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Figs 3.42A and B: Specimen of kidney showing dilatation and caseous material as content. It is tuberculous pyonephrosis. Ureter is visualised in the specimen. Often there may be ureteric stricture due to tuberculosis.
Langhan’s giant cells and epithelioid cells. These granulomas coalesce to form a papillary ulcer and other consecutive different forms.

**Pathological Types**
- Tuberculous papillary ulcer.
- Cavernous form.
- Hydronephrosis.
- Pyonephrosis [due to (secondary) superadded infection by *E. coli*, *Klebsiella*].
- Tuberculous perinephric abscess.
- Calcified tuberculous area (mimics calculi, hence called as pseudo calculi).
- Caseous kidney - often called as putty kidney or cement kidney (it goes for autonephrectomy).
- Miliary tuberculosis.
- Tuberculous bacilluria occurs from an early stage of the disease which causes tuberculous ureteritis and stricture ureter. Commonest site for stricture is ureterovesical junction; second common site is pelvi uretric junction.

Tuberculous cystitis eventually results in golf hole ureter and thimble bladder (cystoscopic findings). This is due to fibrosis causing rigid withdrawn dilated ureteric orifice looking like a golf hole. Entire urinary bladder gets fibrosed, stiff and is unable to dilate to accommodate urine causing thimble systolic bladder.

Tuberculous prostatitis, seminal vesiculitis (P/R- palpable seminal vesicle), tuberculous epididymitis and funiculitis are other associations. Thickened epididymis with ulcer on the posterior aspect may be often found. Tuberculous funiculitis with beaded, thickened vas deferens is seen.

**Clinical Features**
- It is common in males and common on right side.
- Frequency—both day and night, polyuria.
- *Sterile pyuria*—Urine is pale and opalescent with presence of pus cells without organisms in acid urine — *abacterial aciduria*. (Other causes: Interstitial cystitis, Chlamydia).
- Painful micturition with often haematuria; haematuria may be overt or microscopic (50%).
- Renal pain and suprapubic pain.
- Tuberculous kidney is rarely palpable unless there is hydronephrosis or perinephric abscess.
- Presentation like acute pyelonephritis.
- Features of urinary stones; recurrent urinary tract infection; renal failure if both kidneys are diseased; hypertension.
- Enlarged prostate and seminal vesicle, thickened beaded vas, thickened epididymis, impotence, infertility are other features.
- Haemospermia; pelvic pain.
- Dyspareunia; menstrual dysfunction; vaginal discharge; infertility in females.
- Fever and weight loss.
- Often cough with expectoration and haemoptysis may be present.

**Investigations**
- Hb%; ESR; Chest X-ray; Mantoux skin test is usually positive.
- Ultrasound abdomen to see kidney, bladder.
- *Three consecutive early morning samples of urine* (EMSU) are collected and sent for microscopy, (Ziehl-Neelsen staining), culture in Lowenstein-Jensen culture media (L-J media) or guinea pig inoculation.
- Polymerase chain reaction (PCR) for tuberculosis.
- Plain X-ray KUB- may show calcification.
- IVU - Hydrocalyx, narrowing of calyx, stricture ureter which are multiple with dilatations in between.
- Often RGP is very useful, as better definition of ureter, pelvis, calyces and selective sampling of urine are possible.
- Voiding cystourethrogramy (MCU) to see ureteric stricture and reflux.
- Cystoscopy reveals multiple tubercles, bladder spasm, and oedema of ureteric orifice eventually forming ‘golf hole ureter’, scarring, ulceration, and bleeding, stone formation.
- CT scan of abdomen and pelvis.
Treatment

- Antitubercular therapy is started—INH, rifampicin, ethambutol, and pyrazinamide. Duration of treatment is one year.
- After 6-12 weeks of drug therapy, surgical treatment is planned. Kidney is exposed. Pyocalyx is drained. Cut edge of the capsule is sutured—Hanley’s renal cavernostomy.
- Hydronephrosis—Anderson Hynes operation or nephrostomy or stenting (J’stent) of ureter is done.
- Renal abscess not resolving for 2 weeks should be drained.
- Ureteral stricture—Stenting/reimplantation of the ureter into the bladder/psoas hitch/Boari’s flap/ileal conduit (Koch’s ileal conduit).
- Thimble bladder—Hydraulic dilatation/ileocystoplasty/caecocystoplasty/sigmoid colocystoplasty is done.
- In unilateral lesion, with gross impairment of renal function-nephro ureterectomy.

Indications for nephroureterectomy
- Nonfunctioning kidney
- Disease extensively involving the kidney
- Disease causing hypertension and severe obstruction
- Tuberculous pyonephrosis
- Coexisting renal cell carcinoma

SPECIMEN OF RENAL ABSCESS/CARBUNCLE

Renal abscess/renal carbuncle
- A localised inflammatory necrotic mass of tissue involving renal parenchyma, caused by Staphylococcus aureus and coliform organisms, source of which is cutaneous infections like boil and carbuncle. Eventually infection may spread to entire kidney causing multiple abscesses
- It presents as ill defined tender swelling in the loin, with pyrexia and leucocytosis

SPECIMEN OF KIDNEY WITH RENAL CELL CARCINOMA (RCC)

- It is an adenocarcinoma arising from renal tubular cells- most common site is proximal renal tubular cell. Common in upper pole of kidney.
- More common in males; more common in 5th-6th decade of life.

Other names for renal cell carcinoma
- Hypernephroma—misnomer. It is initially thought that tumour is arising from above the kidney
- Grawitz tumour
- Clear cell carcinoma
- Internist tumour
Figs 3.44A to D: Renal cell carcinoma. Note the large sized tumour in one of the poles. It is common in upper pole but can occur in lower pole. Occasionally it can be bilateral. Papillary tumours are eosinophilic papillary projections which are less vascular and multicentric. It is an adenocarcinoma arising from renal tubules. Grossly it is large vascular with a pseudocapsule infiltrating the renal capsule, and calyces. In first photo it is seen arising from lower pole and in next two they are from upper poles. Cut section is yellowish due to lipoid content. Haemorrhagic areas with necrosis are seen.

**Aetiology**
- It is associated with von-Hippel-Lindau disease (Cerebellar haemangioblastoma, retinal angiomatosis, phaeochromocytoma, tumour or cysts of pancreas). Here RCC is commonly bilateral
- Diet rich in animal fat
- Environmental factors like asbestos, lead, cadmium and tobacco
- Cigarette smoking
- Chromosomal aberration, tuberous sclerosis
- Acquired cystic kidney disease after long-term dialysis
- Birt-Hogg-Dube syndrome with hereditary chromophobe RCC and oncocytoma
- Cortical renal adenoma? could be RCC by itself
**Microscopy:** Malignant cells which are cubical or polyhedral containing lipid, cholesterol and glycogen. Histological types—clear (75%), granular, spindle, sarcomatoid, and papillary (15%).

**Spread**
- **Local:** Into the perinephric pad of fat, calyces and renal pelvis.
- **Blood spread:** RCC enters the renal vein as *proliferating tumour thrombus* which extends into the IVC and later gets detached causing ‘cannon ball secondaries’ in the lung which are often calcified. Once primary tumour is removed, secondaries may regress due to tumour immunity. Occasionally secondaries occur in bone, liver and brain. Left testicular vein which drains into left renal vein may gets blocked by proliferating tumour thrombus resulting in *irreducible left sided varicocele*.
- **Lymphatic spread:** To hilar lymph nodes, para aortic lymph nodes.

**AJCC (American joint committee on cancer) staging of RCC – TNM staging**

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0</td>
<td>No primary tumour</td>
</tr>
<tr>
<td>T1</td>
<td>Tumour less than 7.0 cm size, limited to kidney. T1a is tumour 4cm or less; T1b is tumour 4-7 cm in size</td>
</tr>
<tr>
<td>T2</td>
<td>Tumour more than 7.0 cm size, limited to kidney</td>
</tr>
<tr>
<td>T3</td>
<td>Tumour extends into major veins, adrenals, perinephric fat but not into the Gerota’s fascia</td>
</tr>
<tr>
<td>T3a</td>
<td>Into adrenal or perinephric tissue</td>
</tr>
<tr>
<td>T3b</td>
<td>Into renal vein or IVC below diaphragm</td>
</tr>
<tr>
<td>T3c</td>
<td>Tumour extends into IVC above the diaphragm</td>
</tr>
<tr>
<td>T4</td>
<td>Tumour invades Gerota’s fascia and extends beyond</td>
</tr>
</tbody>
</table>

| N0    | No lymph nodes |
| N1    | Spread to single regional lymph nodes |
| N2    | Spread to more than one regional lymph nodes |

| M0    | No blood spread |
| M1    | Distant spread present to lungs - 75%, soft tissues - 35%, bones - 20%, liver – 15%, CNS – 8%, skin – 8% |

**Robson-Flocks and Kadesky staging of RCC**

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1:</td>
<td>Tumour confined to renal parenchyma.</td>
</tr>
<tr>
<td>Stage 2:</td>
<td>Tumour invasion to perinephric fat but confined with in Gerota’s fascia</td>
</tr>
<tr>
<td>Stage 3:</td>
<td>(a) Tumour invasion to renal vein or IVC (b) Invasion to regional lymph nodes (c) Both a+b</td>
</tr>
<tr>
<td>Stage 4:</td>
<td>Invasion to adjacent organs other than adrenal Distant metastasis</td>
</tr>
</tbody>
</table>

**Clinical features of RCC**

- **M:** F: 2:1
- **Haematuria.**
- **Clot colic.**
- **Dragging discomfort in the loin.**
- **Mass in the loin which moves with respiration, mobile, nodular, hard, with dull renal angle and resonant band in front.**
- **Left sided varicocele** which is *irreducible*.

**Triad of RCC**

1. Pain
2. Haematuria – 30%
3. Palpable renal mass

**Note:** 45% present as early disease; 25% as locally advanced disease; 30% as metastatic disease.

**Atypical presentations:**

a. Due to secondaries
   - Pathological fractures.
   - Persistent cough and haemoptysis.
b. **Persistent pyrexia** with no evidence of infection. (Pyrexia of Unknown Origin) – 20%.
c. Constitutional symptoms: Malaise, lethargy and severe anaemia.
d. Polycythemia: 4% - due to increased secretion of erythropoietin.
e. Hypercalcaemia due to PTH like hormone secretion, hypertension due to increased secretion of renin from kidney tissue adjacent to tumour.

**Note:** (Surgical renal conditions associated with hypertension – PCKD (polycystic kidney
disease), renal cell carcinoma, and renal artery stenosis.

g. Stauffer's syndrome: Nonmetastatic reversible liver dysfunction which gets corrected after nephrectomy. It is 7% common. It carries poor prognosis.
h. Cushing’s syndrome.
i. Leukaemoid reaction due to bone marrow stimulation.
j. Secondary amyloidosis 5%.

Investigations

- Urine microscopy for RBCs.
- IVU - shows mass lesion and irregular filling defect.
- Ultrasound abdomen - To know the size, extension, lymph node involvement, spread to the liver, status of renal vein and IVC.
- CT scan: It is confirmatory and modality of choice. Multidetector CT and CECT (contrast enhancement CT) are very useful in detecting early lesion/function/spread/venous status. Lymph node status, tumour extension are well made out with CT. Contrast enhancement CT scan helps to find out function of opposite kidney and tumour thrombus in renal vein or IVC.
- Renal angiogram through Seldinger technique via transfemoral route, to see the vascularity. Pharmaco-angiogram (Inject nor adrenaline along with dye while doing angiogram). As tumour vessels are autonomous they will not constrict whereas adjacent normal vessels will constrict, so tumour blush is visualised. Through angiogram, therapeutic embolisation of tumour can be done to reduce the vascularity of tumour.
- MRI/MR angiogram is unique in identifying the spread in to IVC especially in the thorax. In such occasion oesophageal endosonography is also useful to visualise thoracic extension of the tumour thrombus.
- Chest X-ray shows cannon ball secondaries. Often it is calcified. CT chest is ideal and more reliable.
- Bone scan to see bone secondaries.
- Peripheral smear, serum calcium, haematocrit and ESR, RBC count are other supportive investigations.

<table>
<thead>
<tr>
<th>Differential diagnosis</th>
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</thead>
<tbody>
<tr>
<td>Polycystic kidney disease</td>
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<tr>
<td>Solitary cyst of kidney</td>
</tr>
<tr>
<td>Adrenal tumour</td>
</tr>
<tr>
<td>Retroperitoneal tumour</td>
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<tr>
<td>Carcinoma colon</td>
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</tbody>
</table>

Treatment of RCC

Surgery is the treatment of choice.

<table>
<thead>
<tr>
<th>Structures removed in radical nephrectomy are</th>
</tr>
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<tbody>
<tr>
<td>1. Entire kidney along with tumour</td>
</tr>
<tr>
<td>2. Perinephric tissue</td>
</tr>
<tr>
<td>3. Ipsilateral adrenal gland</td>
</tr>
<tr>
<td>4. Proximal 2/3rd ureter/as low as possible</td>
</tr>
<tr>
<td>5. Lymph nodes from crus of diaphragm to aorta bifurcation with renal hilar nodes</td>
</tr>
</tbody>
</table>

1. Radical nephrectomy: Approach is transperitoneal. Retroperitoneal/Nagamatsu (resection of 11th rib) approach/thoraco abdominal approach/posterior vertical are other approaches. Patient will be in lateral position. After laparotomy, colon is mobilized medially. Vessels are identified and dissected and ligated securely (transfixation and three ligatures proximally using non absorbable silk/polypropylene sutures).

Preoperative renal artery embolisation can be done to decrease vascularity and to facilitate the entire removal of tumour. Always ideally renal vein is ligated first so as to prevent tumour dislodgement, but it causes torrential haemorrhage from kidney and tumour due to congestion and as such tumour is very vascular. So many surgeons/urologists prefer to ligate renal artery first. In case of IVC extension, IVC is opened after applying an oblique vascular clamp, tumour thrombus is removed and IVC is sutured. In supra diaphragmatic venacaval extension of thrombus, cardio-pulmonary bypass is necessary.
2. Even in large fixed tumour, palliative nephrectomy or debulking is advised as it may cause regression of secondaries. This spontaneous regression is only transient and observed only in few cases of RCC. Significance given earlier to this phenomenon is largely questioned at present.

3. **Nephron sparing surgeries** in bilateral RCC (Bilateral partial nephrectomy) or RCC in a solitary kidney. Renal artery is temporarily occluded using vascular clamps and kidney is cooled to have proper control of bleeding and adequate visualisation of the line of resection. Partially resected specimen is assessed by frozen section biopsy. Retained partial capsule is sutured after haemostasis. Renal arterial clamp is released.

4. Pre-operative renal artery embolisation can be done to decrease the tumour vascularity using gel foam/spheres/coils/muscle piece.

5. **Chemotherapy**: 5 FU, floxuridine, vinblastine and progesterone can be tried. RCC is a remarkably refractory solid tumour.

6. Interferons (IFN – alpha) and interleukins (IL-2) have shown beneficial effects.

7. Antiangiogenic drugs are under trial like endostatin and angiostatin. RCC is highly vascular and there is highly angiogenic environment to give possible benefit by antiangiogenesis.

8. **No role for radiotherapy**.

9. Laparoscopic approach is becoming popular. Here renal artery is ligated first. It is confirmed to be safe and adequate.

10. Solitary lung metastasis patient may get benefited by wide resection of the secondary.

11. Humanised monoclonal antibodies like bevacizumab which neutralises VEGF are under trial.

---

**Prognosis in RCC**

Overall 5 year survival rate is 40%. In early localised disease it is 70-90%. In advanced and metastatic disease it is 10-15%

**Prognostic factors are** -
- Tumour size more than 4 cm carries poor prognosis.
- Extension into the renal vein.
- Presence of secondaries.
- Differentiation.
- Local extension.
- Hypercalcaemia and Stauffer’s syndrome carry poor prognosis.

5 year survival is 65% for stage I and II; 40% for stage III; 10% for stage IV

---

**SPECIMEN OF HYDATID CYST OF LIVER**

Word meaning of Hydatid is ‘dew/watery drop’ in Latin and in Greek *hydatid* means watery vesicle.

It takes few years to evolve into a complete hydatid cyst. Most commonly involved segment is segment VII – 27%. Commonly right lobe – 66%; both lobes in 16% and only left lobe in 17% is involved.
Pathology

It has got 3 layers

1. **Adventitia (pseudocyst, pericyst):** Is an inseparable fibrous tissue due to reaction of the liver to the parasite.

2. **Laminated membrane (ectocyst):** Formed of the parasite itself, is whitish, elastic, contains hydatid fluid, which can be peeled off readily from the adventitia.

3. **Germinal epithelium** is the only living part, lining the cyst (endocyst).
   
   This layer secretes **hydatid fluid**, **brood capsules** with scolices (heads of future worms).

**Features of hydatid fluid**

- Clear
- High specific gravity 1.005-1.009
- Shows hooklets and scolices

**Note:**

- Initial sexual cycle in the liver causes *primary echinococcosis*. Once brood capsules disintegrate, it grows into daughter cysts.
- Few hydatid cysts develop from larval stage – protoscolices/daughter cysts in an asexual minor cycle in the same intermediate host called as *secondary echinococcosis*.
- **Dominant cyst** means one cyst among multiple cysts of a single patient which is either largest/in most difficult position/communicating with biliary tree/complicated.

**Course of the Disease**

- The parasite may die and cyst eventually may get *calcified*.
- Commonly cyst *enlarges* and is palpable per abdomen.
- It may cause complications like *jaundice* due to pressure over biliary tree.
- **Rupture into the peritoneal cavity** causes life threatening anaphylactic reaction and shock requires proper management with steroids.
- **Rupture into biliary channels is commonest.** Rupture into bowel, pleural cavity also can occur.
• **Secondary infection** causing suppuration and septicaemia.
• **Secondary cysts** in the lung, spleen, mesentery, retroperitoneum and other organs can occur.
• **Hepatic dysfunction**.

**Clinical Features**
- Asymptomatic palpable liver with *classical thrill (hydatid thrill)* elicited by *three-finger test*.
- Jaundice and pain.
- Features of anaphylaxis if ruptured.
- Discomfort in right upper quadrant area; dyspepsia; hydatid cachexia in children; weight loss; fatigue; vomiting.
- Occasionally splenomegaly, pleural effusion, cholangitis, allergic asthma, fever.

**Differential Diagnosis**
- Hepatoma; amoebic liver abscess; cystic disease of the liver

**Investigations**
- Ultrasound is diagnostic. Reveals rosettes of daughter cysts, double contoured membrane of the cyst due to detachment of the cyst membranes, and calcification of cyst wall. Intraoperative ultrasound (IOUS) is very useful tool.
- CT scan abdomen is more accurate in identifying cyst characters—*cart wheel* look multivesicular rosette like.
- X-ray shows calcification.
- *Primary serological tests*: ELISA; indirect haemagglutination test; latex agglutination test; immunofluorescence antibody test; immunoelectrophoresis. 80-95% sensitivity for liver hydatid.
- *Secondary laboratory tests*: Detection of precipitation line—arc 5; immunoblotting; polymerase chain reaction (PCR). More specific, very useful in extrahepatic hydatid disease and calcified nonfertile liver hydatid
- Liver function tests.
- Casoni’s test; complement fixation test—historical interest.
- MRI when there is jaundice to visualise biliary tree and its relation to hydatid cyst; to find out cystobiliary communication; biliary hydatids in bile duct and hepatic ducts. ERCP can also be done to find out the communications. Other method to find out the cystobiliary communications is intraoperative cholangiogram.
- Aspiration of the cyst should not be done due to risk of anaphylaxis but presently PAIR (Puncture – Aspiration – Injection – Reaspiration) is done effectively.

<table>
<thead>
<tr>
<th>Hassen Gharbi’s ultrasound based classification of liver hydatid cysts (1981)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1: Pure fluid collection</td>
</tr>
<tr>
<td>Type 2: Fluid collection with split wall</td>
</tr>
<tr>
<td>Type 3: Fluid collection with septa</td>
</tr>
<tr>
<td>Type 4: Heterogeneous appearance</td>
</tr>
<tr>
<td>Type 4: Reflecting thick walls</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WHO classification of liver hydatid cyst</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type CL: Active; unilocular; no cyst wall; early stage; not fertile</td>
</tr>
<tr>
<td>Type CE 1: Active; cyst wall present; hydatid sand present; fertile</td>
</tr>
<tr>
<td>Type CE 2: Active; multivesicular rosette like cyst wall; fertile</td>
</tr>
<tr>
<td>Type CE 3: Transitional; detaching laminated membrane; water-lily sign; beginning of degeneration</td>
</tr>
<tr>
<td>Type CE 4: Inactive; degenerative contents; no daughter cysts; not fertile</td>
</tr>
<tr>
<td>Type CE 5: Inactive; thick calcified wall; not fertile</td>
</tr>
</tbody>
</table>

**Treatment**

**Drugs**
- Praziquantel – 60 mg/kg along with albendazole for 2 weeks.
- Albendazole 4 weeks cycles with 2 weeks drug free interval.
- Mebendazole—600 mg daily for 4 weeks.

**Indications for PAIR**
- Inoperable patients
- Patients who refuse surgery
- CL, CE 1, CE 2 and CE 3 types/Gharbi type 1 and 2
- Relapse cysts
- Infected cysts
- In pregnant women
- Cysts more than 5 cm in different liver segments

**Results and problems of PAIR**
- Complication rate—10-40%
- Mortality rate—0.9-2.5%
- Fever—35%-disappears in 72 hours
- Anaphylaxis—0.1-0.2%-same as open surgery—but drugs should be kept ready for anaphylaxis
- Infection—10% well controlled by antibiotics
- Local recurrences—4% - repeat PAIR can be done

**Contraindications for PAIR**
- Inaccessible cysts
- Cysts with multiple septae–honeycomb cysts
- Hyperechogenic cysts
- Communicating cysts to bile duct
- Calcified cysts
- Cysts in lung

**Technique of PAIR**
- Done under US guidance.
- Under local anaesthesia cyst is punctured through thickest route/part of cyst wall using a cholangiography 22 gauge needle.
- Cyst is entered through nondependent wall and 50% of fluid is aspirated. All multiple/daughter cysts are aspirated. Radiopaque dye is injected to see if any communications are present. Scolicidal agents—15-20% hypertonic saline is injected into the cyst. After 20 minutes reaspiration is done. A sclerosant—alcohol is injected. If cyst wall is 6 cm or more a drainage catheter is placed for 24 hours for complete drainage and later alcohol sclerosant is injected.
- Double – puncture aspiration and injection (D-PAI) or modified PAIR/PEVAC (Percutaneous evacuation of cyst) are other procedures done.
- PAIR has gained wide acceptance as it is safe, less invasive, and easier to do, with low morbidity and mortality. Complications and results are same as open surgery.

**Surgery**
- Surgery is still the choice and gold standard therapy for hydatid disease. The abdomen is opened, and the peritoneal cavity is packed with mops (black or coloured mops are used to identify white scolices clearly so as to pick up all and prevent any spillage). Fluid from the cyst is aspirated and scolicidal agents (cetrizime, chlorohexidine, alcohol, hypertonic saline (15-20%), 10% povidone iodine or H2O2) are injected into the cyst cavity (formalin should not be used). Hypertonic saline should be left within the cavity for 15-20 minutes to have effective scolicidal effect.
- Detection of cystobiliary communications is very crucial as it may cause caustic sclerosing cholangitis when scolicidal agent like formalin is used. Communicating openings may be single or multiple. Cyst more than 10 cm is likely to have cystobiliary communications. Often clinically features of communications may not be present. Preoperatively there may be recurrent cholangitis; dilated bile duct. Factors important are—its size; number; site; involvement of hepatic/bile ducts; liver dysfunction. Bile stained cyst on table during aspiration is highly suggestive of communication. White mops soaked with hypertonic saline are kept in the cyst cavity and gallbladder is gently squeezed to see for the bile staining of the mop in the cavity which confirms communication.
• Laparoscopic pericystectomy is becoming more popular. Contraindications are deeply situated cyst, densely adherent cyst, inaccessible cysts; more than 3 cysts; calcified cysts and cysts in other organs. Main problem with laparoscopic pericystectomy is spillage and difficulty in preventing it.
• Liver resection – only occasionally segmental or hemihepatectomy is done.

Procedures used to correct the cystobiliary communications and to obliterate the cavity are:
• Suturing of the communication – simple suture using vicryl/PDS suture with T tube drain of bile duct.
• Pericystectomy (Pericystectomy is done by peeling off the cyst wall and abdomen is closed with or without a drain); marsupialisation.
• Tube drainage of the cavity; capitonage – spiral suturing of the bottom of the cavity upward from base of cavity to the edge of the cyst wall; introflexion – inverting the rim of the cyst edge without apposition; omentoplasty.
• Internal drainage procedures like choledochojenostomy; transduodenal sphincteroplasty; Roux-en-Y cysto/intracystic hepaticojejunostomy; Roux-en-Y hepaticojejunostomy.
• External drainage like cystobiliary disconnection anatomically between cyst and fistula with multiperforated drain into the fistulas through the cyst with multiperforated drain into the cyst cavity with a T tube drain into the bile duct (perdomo procedure); bipolar drainage.
• Reconstructive procedure like pericysto-jejunostomy; bile duct repair.

Malignant hydatid disease
• It is a misnomer as it is a benign condition
• It is caused by Echinococcus multilocularis (Alveolaris). Multiple small cysts are seen all over the both lobes of the liver
• It is difficult to treat and mimics malignancy both clinically and prognosis wise, hence the name
• They die of liver failure

SPECIMEN OF MECKEL’S DIVERTICULUM
• It is a congenital diverticulum arising from the terminal ileum and is part of the unobliterated proximal portion of the vitello intestinal duct.
  — 2% common.
  — 2 feet from the ileocaecal valve.
  — 2 inch in length.
• It is congenital, results from incomplete closure of vitellointestinal duct. Its base is wide mouthed.
• Arises from the antimesenteric border of the ileum, containing all three layers of the bowel with independent blood supply from terminal branch of superior mesenteric artery.
• In 20% of cases mucosa contains heterotopic epithelium like gastric, colonic and or pancreatic tissues.
• It may be connected to or communicates with the umbilicus through a band or fistula.
• It may be associated with oesophageal atresia, exomphalos, anorectal malformations.

Fig. 3.46: Meckel’s diverticulum

Presentations of Meckel’s diverticulum
• Asymptomatic—majority cases.
• Severe haemorrhage—most common complication, seen in children aged 2 years or younger – maroon coloured.
• Intestinal obstruction due to bands/adhesions/intussusception.
• Perforation.
• Intussusception.
• Peptic ulceration.
• Diverticulitis-features mimics acute appendicitis.
• Littre’s hernia.
• Silent Meckel’s diverticulum found during laparotomy or laparoscopy or by radioisotope study.

Diagnosis
• Te⁹⁹ radioisotope scan is very useful – shows hotspot 95% accuracy.
• X-ray abdomen to see complications like obstruction, perforation.
• Laparoscopy is very useful.
• Enteroclysis/small bowel enema may show the Meckel’s diverticulum.

Treatment
• Asymptomatic Meckel’s diverticulum can be left alone when identified during laparotomy.
• Resection of a short segment of ileum containing Meckel’s diverticulum and end to end anastomosis is done.
• Meckelian diverticulectomy with closure of enterotomy also can be done but chances of retaining heterotopic tissues and stenosis are higher.

SPECIMEN OF JEJUNAL DIVERTICULA
See Figure 3.47.

SPECIMEN OF INTESTINAL GANGRENE
See Figure 3.48.

SPECIMEN OF INTESTINE WITH INTUSSUSCEPTION
See Figures 3.49A and B.
Fig 3.49A and B: It is the telescoping of one segment of bowel into the adjacent segment. Ileocolic is the most common type. It occurs in children commonly during weaning period. Red currant jelly stool, sausage shaped resonant mass, appearing and disappearing of mass, empty right iliac fossa are the features. Barium enema shows claw sign; Ultrasound shows target sign/pseudokidney sign. Therapeutic enema using barium or air is tried. If it fails, laparotomy, resection and anastomosis is done.

**Definition of Intussusception**

It is telescoping or invagination of one portion (segment) of bowel into the adjacent segment.

**Types**

1. *Antegrade*—commonest.
2. *Retrograde*—rare (jejuno-jejunal or gastrojejunal stoma).

- It can be single or multiple (rare).
- It can be ileocolic (most common type, 75%), colocolic, ileo-ileo-ileo.
- It is common in weaning period of a child (common in male), between the period of 3-6 months.
- Idiopathic intussusception is common in children (90%), occurs in terminal 50 cm of ileum.
- During weaning, change in diet causes inflammation and oedema of Peyer’s patches—may stimulate
- Upper respiratory tract viral infection which causes oedema of Peyer’s patches is also thought as an etiology for intussusception in children.
- Other causes in adolescents and adults are submucus lipoma, leiomyoma, polyps in jejunum (Peutz-Jegher syndrome), other intestinal polyps, Meckel’s diverticulum and carcinomas with papillary projections.

**Pathology**

**Parts**

- *Apex* is the one which advances.
- *Intussucipiens* is the one which receives (outer sheath);
- *Intussusceptum* are the tubes which advances (middle and inner sheath).

Apex and inner tubes will have compromised blood supply leading in to gangrene.

Because of ischaemia, apex sloughs off and bleeds, which mixes with the mucus to produce the classic *red-currant jelly* that is passed per anum.

Due to *constriction at the neck*, there is impaired venous return causing congestion, oedema and further arterial block leading into perforation at this site. Gangrene which has set in, leads to perforation and peritonitis.

**Clinical Features**

- Sudden onset of pain in a male child, with progressive distension of the abdomen, vomiting, with passage of *red-currant-jelly stool*.
- Often *ISS* is recurrent, when it gets reduced, child automatically feels better and becomes asymptomatic (Mother often complains that ‘Bachha rotha he, Bachha sotha he’—It means child cries during an episode and sleeps peacefully once it gets reduced).
- *On examination*, a mass is felt either on the left or right of the umbilicus which is sausage shaped with concavity towards umbilicus, smooth, firm, resonant, not moving with respiration, mobile which contracts under the palpatinge fingers. *Often mass appears and disappears.*
- Right iliac fossa is empty (Sign of Dance).
- After 24-48 hours, abdominal distension appears and increases progressively with features of intestinal obstruction.
• Eventually gangrene and perforation occurs with features of the peritonitis.

**Differential diagnosis**

*In children:*
- Acute gastroenteritis.
- Purpura with intestinal symptoms.

*In adults:*
- Carcinoma colon.
- Mesenteric mass.

**Investigations**

- Barium enema shows typical *claw sign* or *coiled spring sign*.
- Ultrasound shows *target sign* or *pseudokidney sign* or *bull’s eye sign* which is diagnostic.
- Plain X-ray shows *multiple air fluid levels*.

**Treatment**

- *Reduction by hydrostatic pressure* using either saline or microbarium sulphate solution or air (popular in China). Barium or saline is infused into the rectum through a catheter (Foley’s catheter). Under fluoroscopy, reduction can be observed. Child passes large quantity of gas and faeces; distension of abdomen disappears; pain is relieved; further X-ray shows ileum, caecum and ascending colon. Reduction is successful if done within 24 hours of presentation. It is done in children, where the success rate is 90%.

- If reduction does not occur, *laparotomy* is done under G/A. By gently *milking out* the intussusception with warm packs, it is reduced. After reduction viability of the bowel is checked carefully. If manual reduction is not possible, it is understood that the bowel is likely to be gangrenous which requires resection and anastomosis. In case of viable bowel, often terminal ileum is anchored to the ascending colon and *Jackson veil band* is cut. Patient also requires nasogastric tube aspiration, IV fluids, and broad spectrum antibiotics.

- If intussusception persists for more than 48 hours in infants and children or intussusception in adult requires resection.
- Laparoscopic approach is also useful.

*Note:* Recurrent intussusception is 2% common.

**SPECIMENS OF SMALL BOWEL TUMOURS**

- Tumours of small bowel, both benign and malignant are rare.
- Incidence is 3% of all GI malignancies. It is common in males 3:2. It is common in old people.
- Even though small bowel comprises 75% of entire GI length and 90% of GI mucosal surface, it is an uncommon tumour. This is because of less luminal bacterial content; rapid transit time (2 hours); less exposure of mucosa to potential toxins; protective action of alkaline mucus rich succus entericus; capacity of mucosal cells to detoxify carcinogens like benzopyrones; high levels of luminal IgA and more lymphoid tissue in the small bowel wall.

**Fig. 3.50:** Jejunum showing gross and cut section of the leiomyoma of jejunum. Cut section shows fleshy benign tumour with smooth capsule.

**Fig. 3.51:** Jejunum showing irregular thick constrictive type of tumour – feature of carcinoma jejunum. Note that capsule is not present here.
Fig. 3.52: Specimen showing ileum, appendix and caecum and ascending colon. Tumour seen in the ileum which is well localised and fungating and also large mesenteric nodes are clearly visible.

- **Aetiology**—familial adenomatous polyposis (FAP); Crohn’s disease; celiac disease (commonly lymphoma); previous cholecystectomy individuals; HIV and immunosuppressant therapies in transplant individuals (commonly lymphoma); Peutz-Jeghers syndrome (rarely turns into malignancy).
- **Benign tumours** are 50% of small bowel tumours.

**Benign tumours of small bowel**
- Brunner gland adenoma—in duodenum. It does not turn into malignancy
- Adenoma—common in duodenum. Size > 2 cm is potentially malignant. It can present as bleeding—melena/haematemeses; obstructive jaundice if adenoma is near ampulla; intestinal obstruction
- Lipoma—common in ileum and jejunum
- Leiomyoma—common in jejunum and ileum
- Hamartoma—Peutz-Jeghers syndrome
- Haemangioma

**Features of benign small bowel tumours**
- Often they are asymptomatic
- GI bleeding is common presentation
- Intestinal obstruction; intussusception are other presentation
- Palpable mass is rare

- In duodenum it can present as obstruction/ jaundice
- Investigations – gastroscopy; small bowel enteroscopy; dynamic enteroclysis; barium meal follow through or video capsule endoscopy
- Treatment is surgical resection
- Hamartomas can be left alone unless it causes life threatening bleed
- Complications—haemorrhage; intestinal obstruction and perforation; malignant transformation

**Malignant Neoplasms of Small Bowel**
- **Adenocarcinoma** is most common (35%). Other types are gastrointestinal stromal tumours (GIST); carcinoids; lymphoma; leiomyosarcoma; liposarcoma.
- Metastatic small bowel tumour from melanoma can occur.
- Presentations – vague abdominal discomfort; obstructive features; anorexia and weight loss; anaemia; sudden severe bleeding per anum; liver secondaries; ascites.
- When there is small bowel malignancy additional separate primary malignancy can develop in colorectum/breast/pancreas/stomach. This is more common with small bowel carcinoid.
- Diagnosis is by—CT abdomen; video capsule endoscopy; enteroscopes (push or Sonde pull enteroscopes); enteroclysis; barium follow through X-ray; intraoperative enteroscopy; occult blood test in stool.

CT abdomen, capsule endoscopy (26 × 11 mm) and laparoscopy are ideal tools for diagnosis. In CT, findings are—thickening of small bowel wall more than 1.5 cm, mesenteric nodes, bowel mass more than 1.5 cm; presence of ileocolic/jejunoileal intussusception with concentric rings and doughnuts.

**Most common type**—adenocarcinoma is common in duodenum and jejunum. Upper GI scopy and CT are the investigations. Surgical resection/ pancreaticoduodenectomy are the procedures.
done. It carries a poor prognosis. Patient with Crohn’s disease have still worse outcome.

**AJCC staging**

T1 – Mucosal; T2 – Muscularis spread; T3 – Serosal; T4 – Extraserosal to adjacent tissues; N0 – No nodes; N1 – Presence of nodes; M0 – No metastases; M1 – Presence of metastases

**GI lymphoma** – GIT is most common site of extra nodal lymphoma. It is commonly NHL type. Incidence is 20% of all NHL diseases. Stomach-60%; small bowel – 30% and colon are common sites. Primary small bowel lymphoma is NHL – B cell type, is common (80%). T cell lymphoma, when occurs has got worse prognosis than B cell type. In 10-25% cases multiple lymphomas may be present.

Usual presentations are malabsorption, obstruction, palpable bowel mass (well-defined, smooth and firm, mobile, with impaired resonance, not moving with respiration.), perforation, GI bleeding.

CT scan will show mass lesion; thickened bowel wall; mesenteric nodes; obstruction. CT guided biopsy may be beneficial in confirming.

Treatment is surgical resection/chemotherapy. Overall prognosis is poor.

**Diagnostic criteria for primary GI lymphoma**

- Absence of clinically palpable lymph nodes in neck/axilla
- Absence of mediastinal nodes on chest imaging like CT
- Absence of spleen/liver involvement
- Normal peripheral blood count
- Mesenteric lymph nodes may be present

**Carcinoid Tumour**

It commonly occurs in appendix (65%), ileum (25%), other parts of GIT and rarely bronchus, testis, and ovary. In the small intestine, carcinoids are most often seen within the terminal 2 feet of the ileum. They arise from the enterochromaffin cells (Kulchitsky cells) found in the crypts of Lieberkuhn. These cells are capable of amine precursor uptake and decarboxylation (APUD cells).

**Types of Small Bowel Carcinoids**

1. Fore-gut carcinoids: bronchial/thymic/pancreatic/gastric. Produce low levels of serotonin. It is argyrophillic – cells can be stained with metallic silver in the presence of reducing agent.
2. Mid-gut carcinoids: jejunal/ileal/appendicular/right side colonic. Secretes high levels of serotonin. Argentaffin (stained with metallic silver without a reducing agent) and argyrophillic both.
3. Hind-gut carcinoids: left-sided colon/rectum. Rarely produce serotonin, but produce somatostatin and peptide YY. Presentation as submucosal nodules without ulcers. They are hormonally inactive. It does not stain with silver.

**Features of small bowel carcinoids**

- Primary tumour is usually small, < 1 cm; when size is < 1 cm nodal and hepatic spread is 20-25%. When size is 1-2 cm nodal spread increases to 80% but hepatic spread is 20-25%. When tumour is more than 2 cm nodal spread is more than 80% and hepatic spread is 50%.
- Seen in 50-60 years of age group.
- May be multicentric, when tumour is in organs other than appendix, like in small bowel—40%. Appendicular carcinoid is typically solitary.
- May coexist with synchronous adenocarcinoma of large bowel or breast.
- Most often they are asymptomatic—found incidentally, and difficult to diagnose unless there is hepatic spread.
- May present with abdominal pain, features of intestinal obstruction.
- Once secondaries develop in the liver (which is yellowish) carcinoma syndrome develops (10%), which is due to release of 5-HT, kinins,
prostaglandins, histamine and indoles causing flushing, diarrhoea, cyanosis, asthmatic attacks hepatomegaly, cardiac lesion on right side. Flushing and erythema of face and trunk is common – 80%. Tricuspid and pulmonary valve fibrosis and stiffening occurs due to persistent high 5 HIAA causing right heart failure. Syndrome signifies hepatic spread/bronchial carcinoid/retroperitoneal carcinoid. Attacks can be induced by alcohol.  
- Urine shows increased 5-hydroxy-indole-acetic acid (5HIAA) levels in 24 hours sample signifies carcinoid syndrome.  
- Indium$^{111}$ octreotide scintigraphy; I$^{131}$ MIBG scan and CT scan abdomen are very useful tools.

**Treatment**

- **Surgery**
  If it is in the tip of the appendix (tip is common site), appendicectomy and regular follow up is sufficient. If it is at the base of appendix or terminal ileum right hemicolecctomy is required. In small bowel, if the primary tumour is < 1 cm, with no lymph nodes, then segmental intestinal resection and anastomosis is sufficient. Wide excision of bowel is necessary in case of large, multiple carcinoids, with involvement of lymph nodes. In liver secondaries, along with surgical debulking hepatic resection, hepatic artery ligation or embolisation is tried.
- **Medical treatment**
  Mainly symptomatic when it is advanced or with spread; long acting somatostatin analogue – octreotide can be given. 90% symptom palliation is achieved. Serotonin antagonists, antihistamines, alphamethyl dopa, 5-Fluro-uracil, interferon—alpha, doxorubicin, dacarbazine, radiolabeled somatostatin analogue and Indium$^{111}$ labelled pentetreotide are tried with variable benefits.

**Gastrointestinal Stromal Tumours (GIST)**

- It is rare tumour of GI tract – 0.2 % of all GI tumours.  
- But it is the most common non-epithelial tumour of the small bowel. 25% of all GISTS are from small bowel (Stomach is the commonest site of GIST – 50%; rectum – 15%; colon – 10%).  
- Equal in both sexes and common in 50-70 years age group.  
- GIST arises from interstitial cell of Cajal (pacemaker cell which intercalates between smooth muscle cells and intramural neurons). Mutation of tyrosine kinase and platelet derived growth factor alpha (PDGFα) are the newer pathogenetic theories.  
- GIST is classified as very low risk (2 cm); low risk (2-5 cm); intermediate risk (5-10 cm) and high risk (> 10 cm) based on tumour size and mitotic activity of cells.  
- 95% of GISTS express c-kit—CD117 mutations a specific molecular marker.  
- **Clinical features:** Abdominal pain; weight loss; GI bleed and large mass abdomen are typical. Mass is extraluminal as it is submucosal origin but expands and compresses the mucosa. 50% of GIST can present as metastatic disease of liver and peritoneum (ascites). GIST almost never metastasise to regional lymph nodes.  
- **Investigation:** CT scan is the main investigation; others being tumour/molecular marker to differentiate it from sarcomas. Endosonography guided biopsy/guided FNAC are important to get histological confirmation. 18 FDG PET scan is very useful adjunct to CT but reserved for difficult/equivocal cases.  
- **Treatment:** Surgical excision, commonly with bowel resection.  
  *Imatinib mesylate—a specific oral drug* (year 2000) that inactivates tyrosine kinase kit and so prevents phosphorylation of the receptor and proliferation of tumour is very much beneficial in advanced cases. Now it is also used if the tumour size is more than 10 cm; intraperitoneal rupture/spillage; haemorrhage in GIST; multifocal tumour. Duration
of Imatinib is usually one year. Newer drug – SU11248 inhibits tyrosine kinase receptor as well as blocks PDGFRα. Another newer derivative – sunitinib is used in imatinib refractory cases.

- **Prognostic factors for GIST:** Size of GIST more than 5 cm; higher mitotic activity (>10 mitoses per high power field); liver spread; KIT exon 9 mutation is more aggressive than KIT exon 11 mutations.

**SPECIMEN OF CARCINOMA OESOPHAGUS**

Benign tumours of the oesophagus are rare (1%). It grows slowly like a balloon by expansion with compression of surrounding structures. It never infiltrates or spreads. It can cause obstruction/regurgitation/aspiration/mediastinal compression. It can be squamous papilloma/polyp/inflammatory pseudo tumour/leiomyoma (commonest benign tumour of oesophagus–65%)/neurofibroma/rhabdomyoma/lipoma. True adenoma in oesophagus is very rare.

- Features may be asymptomatic (85% identified incidentally during contrast X-ray/endoscopy); dysphagia/air way obstruction/pneumonia/sputtering during swallowing; stridor/regurgitation. **Leiomyoma** is smooth, sessile, lobulated, firm, with grey white whorled appearance. Only when leiomyoma reaches 5 cm in size it causes obstruction. Multiple diffuse leiomyomas can occur occasionally in females, often as part of the Alport’s syndrome which needs total oesophagectomy with gastric pull up, even though benign. Benign leiomyoma of oesophagus rarely turns into leiomyosarcoma. 90% of oesophageal leiomyomas occur in lower third of the oesophagus.

- **Investigations:** are barium swallow X-ray/Oesophagoscopy/endosonography/CT scan.

- **Treatment:** If tumour is more than 5 cm/symptomatic tumour/intraluminal tumour/when diagnosis is doubtful surgical enucleation is indicated. Enucleation is the choice therapy. Ideally through right-sided thoracotomy it should be done. Occasionally oesophageal resection is needed if tumour is very large/tumour with mucosal ulceration/if tumour is near OG junction. Thoracoscopic resection can be done. Leak, empyema, sepsis and stricture are the occasional complications.

Figs 3.53A to C: Specimen showing gross as well as cut section of oesophagus with proliferative lesion in the oesophagus. It is oesophagectomy specimen.
Note: Unlike in the stomach and intestine (gastric leiomyoma more than 6 cm/intestinal leiomyoma more than 4 cm are potentially malignant), increased size of the oesophageal leiomyoma does not predispose the malignant transformation.

**SPECIMEN OF LIPOMA**

- Lipoma is commonest benign tumour – *universal/ubiquitous tumour*. It is benign neoplasm which is usually capsulated arising from yellow fat. Tumour arising from brown fat is called as *hibernoma* – rare.
- It can be subcutaneous; subfacial; intramuscular; subserosal; submucous; subsynovial; intraarticular; intraglandular; extradural or retroperitoneal.
- Fibrolipoma is lipoma with fibrous tissue.
- Neurolipoma is lipoma with neural components which is often multiple and painful.
- Naevolipoma contains lipoma with haemangiomatous tissue with bluish discolouration over the skin.
- Multiple lipomatosis are common in buttocks, thigh and neck.
- Diffuse lipoma occurs commonly in plantar aspect, and retroperitoneum.
- *Dercum’s disease* / adipose dolorosa is commonly seen in females; common in trunk, buttocks and thigh. It is painful, tender, usually diffuse deposition of fat without any capsule.
- Lipoma is clinically smooth, soft, nontender, freely mobile, semifluctuant, usually non-transilluminant and slips between fingers. Edge of the swelling when pressed with fingers causes displacement of the swelling.
- Lipoma should be differentiated from neurofibroma, sebaceous cyst.
- Complications of lipoma are saponification, calcification, infection, myxomatous degeneration and sarcomatous changes.
- Lipoma in the retroperitoneum, thigh and shoulder region commonly undergoes *sarcomatous changes*. Features of *sarcomatous changes* are – rapid increase in size, increased vascularity with dilated veins, and fixity to deeper structures. Liposarcoma is the commonest sarcoma. It may cause blood spread to lungs and so CT chest should be done along with incision biopsy of the primary lesion.
- Treatment of lipoma is excision. It is done using local anaesthesia if lipoma is small; under general anaesthesia if lipoma is large.
- Liposarcoma is treated by wide excision / compartment excision / amputation with adjuvant chemotherapy and regular follow up.

**SPECIMEN OF PAPILLOMA**

Papilloma is warty swelling from the skin or often from the mucous membrane. It has got a central axis of connective tissue, blood vessels and lymphatics.

**True Papilloma**

- It is a benign tumour with localised overgrowth of the epidermis. It is commonly pedunculated but rarely can be sessile.

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![Fig. 3.54: Specimen of lipoma. Note the colour and gross look.](image1)

![Fig. 3.55: Pedunculated papilloma of skin. Note the variegated surface and its root.](image2)
Pedunculated papilloma is villous with a central axis of connective tissues, blood vessels and lymphatics.

- **Infective papilloma** is a warty lesion due to infection. For example, condyloma acuminata.
- **Papilloma** may be single or multiple. Papilloma may be pigmented or nonpigmented.
- **True papilloma** may turn occasionally into squamous cell carcinoma. There will be sudden increase in size, bleeding or ulceration.
- **Differential diagnosis:** Amelanotic melanoma, pedunculated lipoma or carcinoma.
- Papilloma can occur in the breast called as duct papilloma which is the commonest cause of bloody discharge from the nipple.
- Papilloma can occur in mucus membrane like in oral cavity, urinary bladder (transitional papilloma), in the rectum (columnar), in the larynx, in the gallbladder (cuboidal).
- **Treatment:** True papilloma is excised with its base along with surrounding 1 cm skin margin. Infective warts can be treated by excision or CO₂ snow or diathermy coagulation.

**Complications of papilloma**

- Bleeding
- Malignant transformation
- Ulceration
- Mechanical disability like voice change when it occurs in vocal cord

**SPECIMEN OF MELANOMA**

Melanoma is common in females. In females, leg is the commonest site. In males, trunk is the commonest site. In Bantu tribe sole is the commonest site. Eyes, mucocutaneous junction, head and neck, meninges, oral cavity and paranasal sinuses are other sites.

It is most common in Queensland Australia. It is also common in Western countries and in whites.

**Risk factors are**

- Exposure to UV light.
- Albinism, xeroderma pigmentosa.

![Specimen of melanoma](image)
Junctional naevus, familial dysplastic syndrome, sporadic dysplastic naevi.
Congenital naevus, size more than 20 cm.
Familial (10% - through chromosomes 1p, 6q, 7 and 9).
Earlier skin cancers other than melanoma.
Patients who are on immunosuppressive drugs like after renal transplantation or NHL.

Differential diagnosis for melanoma (other pigmented lesions of the skin)
- Seborrhoeic keratosis, dermatofibroma.
- Pigmented BCC, pigmented SCC.
- Naevus, sebaceous epidermal naevus.
- Kaposi’s sarcoma, mycosis fungoides.
- Cutaneous haemangioma.
- Certain skin adnexal tumours.
- Solar keratosis.
- Pyogenic granuloma.
- Cutaneous angiosarcoma.

Newer TNM staging (2002) for melanoma

T—Tumour.
T0—No tumour.
Tis In situ tumour.
T1a < 1 mm, level II, level III no ulceration.
T 1b < 1 mm, level IV with ulceration.
T 2a 1—2 mm no ulceration.
T 2b 1—2 mm with ulceration.
T 3a 2—4 mm no ulceration.
T 3b 2—4 mm with ulceration.
T 4a > 4 mm no ulceration.
T 4b > 4 mm with ulceration.

N—Node
N0 No nodes.
N1a one node micrometastasis.
N1b—one node macrometastasis.
N2a—2 or 3 nodes micrometastasis.
N2b—2 or 3 nodes macrometastasis.
N2c—no nodes but satellite or in transit lesions.
N3— 4 or more nodes; nodes with satellite or in transits.

M—Metastasis
M 0—No blood spread.
M 1a—Skin, subcutaneous tissue, distant node.
M 1b—Lung spread.

M 1c—Other viscera or distant spread and increase in LDH.

Staging of malignant melanoma (older system)
IA: Thickness less than 0.75 mm
IB: Thickness between 0.76 to 1.5 mm
IIA: Thickness between 1.51 to 4.0 mm
IIIB: Thickness more than 4.0 mm
IIIA: Any of the above+ nodes less than 3 cm
III B: “+ nodes more than 3 cm
IV: “+ any node + M1(distant spread).

Types
- Cutaneous melanoma
- Extracutaneous (ocular is common site)
- Occult (Unknown primary).

Breslow’s classification:
Based on thickness of invasion measured by optical micrometer.
- I: Less than 0.75 mm.
- II: Between 0.76 to 1.5 mm.
- III: 1.51 mm to 4 mm.
- IV: more than 4 mm.

Clark’s levels
- Level 1: Only in epidermis.
- Level 2: Extension into papillary dermis.
- Level 3: Filling of papillary dermis completely.
- Level 4: Extension into reticular dermis.
- Level 5: Extension into subcutaneous tissue.

Important features of melanoma
- Asymmetry
- Border irregularity
- Colour variation
- Diameter > 6 mm
- Elevation

Clinical Types
- Superficial spreading melanoma: Most common – 65%. It has got variegated irregular look; can occur in any part of the body; it has got radial growth and better prognosis.
**Nodular melanoma:** 12-25%. Common in younger age group; more aggressive; common in mucosa and mucocutaneous junction; uniform, nodular; more vertical growth; nodal spread is common; has got poor prognosis.

**Lentigo maligna melanoma:** 7-15%. Less common; least malignant; commonly involves head, neck, face and upper limbs; common in old age; also called as Hutchinson’s melanotic freckle.

**Acral lentiginous melanoma:** 5%. Least common; occurs in palms, soles and subungual region; usually attains large size; nodular type with more vertical growth phase; has got poor prognosis. It is common in Japan.

**Amelanotic melanoma:** This is the worst type. Because of the undifferentiation, tumour cells lose their capacity to synthesize melanin. It presents as rapidly progressive, pinkish fleshy tumour. It may mimic soft tissue sarcoma. It needs markers like S100, HMB45 for diagnosis.

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**Features**
- It can start in a pre-existing naevus (commonly junctional naevus)-90% or as denovo in a normal skin.-10%.
- Melanoma is unknown before puberty.
- Pigmentation with irregular surface and margin with rapid growth.
- Ulceration, bleeding, itching, changes in the colour.
- No induration in melanoma.

**Note:** When a mole turns malignant, following changes should be observed.
- **Major signs:** Change in size, shape and colour.
- **Minor changes:** Inflammation, crusting, bleeding, itching, diameter more than 5 mm, halo around a mole.

**Spread**
- **Through lymphatics** it spread to regional lymph nodes either by permeation or by embolisation. In-transit nodules or satellite nodules in the skin between primary and regional lymph node area is often seen due to retrograde spread to dermal lymphatics.
- **Through Blood:** To lungs, liver (huge liver), brain, skin, bones. Secondaries are typically black. Extensive visceral involvement causes melanuria. Melanoma in retina has got better prognosis, because there are no lymphatics, spread is delayed.
- Sometimes primary is very small and so unnoticed (in anus, subungual region). They present with features of secondaries only.

**Blood Spread in Melanoma**
- **Brain:** Convulsions, localising features and raised intracranial pressure.
- **Lung:** Cannon ball secondaries, pleural effusion, haemoptysis, chest pain and cough.
- **Liver** (massive liver), ascites.
- **Skin:** cutaneous nodules often pigmented.
- **Bones:** bone pain, pathological fracture. Paraplegia/neurological deficits in spine metastasis.
Investigations
- **No incision biopsy.** It can cause early blood spread.
- Excision biopsy of primary is ideal and commonly used method.
- FNAC of lymph node.
- Ultrasound abdomen to see liver secondaries (usually huge hepatomegaly occurs).
- Chest X-ray to see secondaries – cannon ball type. HRCT of chest is ideal.
- Relevant other methods depending on site and spread.
- Urine for melanuria.

Treatment for Melanoma
- **Wide excision** of 3-5 cm clearance. Skin graft or flaps are used to cover the defect.
- Amputation, if small melanoma is in distal phalanx/subungual region.
- Disarticulation is done if it is in proximal phalanx or large melanoma in fingers or melanoma in toes.
- Melanoma between toes (web) needs forefoot amputation or disarticulation of adjacent two toes with adequate clearance.
- Melanoma anal canal needs abdomino perineal resection.
- Enucleation of eye when primary is in eye.
- When FNAC of lymph nodes shows positive for tumour cells, then therapeutic lymph node block dissection is done. When FNAC of lymph node is negative, then elective lymph node dissection (ELND/prophylactic lymph node dissection) is done if tumour is undifferentiated/thickness is 1-4 mm to prevent possible eventual nodal spread. ELND in FNAC negative patients is said to reduce the progression of the disease.
- Sentinel Lymph Node Biopsy (SLNB) is done by injecting radio-labelled Tc 99 colloid sulphur around primary tumour (or by injecting isosulphan blue) and first node is identified using gamma camera. It is dissected and frozen section biopsy is done to confirm the involvement.

- **Isolated limb perfusion** is done for melanomas in limbs using melphalan. Femoral artery and vein are separately cannulated with a proximal tourniquet. Melphalan is injected at temperature 41°C with oxygenator so that tumour tissues/cells become more sensitised for chemotherapy. Good control of local disease is achieved with preservation of the limb. DVT, bleeding, sepsis and gangrene of the limb are the occasional complications. There are less systemic toxicities.
- **Chemotherapy** using DTIC, melphalan, carboplatin, vindesine is given especially when there are secondaries in lungs, liver or bones.
- **Immunotherapy/biological therapy** using BCG, levamisole, Corynebacterium parvum, alpha interferon is also used with some success rate up to 40% in advanced melanomas.

Tumour Markers for Melanoma
- Melan–A.
- S 100.
- HMB 45 (hydroxyl methyl bromide).
- LDH.

| Relation of tumour thickness to nodal spread—based on AJCC classification |
|-----------------------------|-----------------|----------------|
| Lesion | Tumour thickness | Nodal spread |
| Thin | < 1 mm | < 10% |
| Intermediate | 1-4 mm | 20-25% |
| Thick | > 4 mm | 60% |

Prognostic factors
- Tumour thickness—very important factor
- Nodal spread
- Ulceration
- In-transit nodules
- Vertical growth—poor prognosis
- Metastatic disease
- Staging
- Mitotic activity
- Clinical types
- Amelanotic—poor prognosis
Staging as prognostic factor
Stage I — > 90% prognosis
Stage II — 70%
Stage III — 35%
Stage IV — < 2%

SPECIMEN OF THYROID

Figs 3.57A and B: Specimen of subtotal thyroidectomy showing multiple nodules in both lobes. Specimen includes both lateral lobes including isthmus (except only tissue equivalent to pulp of the finger is retained in lower posterior aspect of the gland). Procedure is done for nontoxic/toxic multinodular goitre. Cut section shows multiple nodules with few haemorrhagic spots. Nodules are usually non-functioning but internodular tissues are active. Hemithyroidectomy is removal of entire one lateral lobe and entire isthmus. It is done when disease is limited only to one side of the gland. Partial thyroidectomy is removal of both lateral lobes of the gland which is in front of the tracheo-oesophageal groove with isthmus. It is done in nontoxic nodular goitre (but subtotal thyroidectomy is better option). Total thyroidectomy is removal of most of the glands except small tissue adjacent to parathyroids and recurrent laryngeal nerve. It is done in papillary carcinoma of thyroid. Total thyroidectomy is removal of entire lateral lobes with isthmus. It is done in case of follicular carcinoma of thyroid and medullary carcinoma of thyroid.

Figs 3.58A and B: Gross and cut section of hemithyroidectomy. Entire lateral lobe and isthmus are removed. It is done in solitary nodule thyroid/nontoxic or toxic adenoma of thyroid.

Fig. 3.59: Specimen of thyroid after total thyroidectomy done for follicular carcinoma of thyroid. Note the both lateral lobes and isthmus. Total thyroidectomy is done for follicular and medullary carcinoma of thyroid.
**SPECIMEN OF URINARY BLADDER STONE**

Urinary bladder stone can be primary or secondary (occurs in bladder itself secondary to infection). It is usually radio-opaque unless it is uric acid stone. Presentations are – suprapubic pain; haematuria; retention of urine and recurrent cystitis.

*Treatment:* Cystoscopic removal of stone after fragmentation; laser fragmentation and removal; suprapubic percutaneous cystoscopic extraction or open suprapubic extraperitoneal cystolithotomy.

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**SPECIMEN OF PILONIDAL SINUS**

Fig. 3.61: Pilonidal sinus. It is tuft of hairs entering into the deeper plane causing inflammation, reaction and sinus formation. It is common in intergluteal region in the midline cleft. It can occur in webs of the hand or axilla occasionally. It is common in jeep drivers hence called as *jeep bottom*. It is also common among barbers. Sinus in the midline is called as *primary sinus*. It eventually spreads laterally and forms additional sinuses in paramedian area called as *secondary sinus*. It causes recurrent infection, abscess formation which bursts open forming recurrent sinus with pain, discharge and discomfort. Chronic pilonidal sinus can cause sacral osteomyelitis, necrotising fasciitis. *Treatment:* Excision and primary closure in prone position under general anaesthesia; excision with Z plasty; excision with multiple Z plasty; Karydakis excision and lateralised suturing of the wound away from the midline; Limberg buttock flap; Bascom technique of excision through lateral approach is a good method. Through small lateral incision or multiple small lateral incisions 2-4 mm sized sinus is approached and pus is drained; hairs are removed with only minimal excision of sinus is done. Cavity walls are not excised. Lateral small wounds are either sutured or left open for spontaneous healing. Condition has got high recurrence rate (20%). It is due to improper removal, overlooking of existing diverticulum, entry of new tuft of hairs, breakage of scar.

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**SPECIMEN OF ROUNDWORMS**

Ascaris lumbricoides is the causative worm. It causes worm colic; toxicity; acute intestinal

**Treatment of roundworm obstruction**

- **Drugs:** Piperazine citrate, mebendazole, albendazole.
- Most often by conservative treatment, worms get dispersed and passes per anally. But patient requires nasogastric aspiration, IV fluids, antibiotics, and observation.
- If patient is not responding, then laparotomy is done. *Worm bolus* in the distal ileum is milked in to the caecum. Often enterotomy and removal of worms is required.
Perforation due to worm requires immediate laparotomy, removal of worms and closure of perforation.
- Only rarely, resection and exteriorisation is required.

Note: Perforation usually occurs at the site of pre-existing disease like nonspecific ileal ulcer, amoebic ulcer, typhoid ulcer, and suture line. Vomiting of the roundworms does not signify obstruction by roundworms. It only signifies there is intestinal obstruction (due to any cause) and so worms proximally gets irritated and dispersed moving proximally to get expelled per mouth.

**SPECIMEN OF TESTICULAR TUMOUR**

99% of testicular tumours are malignant.

Figs 3.62A and B: Bolus of roundworms removed through enterotomy as it was causing complete intestinal obstruction at ileum. Enterotomy is closed afterwards horizontally. Specimen 2nd shows roundworm bolus in the intestine.

Obstruction with palpable worm bolus per abdomen; recurrent subacute obstruction; perforation at ileum leading to peritonitis; malabsorption; iron deficiency anaemia; intraperitoneal abscess formation.

Figs 3.63A and B: Gross and cut-section of testicular tumor. Note the cystic spaces with solid tissues and cartilages which signify the feature of teratoma of testis. Teratoma arises from totipotent cells in rete testis.
Figs 3.64A and B: Specimens showing seminomas with smooth fleshy tumour and teratomas with solid and cystic areas.

Predisposing Factors
- Undescended testis: There are abnormal germ cells; altered blood supply and temperature; gonadal dysgenesis. If testis is inguinal (inguinal cryptorchid), then orchidopexy if done before puberty, the incidence of testicular tumour is equal to that of normally descended testis. If the testis is abdominal (abdominal cryptorchid) and not hormonally adequately active, then it is 20 times more prone to develop testicular tumour and so orchidectomy should be done. Patient with inguinal cryptorchid who has not underwent orchidopexy before puberty is more prone for testicular tumour. 10% of testicular tumours are associated with undescended testis. 5% of patients with undescended testis develop testicular tumour on the opposite side with normally descended testis. Late orchidopexy does not prevent testis from turning into carcinoma but allows early diagnosis because of the easily palpable position.
- Testicular atrophy.
- Klinefelter’s syndrome: Eunuch features; testicular atrophy; gynaecomastia with 47 XXY karyotype.
- Hormonal fluctuation.

Classification
- Seminoma—40%.
- Teratoma—32%
- Seminoma + teratoma—14%.
- Choriocarcinoma, yolk sac tumour, embryonal carcinoma
- Interstitial tumours—1.5% (Leydig cell tumour, Sertoli cell tumour)
- Gonadoblastoma
- Lymphomas—7%; has got poor survival rate. CNS/bone marrow disease is common
- Others—carcinoids, secondaries, mesothelial tumours, sarcomas

Seminoma Testis
- It starts in the mediastinum of the testis. It arises from germinial epithelium of the secretory tubules of the testis.
- Grossly, it is lobulated, fleshy, homogeneous, and creamy or pinkish in colour and it compresses adjacent testicular tissue.
- Histologically, malignant cells resemble spermatocytes which are clear cells, with lymphocytic infiltration.
• It spreads through testicular lymphatics into the para-aortic lymph nodes and then to left supraclavicular lymph node. Through blood, it spreads to lungs, liver, brain and bone.

**Types of seminoma**
- **Typical/classic form:** It is commonest type; occurs in middle age; syncytiotrophoblastic type (15%) occurs and produces high levels of beta HCG.
- **Spermatocytic seminoma:** Occurs in older people with different phases of spermatogonia. Spread in this type is very rare.
- **Anaplastic type** has got high mitotic index/nuclear pleomorphism/anaplasia with high potentiality to spread.

**Teratoma**
- It arises from totipotent cells, i.e. ecto, meso, endoderms.
- Grossly tumour surface is irregular, cut section shows solid and cystic spaces with areas of haemorrhages. It often contains gelatinous fluid and cartilaginous nodules.

Histologically there are four types—
1. **Teratoma differentiated:** (1%)  
2. **Teratoma intermediate:** 30% common. Two subtypes are A and B. Matured cells are found in A type but in B type proper differentiated tissues are not found and is more malignant.
3. **Teratoma anaplastic:** (15%). Secretes alpha fetoprotein (AFP).
4. **Teratoma trophoblastic:** (1%). It shows high levels of βHCG. (Normal level is 100 IU).

**Interstitial Cell Tumour**
- **Leydig cell tumour** (2%) musculinis. Prepubertal tumour shows excessive output of androgens causing sexual precocity, extreme muscular development and may mimic infant hercules.
- **Sertoli cell tumour** (1%) feminises. Postpubertal tumour commonly arising from Sertoli cells causes feminising effect with gynaecomastia, loss of libido and aspermia. It may be classic/large cell calcifying/sclerosing.

**Clinical Features**
- Enlargement of testis.
- Fullness and heaviness in the scrotum.
- Pain in the testis (30%).
- Testis will be enlarged, firm, and heavy, with loss of testicular sensation.
- Secondary hydrocele is common.
- Cremaster is hypertrophied and thickened.
- Vas, prostate and seminal vesicles are normal.
- Often para-aortic lymph nodes may be palpable in epigastric region as hard, nodular, nontender, nonmobile, vertically placed, resonant mass (not moving with respiration).
- Haemoptysis, altered breathe sounds and pleural effusion due to lung secondaries.
- Bone pain and tenderness due to secondaries in bone.
- Nodular secondaries in the liver.
- Occasionally it may mimic acute epididymo-orchitis or acute haematocele.
- Gynaecomastia may be present in few teratomas.

**Hurricane type** is very aggressive, highly malignant testicular tumour which is more often fatal in few weeks.

Rarely, if tumour comes out of the tunica albuginea (tunica albuginea is resistant for malignant cell infiltration), then scrotum gets infiltrated and spread can occur to inguinal lymph nodes.

**Differential diagnosis**
- Acute and chronic haematocele  
- Acute epididymo-orchitis  
- Syphilitic orchitis  
- Lepra orchitis

**Sign of vas:** To differentiate tumour from infection - in testicular tumours vas is normal, cord structures may become bulky because of cremasteric hypertrophy where as in infection vas is thickened, beaded, and tender.
Staging of testicular tumours
I. Lesion confined to testis.
II. Nodes involved below the diaphragm
III. Nodes involved above the diaphragm.
IV. Distant (blood) spread.

TNM staging
T0 No evidence of tumour
Tis Carcinoma in situ
T1 Tumour limited to testis and epididymis. Vascular/lymphatic invasion not present. Tumour may invade tunica albuginea but not tunica vaginalis
T2 Tumour limited to testis and epididymis with vascular/lymphatic invasion. Or tumour extends through the tunica albuginea with involvement of tunica vaginalis
T3 Tumour invades spermatic cord with or without vascular/lymphatic invasion.
T4 Tumour invades scrotum with or without vascular/lymphatic invasion
N0 Regional lodes not involved
N1 Single/multiple nodes—not more than 2 cm in size
N2 Regional nodes – between 2-5 cm
N3 Regional nodes > 5 cm
M0 Distant spread not present
M1 Distant spread present
M1a Distant spread to nonregional nodes or to lungs
M1b Distant spread to other than nonregional nodes or lungs

Investigations
- No FNAC; No scrotal approach; No incision biopsy.
  Through inguinal approach, cord and testis are exposed. A soft clamp is applied to the cord at or above the level of the deep ring so as to prevent dissemination through blood. Frozen section biopsy is done from the suspected area. If tumour is positive high orchidectomy is done (Chevassou manoeuvre).
- Measurement of tumour markers (βHCG, AFP, LDH). AFP and HCG are elevated in nonseminomatous germ cell tumours (teratomas). Raised AFP always indicate teratomatous feature of the tumour. AFP level is not increased in pure seminomas. HCG may be elevated in advanced cases of seminomas. LDH level depends on growth rate/cellular proliferation/tumour burden. LDH is increased in 80% of advanced seminomas and 60% of nonseminomatous germ cell tumour.

- Chest X-ray to see lung secondaries. HRCT scan is ideal.
- Ultrasound abdomen to see nodal status like paraaortic nodes and liver secondaries. CT abdomen is better.
- Ultrasound scrotum to see echogenicity of testis and tumour within.

Treatment
- Seminomas are radiosensitive. So after high orchidectomy, radiotherapy is given to increase the cure rate and also to reduce relapse. It is the treatment of choice in stage I seminomas. Opposite testis should be shielded during radiotherapy.
- Seminomas with high tumour marker level are treated as nonseminomatous tumours.
- Chemotherapy is also effective. Cisplatin is very useful drug in seminoma.
- In teratoma after high orchidectomy, Retroperitoneal radical lymph node dissection (RPLND) is beneficial. Even in stage I disease, chances of existing retroperitoneal spread is 30%. So RPLND (infra hilar) has a major role especially in teratomas which are relatively radioresistant. It is removal of precaval, retrocaval, paracaval, interaortocaval, retroaortic, para-aortic, common iliac nodes along with removal of gonadal vein with adjacent fibrofatty tissues from internal ring level to its insertion in to renal vein on left side and inferior vena cava on right side. Commonly bilateral RPLND is done as contralateral nodes also can be involved. RPLND mortality is only 1%. Complications are haemorrhage; injury to structures like major vessels/ureter/bowel; chylous ascites; lymphocele; retrograde ejaculation.
Radiotherapy is not beneficial in teratoma.
Chemotherapeutic drugs for teratoma are Cisplatin, bleomycin, vinblastine, etoposide, ifosfamide, mesna, paclitaxel.

**Follow-up**
- Measurement of tumour markers at regular intervals for 5 years and yearly after 5 years.
- CT abdomen and chest once a year.

**Factors Affecting the Prognosis**
- Histological appearance of tumour.
- Staging of the tumour.
- Age of the patient, younger the age poorer the prognosis.
- Seminoma has got better prognosis than teratomas.
- Hurricane type has got worst prognosis.

**SPECIMEN OF STAGHORN CALCULUS OF KIDNEY**

Fig. 3.65: Staghorn calculus occupies the major and minor calyces. It presents as recurrent pyelonephritis, pyonephrosis and if bilateral renal failure. If kidney function is adequate which is confirmed by DTPA radioisotope scan then nephropyleolithotomy is done. Often initial nephrostomy is needed.

**SPECIMEN OF TUBERCULOUS LYMPHADENITIS**

Fig. 3.66: Specimen of tuberculous lymphadenitis showing yellowish caseating material with matting due to periadenitis. It is common in neck. Caseating type is more common than hyperplastic type. Histologically epithelioid cells are most important other than giant cells of Langhan’s, macrophages.

**Stages of Tuberculous Lymphadenitis**
1. Stage of infection. and lymphadenitis.
2. Stage of periadenitis with matting.
3. Stage of caseating necrosis and cold abscess formation.
4. Stage of formation of collar stud abscess.
5. Stage of formation of sinus which discharges yellowish caseating material.
   (For detail please refer chapter surgical procedures)

**SPECIMEN OF SECONDARIES IN NECK LYMPH NODES**

See Figure 3.67.
(Please refer for detail chapter short cases)

**SPECIMEN OF TRANSITIONAL CELL CARCINOMA OF BLADDER**

See Figure 3.68.
**Bladder Tumours**

1. **Primary:**
   a. Epithelial
      1. *Transitional cell carcinoma* (90%).
      2. *Adenocarcinoma*, arising from urachal remnant or in exstrophy bladder or from glandular metaplasia (2%).

2. **Secondary:** from adjacent organs like sigmoid colon, rectum, uterus, and ovary, prostate.

   a. Connective tissue tumour:
      1. Myoma, angioma, fibromas, sarcomas
      2. Extra adrenal phaeochromocytoma.

   **Squamous cell carcinoma** originates from bilharzial infection (5%) or calculus.

   **Chemical carcinogens are the main factor.** 2-Naphthylamine, aminobiphenyl, benzidine, chloro-O-toluidine, chloro aniline, other dyes.

   Occupation-wise it is common in textile, dye, cable, tyre, petrol, leather workers, painters, chemical workers, sewage workers.

3. **Transitional Cell Carcinoma (TCC)**
   It is the commonest type of bladder tumour.

   **Aetiology**
   3C’s
   - Chemical carcinogens.
   - Cigarette smoking.
   - Cyclophosphamide.

   **Chemical carcinogens are the main factor.**

   Occupation-wise it is common in textile, dye, cable, tyre, petrol, leather workers, painters, chemical workers, sewage workers.

   **Tumour Groups**
   1. **Nonmuscle invasive tumour without involving lamina propria**: Has got excellent prognosis. (70%).
   2. **Nonmuscle invasive tumour with involvement of lamina propria.**
   3. **Muscle invasive type**: (25%). Carries poor prognosis.
   4. **Carcinoma in situ (flat noninvasive)**. Contains irregularly arranged cells with large nuclei, with high mitotic index, replacing normal urothelium.
   This may occur alone—**Primary carcinoma in situ**.
   It may occur in association with a new tumour—**Concomitant carcinoma in situ**.
   It can occur in a patient who had a previous tumour—**Secondary carcinoma in situ**.
   It has got high malignant potential with 50% mortality rate.
   It was called earlier as malignant cystitis as it causes severe dysuria, suprapubic pain and frequency (terminology not used presently).
Types of Bladder Tumours

a. **Superficial bladder tumour:** It may be papillary, pedunculated with narrow stalk, which is often multiple.
   
   It may be sessile with a wide base, which can be single or multiple, which has got tendency to invade the muscle earlier.
   
   Mucosa in and around the tumour is oedematous, red, with dilated vessels, often with encrustations.

b. **Muscle invasive TCC:** Almost always they are solid, sessile, with a broad base and with irregular ulcerated surface.
   
   It may spread through lymphatics to pelvic lymph nodes or through blood to the lung, liver and bones.
   
   It has got poor prognosis.

c. **Carcinoma in situ.**

Sites

Lateral wall—commonest (35%).
Trigone—next common (32%).

Staging

**Jewitt-Strong-Marshall staging**

I  Subepithelial connective tissue.
II  Muscle infiltration superficially.
III  Full thickness muscle and perivesical tissue infiltrated, but mobile.
IV  Fixed to adjacent organs.
IVA  Prostate.
IVB  Pelvic wall.

**TNM staging is used now (American joint committee for cancer 2002).**

Staging is done by Bimanual Palpation under G/A

Clinical Features

1. Painless haematuria.
2. Features of cystitis, with suprapubic pain, frequency, dysuria.
3. Hydronephrosis can occur when tumour obstructs the ureteric orifice.
4. Pain in groin, back, perineum, when tumour invades the pelvic wall.

Investigations

1. Urine microscopy: for RBC’s and malignant cells.
3. IVU: shows filling defect with distortion and often hydronephrosis.
4. Cystoscopy.
5. Bimanual examination under G/A - to stage the tumour.
6. U/S abdomen to see bladder wall, pelvis, liver, lymph nodes.
7. CT scan to evaluate the extension.

Treatment

a. **Noninvasive tumour**

1. **Endoscopic resection of tumour.**
2. **Intravesical chemotherapy** using BCG (weekly for six weeks), Mitomycin C, Epirubicin, Adriamycin can be given especially for carcinoma in situ.
   
   BCG is very useful. Very rarely BCG provocation can occur.
3. **Systemic chemotherapy:** Using cisplatin, 5 FU, adriamycin, mitomycin.
4. **Helmstein balloon degeneration** for large papillary tumour. Balloon is passed into the bladder and inflated so as to cause pressure necrosis of the summit of the tumour. So later remaining part of the tumour can be resected easily through cystoscopy.

b. **Invasive bladder tumour:**

1. **Curative interstitial radiotherapy** using implantation of radioactive gold grains (half life is two and half days), or radioactive tantalum wires (half life is 4 months).

2. **Radical deep external beam radiotherapy** using cobalt 60 is useful as bladder is retained and so normal act of micturition and potency can be maintained. Complication is that it may eventually lead to form a thimble bladder.

3. **Surgery:**
   
   A. **Partial cystectomy** when tumour is confined to fundus of the bladder and is single, with a margin of clearance of 2.5 cm.
B. Radical cystectomy: CT scan is a must before doing radical cystectomy to see the pelvis and lymph node status. Here urinary bladder, urethra, paravesical tissues, lymph nodes (pelvic) are removed. In females, hysterectomy with removal of part of the vagina is done. After surgery urinary diversion is done either by doing continent ileal conduit or uretero-sigmoidostomy or cysto-sigmoido plasty using sigmoid colon or by creating rectal urinary pouch.


**Indications for surgery**

1. Multiple bladder tumours
2. Sessile tumours
3. Recurrent tumours
4. Poorly differentiated tumours
5. In situ carcinomas
6. Squamous cell carcinoma
7. Adenocarcinomas

5. Systemic chemotherapy by cisplatin, adriamycin, mitomycin.

**Prognosis:** Depends on type, differentiation, location, stage, invasion, number, lymph node status, pelvis involvement and response to treatment.
X-rays

Section 4
X-rays are usually a part of the examination for undergraduates as well as post-graduates in surgery. Students should have fair idea about common X-rays, their findings and significances. However CT and MRI have taken over X-rays in places of diagnosis, X-rays are still commonly used and in certain occasions it is the compulsory method of investigation.

X-rays may be plain or contrast. Plain X-rays of abdomen/chest/bone or skull are being used for diagnosis. Contrast X-rays are barium studies/angiograms/urograms/cholangiograms, etc.

**PLAIN X-RAY ABDOMEN**

Plain X-ray abdomen is often taken in acute abdomen/to see stones in pancreas/gallstones or any calcifications. It is also used to see viscus perforation/multiple air—fluid levels/ground glass appearance and so on.

Plain X-ray abdomen is usually taken in standing position. Often X-ray is taken in lateral decubitus position.

**Proper Plain X-ray Abdomen**

- Is taken with low penetration X-ray exposing diaphragm, upper part of the pelvis, bowel shadows, liver shadow and peritoneal outline.
- Calcifications due to pancreatitis (parenchymal/ductal stone), radiopaque gallstones (10%), calcifications in liver/spleen/kidney/meconium ileus/ovarian teratoderminoids/gallstone ileus/phleboliths/vascular calcifications of aorta, renal or splenic arteries/calciﬁed ﬁbroid/calciﬁed ameobic liver abscess/calciﬁed hydatid cyst/calciﬁed lymph node may be seen.
- Gas under diaphragm is diagnostic of bowel perforation.
- Multiple air—fluid levels are features of intestinal obstruction.

**Gas Under Diaphragm**

It is due to—

- Perforated anterior duodenal ulcer (anterior DU perforates; posterior DU bleeds). It is the commonest cause of perforation. Acute ulcer or chronic ulcer with acute exacerbation perforates commonly. Perforation may be precipitated by NSAID, alcohol. Stage of chemical peritonitis, stage of reaction/illusion and stage of bacterial peritonitis are typical.
- Gastric ulcer perforation—both benign and malignant ulcer can perforate. But large gas leak is more likely to be due to malignant ulcer perforation. Gas leak can occur posteriorly into lesser sac causing abscess in lesser sac.
- Jejunal perforation—rare.
- Ileum is another common site of perforation. It causes faecal peritonitis and is more dangerous. It could be typhoid ulcer perforation/Crohn’s disease perforation/roundworm perforation/amoebic ulcer perforation (in terminal ileum)/tuberculous ulcer perforation (commonly it causes stricture—intestinal obstruction – necrosis – perforation)/small bowel malignancy like lymphoma or adenocarcinoma or carcinoid perforation. In typhoid ulcer perforation there will be relative bradycardia, soft abdomen without guarding and rigidity due to Zenker’s degeneration, diarrhoea due to enteritis, increased bowel sounds.
- Colonic perforation is due to amebic ulcer/toxic megacolon/carcinoma/ischaemic colitis.
- Traumatic perforation may be due to either stab injury causing direct penetrating injury of bowel or due to blunt injury abdomen. In blunt injury abdomen sudden shearing force causes traction of either duodeno-jejunal junction or ileo-caecal region causing perforation or transection of the bowel.
- Perforation can occur following surgical/diagnostic procedures like laparoscopic/open laparotomy/tubal insufflation.
Remember

- Appendicular perforation rarely causes pneumoperitoneum because there is hardly any gas in obstructive perforated appendix. Pneumoperitoneum can occur in rare instances, when the perforation is at the base extending to the caecal wall.
- Minimum gas required to show gas under diaphragm is 1 ml.
- Gas under diaphragm is seen in only 70% of duodenal ulcer perforation. In 30% of cases it may not be seen due to gas leak less than 1 ml as a result of sealing of perforation; and adhesion between liver and diaphragm (because of previous surgery leading into adhesions or in alcoholic patients liver is adherent to diaphragm due to perihepatitis) may not show this picture.
- Large quantity of gas may be seen in case of malignant perforation of stomach or colon.

Fig. 4.1A to C: Plain X-ray abdomen in erect posture showing gas under the diaphragm.

Fig. 4.2: Plain X-ray abdomen showing ground glass appearance—feature of peritonitis. It may be primary/secondary/tertiary. Secondary type is common—due to perforation. Primary type is due to primary infection due to *E. coli*, gonococci, pneumococci, etc. It is common in females. It progresses very fast with rapid deterioration. It needs early laparotomy and peritoneal wash and drainage. Tertiary peritonitis is seen in post-laparotomy patients—biliary/faecal. It is often difficult to diagnose.
• Patient should stand (erect posture) for 5-10 minutes to allow gas to come under the diaphragm. Lower chest should include in X-ray exposure.
• Gas is seen as a crescent of radiolucency below the radiological white diaphragmatic line on the right side. Left side fundic gas shadow may mimic the perforated gas. But very often a darker radiolucency gas can also be seen above the fundic gas shadow in X-rays of perforated patients.
• Interposition of colon between liver and diaphragm can occur mimicking the gas under diaphragm radiologically but it does not require any surgical intervention – Chilladiti syndrome.
• Left lateral decubitus X-ray may be taken in patients who are critically ill and cannot be made to stand to get erect X-ray film. Patient is turned towards left with right side up and allowed to wait for 5 minutes. Gas will come under diaphragm and above the liver. Lateral X-ray is taken from side to side.
• Gastric and duodenal ulcer perforations are less severe and less contaminated in initial phases compared to ileal and colonic perforations. Ileal and colonic perforations are severe due to faecal peritonitis and patients develop sepsicaemia/ARDS/DIC/renal failure/MODS.
• Emergency laparotomy after initial resuscitation (nasogastric aspiration, IV fluids, catheterisation, and antibiotics) is the mandatory treatment. After opening the abdomen through adequate midline incision, infected fluid is collected for culture. Fluid is sucked out. Omentum is followed to see the site of perforation. Once the perforation site is identified, it is held carefully as it will be oedematous and friable. It is closed horizontally using interrupted sutures using silk/vicryl/thread. Initially 2 or 3 outer sutures are placed; later centre suture is placed to prevent tearing of the friable perforated edges. Perforation is never closed longitudinally as it may cause narrowing during healing period leading to stricture formation and obstruction. Continuous suture is not used as it may cause tearing of the edges and also compromises the blood supply of the oedematous perforated edges leading to poor healing and eventual leak causing fistula or peritonitis. In gastric or duodenal perforations omental pedicled patch can be placed to enhance the healing (as omentum is vascular, it improves the blood supply of the closure site; its adhesive property seals the perforation well, and as it is rich in lymphatics it promotes the healing) – Roscoe-Graham operation. In infracolic (small or large bowel) leak, omental patch is not advisable as it can cause omental banding and subsequent intestinal obstruction. 10 liters of normal saline is used to give peritoneal wash. Drain is placed and abdomen is often closed with tension sutures.
• In severe faecal peritonitis following ileal/colonic perforation, ileostomy or colostomy may be a better option as closure of perforation may not take up leading into re-leak or peritonitis.
• DU perforation rarely can be treated conservatively (Harman-Taylor regime) – can be done only in early duodenal ulcer perforation if thought of sealed and in patients totally unfit (critical cardiac patients) for surgery.
• In chronic duodenal ulcer perforation if patient is opened within 6 hours and if there is not much contamination then definitive procedures like vagotomy and gastrojejunostomy or highly selective vagotomy (HSV) can be done. Good general condition of the patient and surgeon’s experience are a must.
• Perforated gastric ulcer may be of malignant nature and so edge biopsy should be taken. Few consider partial gastrectomy as the treatment as perforated malignant gastric ulcer is always advanced (serosa is involved) and partial gastrectomy is sufficient as a palliation.
• Ileal typhoid ulcer perforations may be multiple and so carefully should be searched for so as not to miss any additional perforations. Often resection and anastomosis
X-rays may be required in multiple perforations. Biopsy from the edge is a must before closure of ileal perforation.

- Typhoid ulcers are longitudinal and antimesenteric. Amebic ulcers are transverse and flask shaped and can occur both in mesenteric as well as antimesenteric areas.
- Post-laparotomy pneumoperitoneum takes 7-14 days to disappear. In children gas in the peritoneum gets absorbed faster than in adults.
- Penetrating injury (stab injury) can cause pneumoperitoneum without any bowel injury as air from the atmosphere can get into the peritoneal cavity to show gas under the diaphragm.

Different signs in X-ray in perforation
- Cupola sign: Crescent shaped radiolucency under the diaphragm
- Rigler's sign: Visualisation of both aspects of the bowel wall being outlined by gas on either side
- Inverted V sign: Gas on either sides of the falciform ligament
- Football sign: Collection of gas in the centre of the abdomen like a football
- Triangle sign: Gas between bowel loops

Conditions which mimic pneumoperitoneum-pseudopneumoperitoneum
- Subpulmonary pneumothorax
- Chiladiti syndrome
- Subphrenic abscess due to infections by gas forming organism like Clostridium welchii
- Subdiaphragmatic fat or omental fat under the diaphragm may rarely mimic gas under the diaphragm

Figs 4.3A and B: Plain X-ray abdomen showing multiple air-fluid levels due to intestinal obstruction. Adhesions and bands either congenital or postoperative are the common causes. In Asian countries hernia is the common cause of intestinal obstruction.

- Intussusception.
- Roundworm bolus obstruction.
- Stricture ileum—either tuberculosis or Crohn's disease.
- Carcinoma small bowel/carcinoma colon when it is stricture type (left sided colonic growth).
- Volvulus of colon/small bowel.

Multiple Air-fluid Levels
It is due to intestinal obstruction.

Causes of Intestinal Obstruction
- Hernia (commonly inguinal hernias but can be any hernias) and adhesions are the commonest causes. In Western countries, hernia is the common cause of intestinal obstruction.
**Intestinal obstruction may be dynamic or adynamic:**

<table>
<thead>
<tr>
<th></th>
<th>Dynamic obstruction</th>
<th>Adynamic obstruction</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outside the wall</strong></td>
<td><strong>In the wall</strong></td>
<td><strong>In the lumen</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Tuberculous stricture</strong></td>
<td><strong>Gallstones</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Crohn’s disease</strong></td>
<td><strong>Roundworm</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Malignancy</strong></td>
<td><strong>Inspissated faeces</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Radiation stricture</strong></td>
<td><strong>Meconium ileus</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Benign tumours</strong></td>
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</tbody>
</table>

**Causes of intestinal obstruction:**

<table>
<thead>
<tr>
<th>Site of obstruction</th>
<th>Proximal small bowel</th>
<th>Distal small bowel</th>
<th>Large bowel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duodenum and jejunum</td>
<td>Anywhere in large intestine</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Causes:**

- Congenital TB strictures
- Malignancy
- Lipomas
- Malignancy
- Leiomomas
- Bands and adhesions
- Gallstones
- Hernias - common cause
- Roundworm
- Congenital

**Clinical features:**

- Severe vomiting, dehydration, no or less distension, colicky pain
- Distention, vomiting, dehydration
- Constipation, distention, vomiting, Less pain

**Special features:**

- Plain X-ray
- Valvulae conniventes
- Characterless
- Dilatation and haustration

**Intestinal obstruction may be due to either congenital or acquired causes:**

<table>
<thead>
<tr>
<th>Congenital causes</th>
<th>Acquired causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Anorectal malformations</td>
<td>• Hernia (commonest)</td>
</tr>
<tr>
<td>• Congenital megacolon</td>
<td>• Postoperative</td>
</tr>
<tr>
<td>• Adhesions</td>
<td>• Intussusception</td>
</tr>
<tr>
<td>• Duodenal atresia</td>
<td>• Roundworm</td>
</tr>
<tr>
<td>• Intestinal atresia (ileal)</td>
<td>• Gallstones</td>
</tr>
<tr>
<td>• Bands and adhesions</td>
<td>• Tuberculosis</td>
</tr>
<tr>
<td>• Malrotation</td>
<td>• Malignancy</td>
</tr>
<tr>
<td>• Volvulus neonatorum</td>
<td>• Internal hensias</td>
</tr>
</tbody>
</table>
Intestinal obstruction may be:
2. Chronic.
3. Acute on chronic: Common in large bowel.
4. Closed loop obstruction.

Pathology in Intestinal Obstruction
Changes proximal to the bowel obstruction:

Fluid collects just proximal to the obstruction which is derived from saliva, stomach, pancreas and intestine. Because of oedema and inflammation absorption decreases, sequestration of fluid from the circulation into the lumen occurs and bacteria (E. coli, Klebsiella, anaerobes, bacteroides and other organisms) multiply, toxins are released – toxaemia occurs. Vomiting, defective mucosal absorption due to oedema and toxaemia, sequestration of fluid into the gut lumen leads to severe dehydration, and electrolyte imbalance.

<table>
<thead>
<tr>
<th>Normal GI secretions</th>
<th>Gas in intestinal obstruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saliva – 1-1.5 litres</td>
<td>Swallowed air—90%, diffusion from blood</td>
</tr>
<tr>
<td>Bile – 1 litre</td>
<td>– 20% and bacterial action – 10%</td>
</tr>
<tr>
<td>Stomach – 1.5-2.5 litres</td>
<td>90% gas is nitrogen, remaining are H₂S and others</td>
</tr>
<tr>
<td>Pancreas – 1.5-2 litres</td>
<td>Gas initially located in proximal part of the bowel later gets churned into distal fluid due to peristalsis</td>
</tr>
<tr>
<td>Intestine – 2.5-3 litres</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Fluid in intestinal obstruction</th>
<th>Bacteria in intestinal obstruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sequestration of the fluid into the lumen</td>
<td>E. coli</td>
</tr>
<tr>
<td>Poor absorption through the mucosa</td>
<td>Anaerobes – bacteroides</td>
</tr>
<tr>
<td>Contains toxins and multiplying bacteria</td>
<td>Klebsiella</td>
</tr>
<tr>
<td>Can cause toxaemia and aspiration</td>
<td></td>
</tr>
</tbody>
</table>
Proximal to the collected fluid, air accumulates (derived from swallowed air (70%), diffusion from blood into the lumen (20%), from digested product and bacterial action (10%). Main gaseous component is nitrogen (90%) and also hydrogen sulphide. Oxygen and carbon dioxide gets absorbed. During vigorous peristalsis air enters the distal fluid, results in churning, and is the reason to cause multiple air-fluid levels in plain X-ray abdomen.

Changes at the site of the obstruction

Bowel distal to the obstruction is inactive and collapsed.

Clinical Features
- Abdominal pain: Initially colicky and intermittent; later continuous and severe.
- Vomiting: In jejunal obstruction it is early and persistent. In ileal obstruction, it is recurrent occurring at an interval; initially bilious later feculent. In large bowel obstruction, vomiting is a late feature.
- Distension: It is absent or minimal in case of jejunal obstruction. Obvious with visible intestinal peristalsis (VIP) and borborygmi sounds in case of ileal obstruction. It is enormous in case of large bowel obstruction.
- Constipation: It is absolute, i.e. neither faeces nor flatus is passed.

Exceptions (obstruction without constipation)
- Richter’s hernia obstruction
- Gallstone obstruction
- Mesenteric vascular occlusion
- Intestinal obstruction with a pelvic abscess

Other features
Dehydration—Oliguria → Renal failure.
Features of toxaemia and sepsicaemia: Tachycardia, tachypnoea, fever, sunken eyes, cold periphery.

Closed Loop Obstruction
When there is obstruction in the large bowel, with ileo-caecal valve competence, pressure increases in the caecum.

Perforation also can occur at the site of obstruction due to the malignant growth.

Figs 4.5A and B: Plain X-ray showing multiple air-fluid levels — feature of small bowel obstruction — ileal obstruction in a child and in an adult.
Features of strangulation: Shock, tenderness, rebound tenderness; guarding and rigidity, absence of bowel sounds. In case of strangulated hernia, a swelling which is tense, tender, rigid, irreducible, no expansile impulse on coughing and H/O recent increase in size is seen.

Per-rectal examination: Shows empty, dilated rectum, often with tenderness. If rectal growth is the cause for obstruction, it may be palpable.

Investigations
- **Plain X-ray abdomen**: Multiple air-fluid levels
  - Proximal the obstruction → Lesser the air fluid level.
  - Distal the obstruction → More the air fluid level.

![Fig. 4.6: Plain X-ray abdomen showing early intestinal obstruction. X-ray shows dilated bowel loops with valvulae conniventes. It takes 6-12 hours to develop multiple air-fluid levels.](image)

Normally, three fluid levels can be seen in plain X-ray film—at fundus of stomach, at duodenum and often at caecum.

Maximum caliber of jejunum is 3.5 cm; of ileum is 2.5 cm; of caecum is 9 cm and of transverse colon is 5.5 cm. Dilatation of transverse colon more than 6 cm is called as megacolon. Caecum can dilate up to the diameter of 15 cm. Caecal dilatation more than 15 cm diameter is

![Fig. 4.7: Plain X-ray abdomen showing air-fluid levels with dilated colon. Probable site of obstruction is distal colon. It could be due to growth in the colon.](image)

![Fig. 4.8: Plain X-ray abdomen showing valvulae conniventes of jejunum.](image)
a sign of impending perforation. Competent ileo-caecal valve aggravates the chances of colonic dilatation and perforation because of the closed loop obstruction which increases the intra-colonic pressure significantly.

- Jejunum shows concertina effect due to valvulae conniventes
- Ileum is smooth and characterless—(Wangensteen)
- Large bowel shows haustration

- Barium enema and meal is contraindicated in acute intestinal obstruction.
- Hb%, Blood urea and serum creatinine, serum electrolytes.
- CT scan abdomen is very reliable type of investigation.

**Treatment**
- Naso-gastric aspiration: To reduce toxic effects and to reduce possibility of aspiration pneumonia.
- Replacement of fluid and electrolytes.
- Antibiotics: Ampicillin, gentamycin, metronidazole, cephalosporins.
- Surgery: Immediate laparotomy is done and the site (by finding the junction of dilated proximal and collapsed distal bowel) and cause of the obstruction is identified. The obstruction is relieved.

The viability of the bowel is checked (by colour (black or pink), peristalsis, pulsations, bleeding, friability, serosal shining,). If bowel is not viable resection and anastomosis is done. Proper peritoneal wash is given and the abdominal cavity is drained. Abdomen is closed in layers using nonabsorbable sutures (polyethylene, polypropylene, nylon). Often tension sutures are required. Small bowel can be decompressed using Savage’s decompressor.

In case of right sided colonic obstruction right hemicolectomy with ileo-colic anastomosis is done. In case of left sided colonic obstruction left hemicolectomy (resection) and colo-colic anastomosis is done with a de-functioning colostomy (right side transverse) which is closed after 6 weeks.

**Complications of intestinal obstruction**
- Peritonitis
- Hypovolaemic and septic shock
- Renal failure
- ARDS
- Intra-abdominal abscess
- Moribund status

**Post-surgery complications**
- Pelvic abscess
- Subphrenic abscess
- Septicaemia
- Biliary or faecal fistulas
- Burst abdomen
- Bands and adhesions
- Incisional hernias
Obstruction due to recto-sigmoid growth with patient being severely ill—Hartmann’s operation can be done to save the life of the patient wherein distal stump with the growth is closed, proximal colon is brought out as end colostomy.

**Causes for strangulation in intestinal obstruction**
- Distension causing reduced venous return and so later decreased arterial supply
- Mesenteric twist
- Mesenteric ischaemia
- External compression like in hernia

**In strangulation of bowel patient develops**
- **Pain** which becomes continuous, with tenderness, and rebound tenderness
- **Toxic features** due to absorption of toxins and translocation of bacteria across the mucosa into the blood
- Guarding and rigidity
- Systemic features like tachycardia, tachypnoea, oliguria and drowsiness
- Leucocytosis and altered blood urea, serum creatinine and electrolytes

**Checking the viability of the bowel prior to resection**
- Peristalsis, pulsation
- Colour of the bowel—pink or black; bleeding
- Friability, serosal shining
- Using 100% oxygen look for change in colour as red/pink
- On table colour Doppler to see mesenteric vessel
- IV fluorescent dye injection will make viable bowel purple (fluorescence)

**Note**
- *Single bubble sign*: Congenital hypertrophic pyloric stenosis
- *Double bubble sign*: Duodenal atresia, annular pancreas
- *Soap-bubble sign*: Meconium ileus
- *Triple-bubble sign*: Intestinal atresia

**Sigmoid Volvulus**

*x Plain X-ray abdomen:*
- Typically shows three lines in sigmoid volvulus. Two outer lines signify outer margins of the dilated sigmoid colon. One thick intervening line signifies the inner walls of the sigmoid—Dahl Froment’s sign.
- Omega sign/coffee-bean sign/bent inner tube sign.

Dilute barium or water soluble contrast study shows tapering of the upper end into a spirally twisted sigmoid colon—bird-beak sign/ace of spades appearance.

CT scan shows typical whirl pattern:
- Volvulus is twist/abnormal rotation of the loop of the bowel on its own mesenteric axis. It occurs in sigmoid colon commonly (65%); in caecum (30%), small bowel (midgut), stomach occasionally.
Sigmoid volvulus is common in Asia; common in India; common in south India because of more fibre diet. Transverse colon usually does not undergo volvulus because of its broad and wide based short mesentery.

**Note**
Sigmoid volvulus is anticlockwise – 65% - common in males
Caecal volvulus is clockwise ('C' for Caecum-Clockwise) – 30% common in females

It requires *one and half turn* of rotation to cause vascular obstruction and gangrene which eventually leads into perforation either at the root or at the summit of the sigmoid loop. Enormous distension of the colon occurs. Sometimes ileum comes to the root of the sigmoid volvulus and encircles it causing compound

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**Fig. 4.11:** Plain X-ray abdomen showing sigmoid volvulus – dilated sigmoid colon.

<table>
<thead>
<tr>
<th>Predisposing factors for sigmoid volvulus</th>
<th>Sigmoid volvulus is common in</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Adhesions</td>
<td>• Ogilvie’s syndrome</td>
</tr>
<tr>
<td>• Peridiverticulitis</td>
<td>• Mentally retarded individuals</td>
</tr>
<tr>
<td>• Overloaded redundant pelvic colon</td>
<td>• Chaga’s disease</td>
</tr>
<tr>
<td>• Long pelvic mesocolon</td>
<td>• Hypothyroidism</td>
</tr>
<tr>
<td>• Narrow attachment of sigmoid mesocolon</td>
<td>• Patients on anticholinergic drugs</td>
</tr>
<tr>
<td>Types</td>
<td>• Multiple sclerosis</td>
</tr>
<tr>
<td><strong>Acute</strong></td>
<td>• Scleroderma</td>
</tr>
<tr>
<td><strong>Recurrent</strong></td>
<td>• Parkinson’s disease</td>
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<table>
<thead>
<tr>
<th>Clinical features</th>
<th>Differential diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Pain abdomen</td>
<td>• Ogilvie’s syndrome—colonic pseudoobstruction</td>
</tr>
<tr>
<td>• Enormous abdominal distension</td>
<td>• Faecal impaction in old age</td>
</tr>
<tr>
<td>• Tympanic abdomen</td>
<td>• Carcinoma rectosigmoid</td>
</tr>
<tr>
<td>• Features of obstruction – obstipation, vomiting (late), distension</td>
<td>• Paralytic ileus</td>
</tr>
<tr>
<td>• Tyre like feeling of sigmoid colon</td>
<td></td>
</tr>
<tr>
<td>• Dehydration</td>
<td></td>
</tr>
<tr>
<td>• Later features of peritonitis once perforation occurs</td>
<td></td>
</tr>
</tbody>
</table>

**Treatment**
- Flatus tube insertion gently in OT
- Sigmoidoscopy insertion gently in OT
- Sigmoidopexy
- Resection and exteriorisation – colostomy and distal mucus fistula (Paul-Mikulicz operation) and later closure of colostomy after 6-12 weeks
volvulus in which case knotted small bowel also becomes gangrenous–ileo-sigmoid knotting.

**Plain X-ray Abdomen Showing Pancreatic Stones**
- Pancreatic stones are commonly radiopaque and multiple.
- It can be pancreatic parenchymal calcification or ductal stones.
- In ductal stones ductal dilatation is common (more than 3 mm). Often it will be 10–20 mm diameter. Ductal stones are reasonably better than parenchymal calcification. Treatment here is pancreatojejunostomy with splenectomy (Puestow’s); pancreaticojejunostomy without splenectomy (Partigton-Rochelle operation); Frey’s decorating of the head and jejunal anastomosis; duodenal preserving resection of head of pancreas in front of the portal vein (Beger).
- If there is parenchymal calcification – severity of the disease is much more than ductal stones. Patient is also more prone for malignant transformation. Here resection of the pancreas is better treatment. It may be pancreato-
duodenectomy (Whipple’s operation); distal pancreatectomy or occasionally total pancreatectomy.
- Ideal treatment for chronic pancreatitis is resection. But commonly done are drainage procedures. Endoscopic stenting; stone extraction are mainly for temporary remedy or for initial control.
- Essential investigations are HRCT scan, ERCP *(chain of lake appearance)* and often MRCP.
- Other investigations are blood sugar, serum amylase (for relapsing cases) and LFT.
- It is common in males, common in Kerala (diet, Tapioca induced – Kerala diabetes).

**Fig. 4.12A and B:** Plain X-ray showing multiple pancreatic ductal stones. Also note the photo picture of the removed stones of same patient.

**Fig. 4.13:** Pancreatic parenchymal calcification in chronic pancreatitis. It is more difficult to manage than ductal stones.

**X-ray features in acute pancreatitis**
- Gasless abdomen
- Sentinel loop
- Colon cut-off sign
- Duodenal ileus
- Mottled lucencies
- Renal halo sign

**Treatment Strategy for Chronic Pancreatitits**
- Resection procedures.
- Drainage procedures.
- Management of biliary stenosis.
- Pain relief by drainage/resection/abdominal splanchnicectomy and celiac ganglionectomy.
Drainage

- Technically easier – commonly done procedure
- Less mortality < 2-5%
- Adequate pain relief
- Recurrence of pain
- Diseased tissue is left behind
- Disease progression
- Fear of occult carcinoma existing or later onset

Resection

- Ideal procedure
- Technically demanding
- Mortality 8-21% (Gall 1977)
- Used when carcinoma is suspected or localised disease
- Head is the pacemaker of the disease – so resection of head will control the disease well
- Whipple’s resection is preferred
- Subtotal 95% pancreatectomy is also used
- Total pancreatectomy is last resort

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About pancreatitis – ‘Pancreas is abdominal tiger’- Moynihan

‘I do not know if this operations extended life of the patient, but they definitely shortened mine…’

— Unknown surgeon

Theodor Kocher called the pancreas “the mischief maker of the abdomen.” Some surgeons have stronger language to describe this organ, but decorum demands that such a language be excluded from such a syllabus.”

— JP Patrick O’Larey MD

‘Chronic pancreatitis remains an enigmatic process of uncertain pathogenesis, unpredictable clinical course, and unclear treatment’

‘Chronic pancreatitis is NOT primarily a surgical disease. No surgery can reverse/get back the lost exo/endocrine functions’. Surgery is an ultimate inevitability for chronic pancreatitis.

Clinical Features of Chronic Pancreatitis

- Pain in epigastric region, persistent and severe, that radiates to back. This pain is due to irritation of retro-pancreatic nerves or due to ductal dilatation and stasis or due to chronic inflammation itself.
- Exocrine dysfunction: Diarrhoea, asthenia, loss of weight and appetite, steatorrhoea (signifies severe pancreatic insufficiency), malabsorption.
- Endocrine dysfunction: Diabetes mellitus.
- Mild jaundice is due to narrowing of retropancreatic bile duct and cholangitis.
- Mass per abdomen, just above the umbilicus, which is tender, nodular, hard, felt on deep palpation, not moving with respiration, not mobile, resonant on percussion.
- Mallet-Guys sign: In right knee chest position, when left hypochondrium is palpated tenderness can be elicited in chronic pancreatitis as bowel loops are shifted towards right allowing direct palpation of the pancreas.

Causes of Pain in Chronic Pancreatitis

- Disruption of perineural sheath of splanchnic nerves due to toxins – of celiac ganglions and greater splanchnic nerves (right and left).
- Raised pancreatic ductal pressure.
- Raised interstitial pressure.
- Biliary obstruction.
- Pseudocyst formation.
- Pancreatic chronic inflammation.

Complications of Chronic Pancreatitis

- Pseudocyst of pancreas.
- Pancreatic ascites/pancreatic pleural effusion.
- CBD stricture.
- Duodenal stenosis.
- Portal or splenic vein thrombosis.
- Peptic ulcer.
- Carcinoma pancreas.
- Pancreatic fistula.
### Indications for surgery in chronic pancreatitis
- Intractable pain
- Severe malabsorption, multiple relapses
- Suspicious of carcinomas
- To deal complications like pseudocyst/ascites/effusion/portal hypertension/biliary obstruction
- Pancreatic duct stenosis/obstruction
- Pancreatic duct > 7 mm in diameter

### Indirect procedures in chronic pancreatitis
*Only as supportive method*
- Sphincteroplasty
- Biliary-enteric anastomosis (Choledochojejunostomy/Duodenostomy)
- Triple anastomosis – choledocho-jejunal, pancreatico-jejunostomy
- Splanchnicectomy/celiac ganglionectomy to relieve pain
- ERCP stenting – usually temporary as recurrence rate and problems of stent (blockage, displacement, sepsis)

### Direct surgeries
#### Drainages
- Lateral pancreatico-jejunoscopy
- Duval retrograde pancreatico-jejunoscopy
- Frey and Smith operation
- Beger’s procedure
- Cystogastrostomy
- Cystogastrostomy with external drainage
- Roux-en-Y cystojejunostomy

#### Resections
Distal/subtotal/Whipple’s/rarely total – pancreatectomies

### Biliary duct stenosis in chronic pancreatitis
#### Indications for surgical intervention
- Persistent jaundice for 1 month
- Cholangitis
- Evidence of developing cirrhosis on biopsy
- Inability to exclude pancreatic cancer
- Progressive strictures of biliary ducts
- Persistent elevation of alkaline phosphatase

#### Procedures
- Choledochojejunostomy – Roux-en-Y
- Choledochoduodenostomy
- Resection if carcinoma is suspected
- ERCP stenting – temporary

### Aetiology of chronic pancreatitis
- Alcohol
- Stones in biliary tree
- Malnutrition, diet
- Hyperparathyroidism
- Hereditary (Familial hereditary pancreatitis)
- Idiopathic
- Trauma
- Congenital anomaly (Pancreatic divisum)

### Classification of chronic pancreatitis
- Chronic relapsing
- Chronic persistent
  - Chronic non-calcifying
  - Chronic calcifying
    - Ductal stones
    - Parenchymal

### Pathology
- Focal necrosis
- Segmental/diffuse fibrosis
- Parenchymal calcifications
- Or ductal stones
- Stricture or dilatation
Plain X-ray Abdomen Showing Gallstones

- Gallstones are commonly radiolucent (90%).
- Multiple stones are usually faceted because of equal pressure in a compact gallbladder.
- Plain X-ray shows radiopaque lesion to the right side of the vertebra below rib cage. It should be differentiated from kidney stones. In lateral view X-ray, gallstone will be in front of the vertebra whereas kidney stone overlaps the vertebra. Often gallstone has got central radiolucent area – sea gull sign/Mercedes Benz sign.
- Silent/asymptomatic gallstone is one which is identified on routine investigation where

Silent gallstone need not be treated unless
- Patient is diabetic/immunosuppressed
- Chances of developing gallbladder carcinoma
- Stone more than 2.5 cm/multiple stones
- If gallbladder wall is thickened

there are no specific relevant symptoms related to gallstones. Chances of developing symptoms in a silent gallstone are 5% in 5 years and 20% in 15 years.
Fig. 4.16: Duval procedure for chronic pancreatitis. It is a type of pancreaticojejunostomy which is not commonly used because of the high failure rate.

Fig. 4.17: Frey and Smith operation. Here decoring of head is done prior to pancreaticojejunostomy.

Fig. 4.18: Partington Rochelle operation (pancreatico-jejunostomy) for chronic pancreatitis. Here spleen is retained (in original Puestow’s spleen is removed).

Fig. 4.19: Puestow’s pancreaticojejunalostomy operation for chronic pancreatitis. Here spleen is removed.
Figs 4.20A and B: Multiple gallstones in a plain X-ray. Only 10% gallstones are radio-opaque. Often they are facetted each other because of compact and equal pressure. Center of the gallstone is often found radiolucent and is called as Mercedes Benz sign/Seagull sign.

Remember

- Presently ultrasound is ideal investigation for gallstones.
- To see gallbladder function or confirm cholecystitis radioisotope HIDA/PIPIDA scan is ideal.
- Cholecystitis can cause jaundice due to cholangitis.
- Other causes of jaundice should be ruled out – CBD stones/Mirizzi syndrome.
- Limey gallbladder is gallbladder filled with toothpaste like mixture of calcium carbonate and calcium phosphate. Plain X-ray shows dense radio-opaque gallbladder shadow.

- Porcelain gallbladder is one where gallbladder wall is calcified because of chronic cholecystitis. It is potentially malignant.
- Cholesterol stone occurs when there is alteration in levels of cholesterol, lecithin and bile salts. This altered bile has got more cholesterol than adequate micelle and is called as lithogenic bile. Here bile is in supramicellar zone.
- Mixed stones are commonest – 90%.
- ‘Gall stone is a tomb stone erected to the memory of the organism within it’ – Moynihan’s aphorism.
- Complications of gallstones: Acute cholecystitis, chronic cholecystitis, empyema gallbladder, mucocele of gallbladder, perforation and peritonitis, secondary CBD stones, cholangitis, pancreatitis, Mirizzi syndrome, gallstone ileus, pericholecystitic abscess and carcinoma of gallbladder.
- Black pigment stones are more common in gallbladder; brown pigment stones are common in CBD.
Dissolution therapy

<table>
<thead>
<tr>
<th>Indications</th>
<th>Contraindications</th>
<th>Methods</th>
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<tbody>
<tr>
<td>• Functioning gallbladder with cholesterol stone</td>
<td>• Non-functioning GB</td>
<td>• Ursode-oxycholic acid</td>
</tr>
<tr>
<td>• Single stone less than 1.5 cm</td>
<td>• Stone more than 1.5 cm</td>
<td>• Chenodeoxycholic acid</td>
</tr>
<tr>
<td>• Radiolucent stone</td>
<td>• Radio-opaque stone</td>
<td>• Citrates, monoterpenes</td>
</tr>
<tr>
<td>• Old age and patient who are not fit for surgery</td>
<td>• Multiple stones</td>
<td>• Percutaneous infusion of methyl tertbutyl ether (MTBE) infusion into the GB</td>
</tr>
</tbody>
</table>

Contraindications

• Non-functioning GB
• Stone more than 1.5 cm
• Radio-opaque stone
• Multiple stones

Methods

• Ursode-oxycholic acid
• Chenodeoxycholic acid
• Citrates, monoterpenes
• Percutaneous infusion of methyl tertbutyl ether (MTBE) infusion into the GB
• Shock waves

Charcot’s triad of ascending cholangitis
• Intermittent pain
• Intermittent fever
• Intermittent jaundice

Reynold’s pentad of suppurative cholangitis
• Persistent pain
• Persistent fever
• Persistent jaundice
• Toxicity and shock
• Altered mental status

• Cholesterol stones are common in Western countries; pigment/mixed stones are common in Asian countries.
• Acute acalculous cholecystitis is 5% common occurs after stress, major surgeries or in cholecystoses.

Differential diagnosis of radio-opaque shadow
• Kidney stone
• Gallstone
• Calcified 12th rib tip
• Phlebolith
• Pancreatic stone
• Radio-opaque foreign body
• Faecolith
• Calcified lymph node
• Renal tuberculosis calcified
• Renal cell carcinoma—calcifications
• Adrenal tumour—calcification
• Teratomatous dermoid
• Calcification of atheroma in aorta
• Calcified lesion in liver – amoebic liver abscess/calcified hydatid cyst

Fig. 4.22: ARDS—Adult/Acute respiratory distress syndrome. It occurs in respiratory failure, sepsicaemia, in toxic conditions and pulmonary oedema. It needs critical care and ventilatory support. It has got poor prognosis.

X-RAY BONES
See Figures 4.36 to 4.58.

OTHER PLAIN X-RAYS
See Figures 4.59 to 4.75.
Fig. 4.23: Chest X-ray showing pulmonary infarct—peripheral wedge-shaped lesion is typical. It may be due to small/medium embolus.

Fig. 4.24: Chest X-ray showing hydropneumothorax with collapsed lung margin and fluid level. It could be due to trauma, ruptured bullae or tuberculosis.

Figs 4.25A and B: Chest X-ray PA view and lateral showing subcutaneous emphysema as dark multiple streaks/lines.
Figs 4.26A and B: Chest X-ray PA view showing carcinoma bronchus – left sided.

Fig. 4.27: Chest X-ray showing cannon ball secondaries. Often there may be pleural effusion/consolidation also. Early secondaries may be missed by chest X-ray as only 60 - 70 % of the lung can be seen in chest X-ray. So contrast (HRCT) is ideal to pick up lung secondaries. Secondaries in the lung are usually multiple, smooth and rounded. It is because secondaries arise from the single primary spread into different places of the lung that occurs at same time with similar cellular mitotic activity. It is smooth because of the lung resistance. Common primaries causing secondaries in lungs are— all sarcomas, carcinomas from breast, thyroid, kidney, testis and prostate. Secondaries from kidney may be calcified and it may disappear after palliative nephrectomy because of the increased tumour immunity. Secondaries in lung are usually treated by chemotherapy. Drugs are specific of primary type. Solitary secondary or secondaries limited to one segment may be considered for lobectomy. But results are poor.

Fig. 4.28: Chest X-ray showing large soft tissue sarcoma. It was synovial sarcoma from shoulder extending into chest wall. Patient underwent forequarter amputation.
Fig. 4.29: Thoracic aortic aneurysm (descending thoracic aorta)

Figs 4.30A and B: Chest X-ray PA (6 feet [180 cm] from patient) and lateral view showing mediastinal tumour–probably lymph nodal mass. It may be lymphoma/secondaries. Ideal investigation is contrast CT chest. Mediastinoscopy for diagnostic biopsy also may be useful.

Fig. 4.31: Chest X-ray showing superior mediastinal mass – tumour. It can cause compression over superior vena cava causing dilated veins over the chest.

Fig. 4.32: Chest X-ray showing localized area with fluid level in the right lung – feature of lung abscess. HRCT and bronchoscopy are essential investigations. Tuberculosis should be ruled out. Antibiotics, chest physiotherapy and often surgery are the therapeutic modalities.
Figs 4.33A and B: Chest X-ray showing localised lesion right lobe–lung Hydatid cyst. After rupture it shows water-lily appearance.

Figs 4.34A and B: Massive effusion on right side in one X-ray and left side in another. It may be due to malignancy either primary or secondary or mesothelioma of pleura or due to tuberculosis. Malignant effusion is haemorrhagic. It is treated by slow tapping (maximum 1000 ml at a time) or slow continuous decompression. Rapid tapping can lead into sudden severe pulmonary oedema with respiratory distress often which may be life-threatening.
Fig. 4.35: Chest X-ray showing mediastinal mass – PA view and lateral view. It is posterior mediastinal mass–neurofibroma which was removed through thoracotomy.

Fig. 4.36: Achondroplasia.

Fig. 4.37: X-ray humerus showing osteochondroma (exostoses). It is the commonest benign tumour of the bone. It has got base, pedicle and a cartilaginous cap often with a bursa near the cap. It may turn into chondrosarcoma (not osteosarcoma).

Fig. 4.38: X-ray lower end of the radius and ulna showing osteochondroma (exostoses) of the lower end of radius with scalloping of the lower end of the ulna.
Figs 4.39A to C: X-ray pelvis showing osteoblastic secondaries in ilium, ischium and sacrum (pelvic bones)—primary is from prostate.

Figs 4.40A and B: X-ray showing osteolytic secondaries in the ischium and pubic bone.

Fig. 4.41: X-ray humerus showing pathological fracture in humerus due to secondaries from carcinoma breast.
**Fig. 4.42:** X-ray pelvis with both upper ends of femur. It shows osteolytic lesion in right upper end of the femur.

**Fig. 4.43:** X-ray skull showing secondaries in the skull-soft tissue shadow with destruction. It is seen in secondaries from follicular carcinoma of thyroid. It is usually vascular, pulsatile and well localised secondaries.

**Fig. 4.44:** X-ray skull showing punched out lesions – could be secondaries/primary hyperparathyroidism/multiple myeloma/histiocytosis.

**Fig. 4.45:** Skull X-ray showing salt and pepper lesion/multiple punched out lesions – primary hyperparathyroidism – von Recklinghausen lesion – Osteitis fibrosa cystica.
Fig. 4.46: X-ray humerus showing widening with cystic spaces – brown tumour of humerus due to primary hyperparathyroidism. Differential diagnosis is secondaries.

Figs 4.47A and B: X-ray neck with upper chest showing cervical rib on left side. It is of complete type. It could be of fibrous, bony, combined type; unilateral/bilateral; asymptomatic/symptomatic. Commonest presentation is neurological – tingling and numbness along the C8 and T1 root distribution. When compression of subclavian artery occurs it causes post stenotic dilatation due to Eddie’s current. Thrombosis can occur in it which may throw an embolus causing digital ischaemia/gangrene. X-ray neck, angiogram, arterial Doppler, nerve conduction studies are the needed investigations. Treatment is extraperiosteal excision of cervical rib with scalenotomy and often with excision of first rib.
Fig. 4.48: X-ray skull, lateral view showing depressed fracture. Depressed fracture skull often needs elevation. CT head is a must to see intracranial injuries. If it is in the midline it should not be elevated as it overlies the superior sagittal sinus.

Fig. 4.49: Plain X-ray pelvis showing ectopia vesicae. Note the separation of pubic bones widely.

Fig. 4.50: X-ray tibia showing Brodie’s abscess. Brodie’s abscess is subacute osteomyelitis with pus formation. It can cause pathological fracture. It should be differentiated from Ewing’s sarcoma.

Fig. 4.51: X-ray tibia showing osteomyelitis of the tibia—sclerosing osteomyelitis with pathological fracture.
Fig. 4.52: X-ray femur showing osteomyelitis of the femur. Dense bone in the centre – sequestrum can be seen. Surrounding radiolucent area is area of granulation tissue. It signifies separation of the sequestrum. Radiologically sequestrum is denser than normal bone because of lack of normal decalcification (dead bone is dense bone). Sequestrum comes out through an opening, sinus (cloaca). Surrounding bone is having new bone formation due to periosteal reaction (involucrum). Sequestrum can be ivory (syphilis); feathery (tuberculosis); granular (salmonella); ring (amputation stump); black (fungal, stump). In tuberculous osteomyelitis there is less or no new bone formation.

Figs 4.53A and B: Orthopantomogram – OPG. It is taken in oral carcinomas to look for mandibular secondaries, in trauma (fracture mandible), osteomyelitis of the mandible and jaw tumours. Patient keeps his/her chin over the chinrest of the machine. Machine rotates around the jaw closely to get the film. First film (OPG) shows dentigerous cyst. It should be differentiated from osteoclastoma.

Fig. 4.54: Osteoclastoma of upper end of the fibula. Note the soap bubble appearance. It arises from epiphysis. It also occurs in flat bones.
Fig. 4.55: X-ray lower end of the femur showing features of osteosarcoma. Codman’s triangle; sun ray appearance; new bone formation with destruction of bone with pathological fracture.

Fig. 4.56: X-ray upper ends of tibia and fibula showing chondrosarcoma arising from fibula. Confirmation is done by open biopsy. Treatment is wide excision with removal of the upper end of fibula. Amputation is not required in every patient and depends on the extent of the tumour.
Fig. 4.57: X-ray showing sacrococcygeal teratoma in an infant.

Fig. 4.58: Skull X-ray showing soft tissue shadow which is radiopaque – could be meningioma or soft tissue swelling.

Fig. 4.59: Anorectal malformation (ARM). Blind anal dimple is marked with a radiopaque marker. X-ray is taken to find out the level of rectal pouch and distance is measured and assessed as whether it is above/below the pubococcygeal line. It is used to find out whether ARM is high or low.

Fig. 4.60: X-ray neck, lateral view showing thyroid swelling with calcification. Fine calcification signifies papillary carcinoma of thyroid. Ring calcification signifies multinodular goitre.
Fig. 4.61: X-ray neck showing thyroid enlargement due to multinodular goitre with ring calcification (coarse).

Fig. 4.62: X-ray showing retrosternal goitre – extension from neck. Percussion over the sternum will be dull. Pemberton’s sign will be positive (by raising arms above the shoulder will cause dilatation of veins over face and chest wall with dyspnoea due to compression of SVC and trachea).

Fig. 4.63: X-ray showing large stone (radiopaque) in submandibular salivary gland. Stone formation is common in submandibular salivary gland; not in parotid gland. (Secretion from parotid is serous with less calcium and has dependent drainage; whereas secretion of submandibular salivary gland is mucus, contains more calcium; with nondependent drainage). Stone causes sialadenitis. It is commonly radio-opaque. It is treated by excision of the gland.
Figs 4.64A and B: X-ray neck AP and lateral view showing radiolucent air filled area – feature of laryngocele. It is a unilateral narrow necked, air-containing diverticulum resulting from herniation of laryngeal mucosa through thyrohyoid membrane where it is pierced by superior laryngeal nerve. It can be external or internal. It presents as a smooth, soft and resonant swelling in the neck adjacent to larynx which is more prominent while blowing, coughing and Valsalva manoeuvre. Cough and hoarseness are common. X-ray is diagnostic. Treatment is excision.

Figs 4.65A and B: Mammography. It is plain X-ray of breast. Cranio-caudal and medio-lateral films are taken. Microcalcification, smooth/irregular soft tissue shadow; speculations are the findings to be looked for.
Fig. 4.66: Foreign body in trachea-radio-opaque-coin. It needs bronchoscopic removal under anaesthesia. It can cause collapse of the lung, infection or erosion.

Fig. 4.67: Foreign body (COIN) in the lower oesophagus. Usually it can be removed by an endoscope. Common foreign bodies are: Coins, dentures, pins, fish or meat bones. Fish or meat bones are more dangerous because of their ragged sharp edges which often perforate the oesophagus causing mediastinitis, empyema and sepsis. Often it may be life-threatening. Sites of impaction in oesophagus are cervical constriction—C6; broncho aortic constriction—T4; diaphragmatic constriction—T10; site of pre-existing malignancy or inflammatory stricture. Features are— sudden dysphagia with chest pain and breathlessness. Later presents with features of shock, sepsis, mediastinitis and empyema.

Management— X-ray shows site and level of the foreign body; Endoscopic removal can be tried; Impacted large foreign body should be removed by thoracotomy; Antibiotics, jejunostomy, TPN, ICT are also required.
Fig. 4.68: X-ray showing calcified areas in the right side of the pelvis. It could be teratomatous dermoid of ovary, calcified nodes, bladder calculi, diverticula or bolus of gallstones in ileum.

Fig. 4.69: X-ray showing diaphragmatic hernia with bowel shadow on the left side of the chest and heart shadow on right side.

Figs 4.70A and B: X-ray showing diaphragmatic eventration on right side (localised). It differs from diaphragmatic hernia by not having sac and lungs are normal. Muscular component of diaphragm is not well developed and so eventration occurs. It is treated by plication of diaphragm using nonabsorbable sutures. Left sided diaphragmatic eventration in another X-ray is obvious and significant.
Fig. 4.71: Plain X-ray showing copper T in place.

Fig. 4.72: Plain X-ray abdomen showing calcification in liver. It could be calcified amoebic liver abscess/calcified hydatid cyst.

Figs 4.73A to C: Plain X-ray showing calcified aorta and femoral arteries in an atherosclerotic patient.

Fig. 4.74: Plain X-ray showing stents in CBD and pancreatic ducts. It is placed in a patient who presented with recurrent pancreatitis with block/stricture in both terminal CBD and pancreatic duct. Later patient underwent choledochojejunostomy and pancreaticojejunostomy.
**Fig. 4.75:** X-ray skull showing haziness in maxillary region on right side – feature of carcinoma of maxillary antrum.

**Fig. 4.76:** Plain X-ray KUB/KUBU (Kidney; Ureter; Bladder; Urethra). Note the psoas shadow.

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**PLAIN X-RAY KUB/KUBU (KIDNEY, URETER, BLADDER, URETHRA)**

**Preparation of the Patient for KUB**

Enema/laxative are given on previous day and the patient is asked to fast in order to reduce the shadows of bowel gas in X-ray.

High penetration X-ray is taken in supine position which covers pubic symphysis and lower two ribs.

**Interpreting the Films**

First bony parts are looked—hip, pelvis, lumbar vertebrae for fractures, scoliosis, spina bifida and secondaries in the spine. Lumbar spine should be counted from below upwards (L₅ to L₁), not from above downwards (as 12th rib may be absent causing misinterpretation of 12th vertebra as L₁ vertebra).

**Kidney Shadow**

Kidney shadows are visualized in plain X-ray KUB due to difference in the density between kidney and perinephric fat. Its size, location, calcification and stones should be looked for. In children perinephric fat is absent and so kidney shadows are not visualized.

**Psoas Shadow**

It is visualised well in normal kidney. It is obliterated in enlarged kidney, scoliosis, retroperitoneal tumours, cold abscess/psoas abscess due to spinal tuberculosis, splenic injury, and retroperitoneal haematoma.

**Ureteric Line**

Ureteric line in plain X-ray KUB is a conventional line which runs along the tips of the transverse processes of the vertebrae, crosses the sacroiliac joints and reaches up to the point medial to the ischial spine. Line is observed for any radiopaque shadow which signifies ureteric stone. If it is present, its location and size should be observed.

Bladder, prostate and urethral areas should be looked for any lesion.

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**BARIUM SWALLOW X-RAY (REFER PAGE 397)**

Thick solution/paste of barium sulphate is given to the patient to swallow. Under fluoroscopy
Figs 4.77A and B: Plain X-ray KUB showing bilateral staghorn calculi. Patient may be presenting with renal failure. Renal function tests, IVU, DTPA radioisotope scan, ultrasound abdomen and urine culture are essential investigations. Kidney with better function should be operated first and later on other side. If there is renal failure, initial haemodialysis and bilateral nephrostomy is done. Later once kidney function is better than specific nephropyelolithotomy is done. Stone is usually triple phosphate stone (calcium, magnesium and ammonium phosphate stone).

Fig. 4.78: Plain X-ray KUB showing large stone IN renal pelvis. It can be removed by PCNL or open pyelolithotomy.

Fig. 4.79: Renal stone on right side with a J stent on left ureter.
Fig. 4.80: Plain X-ray showing stone in the renal pelvis on right side (phosphate stone) and stone in the bladder, (oxalate stone with spikes).

Fig. 4.81: Stone in the left ureter in middle 1/3. It should be removed by URS/PCNL/Laparoscopic/open ureterolithotomy.

Figs 4.82A to C: X-ray showing large bladder stone.
Fig. 4.83: Plain X-ray showing stones in horse shoe kidney. IVU will show flower vas appearance.

Fig. 4.84: Large vesical calculus. It is radiopaque; phosphate/triple phosphate stone with laminations. It is secondary bladder stone (which is secondary to infection).

Fig. 4.85: X-ray pelvis showing radiopaque Malecot’s catheter in situ.

(dynamic study) while barium is descending along the oesophagus slowly, oesophagus is observed for any mucosal changes, alteration in motility and block/narrowing. Once suspected area is identified required films are taken as needed. Usually oblique films are taken.

**What are the indications?**

Any patient with dysphagia/odynophagia (painful swallowing) for more than 3 weeks is an indication for barium swallow/oesophagoscopy.

- Achalasia cardia
- Carcinoma oesophagus
- Oesophageal strictures – corrosive
- Extrinsic compression – mediastinal mass
- Tracheo-oesophageal fistula
- Pharyngeal pouch and oesophageal diverticula
- Oesophageal varices
- Hiatus hernia
- Oesophageal webs
- Leaking oesophageal anastomosis

Barium is radiopaque and so it is used. Barium sulphate is inert and in sulphate media, it will not get absorbed into circulation. Barium phosphate (barium in phosphate media) gets absorbed and barium is neurotoxic. Barium phosphate is commercially used rat poison. Water soluble contrast like gastrograffin is used for identifying leak, perforation or fistula.
Barium Swallow X-ray of Pharyngeal Pouch

It is a protrusion of mucosa through Killian’s dehiscence, a weak area of the posterior pharyngeal wall between thyropharyngeus (oblique fibres) and cricopharyngeus (transverse fibres) of the inferior constrictor muscle of the pharynx. Imperfect relaxation of the cricopharyngeus increases the pressure in the pharynx, mainly during swallowing which leads to protrusion of mucosa through the Killian’s dehiscence causing pharyngeal pouch.

The protrusion is usually towards the left.

Stages:
1. Small diverticulum.
2. Large, globular diverticulum causing regurgitation, cough, dysphagia, respiratory infection.
3. Large pouch which is visible in the neck as a globular swelling often tender, smooth and soft. They present with dysphagia, features of respiratory infection like pneumonia and lung abscess, weight loss and cachexia. Pouch may itself get infected and form an abscess. Often the pouch may descend downwards and enter the superior mediastinum.

Clinical features: Pain, dysphagia, recurrent respiratory infection, swelling in the neck on the left side which is smooth, soft and tender. Gurgling in the swelling on pressing is common. Swelling is usually resonant.

Oesophagoscopy may cause perforation of pouch and mediastinitis. So it can be avoided or it should be done gently.

Treatment: Antibiotics has to be started.

Pharyngeal pouch is excised by an oblique neck incision (approach from neck). As there is cricopharyngeal spasm, cricopharyngeal myotomy (i.e. cutting of cricopharyngeal circular muscle fibres without opening the mucosa) is done to prevent the recurrence. Under general anaesthesia with nasogastric tube in the oesophagus, oesophagoscope is gently passed into the pharyngeal pouch and pouch is soaked with acriflavine solution using ribbon gauze.

Complications:
1. Infection either mediastinitis or lung infection. (Pneumonia or lung abscess).
2. Pharyngeal fistula.
3. Abscess in the neck.
Aetiology:
- Stress.
- Vit B1 deficiency.
- Chaga’s disease, varicella zoster infection.

There is pencil shaped narrowing of cardia (O-G junction) with enormous dilatation of proximal oesophagus, which contains foul smelling fluid and is more prone for aspiration pneumonia.

Achalasia cardia is a precancerous condition.

Clinical Features
Common in females between 20 and 40 years age group present with progressive dysphagia, which is more for liquid than to solid food. Regurgitation and recurrent pneumonia/lung abscess are common. Also presents with malnutrition, general ill health, chest pain and, odynophagia.

Treatment
1. Modified Heller’s operation: Oesophagocardiomyotomy.

Either through thoracic or abdominal approach, thickened circular muscle fibres are cut longitudinally for about 8-10 cm, at 2 cm proximal to the thickened muscle to 1 cm distal to O—G junction. Care should be taken

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<tr>
<th>Barium swallow X-ray in Achalasia cardia</th>
<th>Chest X-ray in Achalasia cardia</th>
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<tr>
<td>• Pencil shaped narrowing of the oesophagus at its lower end—<em>bird beak appearance</em></td>
<td>• Features of aspiration pneumonia</td>
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<tr>
<td>• Proximal dilatation of the oesophagus—<em>mega/sigmoid oesophagus</em></td>
<td>• Soft tissue shadow with air fluid level, right to right atrium</td>
</tr>
<tr>
<td>• Absence of fundic gas shadow</td>
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<tr>
<td>• No mucosal irregularity</td>
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<tr>
<th>Oesophagoscopy</th>
<th>Oesophageal manometry is ideal</th>
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<tr>
<td>• Dilated proximal oesophagus</td>
<td>• Unrelaxed lower oesophagus</td>
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<tr>
<td>• Smooth pencil shaped narrowing at lower end of the oesophagus</td>
<td>• Resting high pressure</td>
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<tr>
<td>• Only oesophagitis in the mucosa</td>
<td>• Persistent high pressure in lower oesophageal sphincter (LOS).</td>
</tr>
<tr>
<td>• Biopsy is a must as it is potentially malignant</td>
<td></td>
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<tr>
<td>• Normal stomach</td>
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not to open the mucosa. Procedure is done through thoracic/open laparotomy/laparoscopic approaches.

2. Nissen’s fundoplication is done along with the above procedure to prevent reflux.

3. Negus hydrostatic dilatation is done to dilate O—G junction. It is not very well accepted method as chances of perforation are high. Symptom control is around 75%. But chances of recurrence and perforation are high.

4. Calcium channel blockers like nifedipine can relieve the symptoms. Endoscopic injection of botulinum toxin into the LOS is also tried.

What is presbyoesophagus?

It is diffuse oesophageal spasm with marked hypertrophy of circular oesophageal muscle.

Intra oesophageal pressure is very high, often 400-500 mm Hg with uncoordinated oesophageal contraction.

Dysphagia, odynophagia, persistent chest pain and malnutrition are the presentations.

Cork screw oesophagus is typical in barium swallow X-ray.

Treatment: Repeated oesophageal dilatation, extensive lengthy oesophageal myotomy from aortic arch to cardia using thoracoscopy.

Total oesophagectomy with gastric/colonic/jejunal pull through.

**Barium Swallow X-ray in Carcinoma Oesophagus**

**Features**

- Irregular filling defect.
- Shouldering sign at the beginning of the tumour.
- Narrowing.
- Rat tail lesion in fluoroscopy—normal oesophagus shows horizontal movements/oscillations in fluoroscopy. This is absent in carcinoma and so it looks like stiff area like rat tail.

**What are the etiologies of carcinoma oesophagus?**

- Diet: salted dry fish, high nitrosamines.
- Deficiencies: vitamin C, riboflavin
- Mycotoxin.
- Alcohol and tobacco.
- Achalasia cardia.
- Oesophageal webs.
- Barrett’s oesophagus.
- Oesophagitis.
- Tylosis.
- Corrosive strictures.
- 5% common.
- Common after 45 years.
- Common in men.
- Common in China-Henan province.
- In India: common in Orissa and Karnataka.

**What is tylosis?**

- Autosomal dominant condition seen from childhood
- Soles and palms are involved called as palmoplantar keratoderma.
- Waxy, yellow lesions, which does not itch.
60% of members of families develop carcinoma oesophagus after the age of 60.

Systemic retinoids are the drugs used for tylosis.

**Pathology**

Common in Middle third— 50%.
Lower third—33%.
Upper third—17%.

In India squamous cell carcinoma is more common—90%.

Lower 3 cms of oesophagus is lined by columnar epithelium, and so adenocarcinoma is common here. Barrett’s columnar metaplasia which occurs in lower third oesophagus is also more prone for adenocarcinoma. In western countries adenocarcinoma is more common.

Gross: Annular—15%.
Ulcerative—20%.
Fungating-cauliflower like—60%.

**Spread**

*Direct:* In upper third it spreads through muscular layer and gets adherent to left main bronchus, trachea, and left recurrent laryngeal nerve (causing hoarseness), aorta or its branches (causing fatal haemorrhage, but rare). It may perforate and cause mediastinitis. It may get adherent to pleura also.

*Lymphatic spread:* It spreads both by lymphatic permeation and lymphatic embolisation. It can cause satellite nodules elsewhere in the oesophagus away from the main tumour. Above in the neck it spreads to left supraclavicular lymph nodes. In the thorax it spreads to paraoesophageal, tracheo-bronchial lymph nodes and to sub diaphragmatic lymph nodes. In the abdomen it spreads to coeliac lymph nodes.

*Blood spread* occurs to liver.

**Clinical Features**

*Recent onset of dysphagia* is the commonest feature. *For dysphagia to develop two third of the lumen should be occluded.*

Regurgitation and cough.

Hoarseness of voice due to recurrent laryngeal nerve palsy.
Anorexia and loss of weight. (severe). (Cachexia).
Pain—substernal or in the abdomen.
Liver secondaries.
Bronchopneumonia.
Features of bronchooesophageal fistula in carcinoma of upper third oesophagus.
Supraclavicular lymph nodes may be palpable.

**Investigations**

*Barium swallow:* Shouldeing sign and irregular filling defect.
Oesophagoscopy to see the lesion, its extent and type.
Biopsy for histological type and confirmation.
Chest X-ray to see pulmonary infection.
Bronchoscopy, to see invasion in upper third growth.
Oesophageal endosonography to look for the involvement of layers of oesophagus.

![Fig. 4.90: Barium study showing shouldering sign, irregular filling defect and narrowing – carcinoma lower oesophagus.](image)
• CT scan to look for local extension and status of tracheo bronchial tree in case of upper third growth.
• Ultrasound abdomen to look for liver and lymph nodes status in abdomen.
• Endoscopic oesophageal staining with labeled iodine results in normal mucosa being stained brown, but remains pale in carcinoma. (As mucosa involved with carcinoma will not take up iodine).

**Fig. 4.91:** Contrast X-ray showing bronchooesophageal fistula in a case of carcinoma oesophagus. Note the dye entering into the oesophagus. In broncho/tracheo oesophageal fistula water soluble nonionic agent (Dianosil) is used.

**Treatment**

*Gastrostomy* should not be done as a palliative procedure.

**Curative treatment:**

*Indications:*

1. Early growth, when patient is fit.
2. When there is no involvement of lymph nodes, bronchus and liver.
3. Post-cricoid tumour is treated mainly by radiotherapy.
4. Often pharyngo-laryngectomy is done along with gastric or colonic transposition. *But complications are more in this procedure.*
5. Ivor-Lewis operation or Mc Keown operation for lower third or middle third or upper third growths (depending on locations) can be done.

**Upper third growth:**

- Treated mainly by radiotherapy.
- Commonly it is advanced with left recurrent nerve palsy and bronchial invasion.

If it is early and operable, Mc Keown three staged oesophagectomy and anastomosis is done in the neck. Initially laparotomy is done to mobilize the stomach. Then thoracotomy through right 5th space is done and oesophagus is mobilized. Through right side neck approach, oesophagus with growth is removed. Anastomosis between pharynx and stomach is done in the neck.

Malignant bronchooesophageal fistula is common in upper third growths.

**Fig. 4.92:** Barium swallow X-ray showing rat tail lesion in the lower oesophagus near O-G junction with narrowing and irregularity – feature of carcinoma oesophagus.
**Middle third growth:**

**Ivor Lewis operation:** After laparotomy stomach is mobilised. Pyloroplasty is done.

Through right 5th space thoracotomy is done and growth with tumour is mobilised. Partial oesophagectomy and oesophago-gastric anastomosis is done in the thorax. Intercostal tube drainage is placed during closure.

If growth is inoperable, Palliative radiotherapy or chemotherapy is given.

**Lower third growth:**

Here through left thoraco-abdominal approach, partial oesophago-gastrectomy is done with oesophago gastric anastomosis. Often jejunal Roux-en-Y loop anastomosis is done.

**Orrhinger and Orrhinger approach,** i.e. Trans hiatal blind total oesophagectomy with anastomosis in the left side of the neck. Through laparotomy, stomach and lower part of the oesophagus are mobilised. Through left sided neck approach, upper part of the oesophagus is mobilised using finger. Blind dissection is completed by meeting both fingers above and below in the thorax. Later oesophagus is pulled up out above through the neck wound and removed. Continuity is maintained in the neck. It is a palliative surgery.

**Thoracosopic— Laparoscopic oesophagectomy** is practised in a few centers. It is popular and better. Total oesophagectomy with three field nodal dissection (celiac/thoracic/neck nodes) is also done as a radical procedure. When interposition is required, mobilised stomach or jejunum or colon (left) are used. Commonly it is placed in the thorax. Often it can be placed in substernal space or in front of the sternum in subcutaneous plane (especially colon). Stomach is commonly used to pull up as it has good vascularity; and it is technically easier to mobilise and pull up for adequate length.

**Palliative Treatment**

**Indications for palliative therapy**

- Relieve pain.
- Relieve dysphagia.
- Prevent bleeding.
- Prevent aspiration.

**Palliative procedures**

- External or intra luminal radiotherapy.
- **Traction tubes** like Celestin or MB tubes through open surgery.
- **Pulsion tubes** like self-expandable metal stents through endoscopes using C arm.
- Endoscopic Laser.
- Chemotherapy – Cis platin, bleomycin, methotrexate, mitomycin and 5 fluoro uracil.
- Transhiatal oesophagectomy.

**Intubation:**

- Atkinson tube.
- Celestin tube.
- Souttar tube.
- Mousseau—Barbin tube—cheaper, but requires laparotomy to pass.

**Expanding metal stents** are passed through endoscope under C-arm guidance.

**Endoscopic laser** is used to core a channel through the tumour to improve dysphagia.

**Complications of oesophagectomy**

- 5-10% mortality.
- Haemorrhage.
- Respiratory infection, often severe.
- Septicaemia.
- Chylothorax, injury to thoracic duct.
- Anastomotic leak—thoracic leak is most dangerous.
- Hoarseness due to recurrent laryngeal nerve palsy.
- Stricture formation.

**Terminal events in carcinoma oesophagus**

- Cancer cachexia
- Sepsis
- Immunosuppression
- Malignant tracheo-oesophageal fistula (causes severe respiratory infection and death. Here expansile endoluminal stents are used at the site of fistula to have temporary benefit).
What is TNM staging for carcinoma oesophagus?
T0: no primary tumour.
Tis: Carcinomas in situ.
T1: Tumour involving submucosa.
T2: Tumour involving muscularis propria.
T3: Tumour with peri-oesophageal spread.
T4: Involvement of recurrent laryngeal nerve, phrenic nerve, sympathetic chain, azygos vein and adjacent structures.
N0: No lymph nodes.
N1: Mobile regional nodes.
M0: No distant spread.
M1: Distant spread or positive celiac nodes.

**BARIUM MEAL X-RAY**

Barium meal X-ray is done using barium sulphate (95% w/v) solution of which 400-600 ml is given orally. It is done on empty stomach. Micronised barium sulphate solution is better. Procedure should be done under fluoroscopic guidance. Buscopan injection is given to the patient to delay the gastric emptying. Glucagon also can be used. Effervescent tablet (calcium carbonate and antifoaming agent) is given to the patient. 200 ml of barium sulphate solution is given to drink. X-rays are taken to get double contrast barium meal X-rays.

**Indications for barium meal X-ray**
- **Duodenal ulcer**: Shows absent/deformed duodenal cap.
- **Benign gastric ulcer**: Shows niche (due to ulcer) and notch (due to spasm).
- **Gastric outlet obstruction**.
- **Carcinoma stomach**.
- **Carcinoma pancreas**: Pad sign.
- **Periampullary carcinoma**: Frostberg reverse ‘3’ sign.
- **Chronic duodenal ileus**.
- **Stomal ulcer**.
- **Duodenal diverticula**: trifoliate duodenum.
- **Trichobezoars**.
- **Gastric fistulas**.
- **Pseudocyst of pancreas**: Widened vertebral – gastric angle.

**Barium Meal X-ray Features of Benign Gastric Ulcer**
- **Niche** on the lesser curve with **notch** on the greater curvature.
- Ulcer crater projects beyond the lumen of the
- Regular/round margin of the ulcer crater – stomach spoke wheel pattern.
- Overhanging mucosa at the margins of a benign gastric ulcer – projects inwards towards the ulcer – Hampton’s line.
- Converging mucosal folds towards the base of the ulcer.
- Symmetrical normal gastric mucosal folds.

**Features of chronic benign gastric ulcer**
- It may be due to atrophic gastritis, smoking, alcohol.
- Typical pain which is more after taking food and is relieved by inducing vomiting.
- Periodicity, haematemesis are other features.
- Complications are – hour glass contracture, tea-pot deformity, erosion into left gastric/
Figs 4.94A and B: Barium meal X-ray showing niche and notch in gastric ulcer. Benign gastric ulcer is usually in lesser curve where there will be niche. Notch occurs on the diagonally opposite side of the ulcer due to spasm of circular muscle fibre.

• Giant gastric ulcer is benign gastric ulcer more than 3 cm in size.
• Benign ulcer occurs usually in the lesser curve whereas ulcer in greater curve is commonly malignant.

Treatment for chronic benign gastric ulcer is partial gastrectomy with Billroth I gastroduodenal anastomosis.

Barium Meal X-ray in Duodenal Ulcer

Absence of duodenal cap or deformed first part of the duodenum is the classical feature of chronic duodenal ulcer. It is due to spasm of the 1st part of the duodenum causing its deformity. Chronic duodenal ulcer can lead into secondary diverticulum leading into trifoliate duodenum.

Fig. 4.95: Barium meal X-ray showing absence of duodenal cap without any obstruction. In chronic duodenal ulcer duodenal cap may be deformed or absent. Duodenal cap, in normal barium meal X-ray is formed by pouching effect of the normal first part of the duodenum. It is lost due to spasm in chronic duodenal ulcer.

Features of duodenal ulcer

• ‘Hurry, worry, curry’: stress, anxiety are the basic aetiological factors.
• Common in blood group O positive.
• Helicobacter pylori infection is seen in more than 90% of duodenal ulcer. Other causes

<table>
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<th>Types of gastric ulcer (Johnson)</th>
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<td>Type I: In the antrum near the lesser curve</td>
<td>25%</td>
<td>High acid level</td>
</tr>
<tr>
<td>Type II: Proximal gastric ulcer with duodenal ulcer</td>
<td>15%</td>
<td>High acid level</td>
</tr>
<tr>
<td>Type III: Pre-pyloric ulcer</td>
<td>05%</td>
<td>Normal acid level</td>
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</table>
are NSAID’s, steroids, alcohol, smoking, hyperparathyroidism.

- Anterior ulcer perforates; posterior ulcer bleeds.
- Hunger pain, early morning pain, periodicity, water brash, malaena are other features.
- Complications are pyloric stenosis, bleeding, perforation and penetration into pancreas.
- Chronic duodenal ulcer will never turn into malignancy.
- Gastroscopy, biopsy for Helicobacter pylori is needed.
- Proton pump inhibitors, anti H pylori drugs are the treatment.
- Surgery is indicated when there is intractable bleeding from the duodenal ulcer or when repeated recurrences or complication sets in. Highly selective vagotomy is done for intractable or repeated recurrent duodenal ulcers without pyloric stenosis. If there is pyloric stenosis then only truncal vagotomy with gastrojejunostomy (posterior, vertical, short loop, retrocolic and isoperistaltic) is done. Pyloroplasty cannot be done in chronically scarred duodenum because of the chances of duodenal leak.

Barium Meal X-ray of Gastric Outlet Obstruction

- Absent duodenal cap, if it is due to cicatrised chronic duodenal ulcer.
- Greater curvature is below the level of iliac crest.
- Mottled stomach due to retained food particles which gives coated/mosaic appearance.
- Barium will not pass into the duodenum.
- Dilated stomach.

Features of gastric outlet obstruction

- Pyloric stenosis is due to congenital/chronic duodenal ulcer/carcinoma pylorus
- Hypochloremic, hyponatraemic, hypokalaemic, hypocalcaemic, hypomagnesemic metabolic alkalosis with paradoxical aciduria is typical.
- Persistent pain, vomiting, visible gastric peristalsis, positive succussion splash, positive ausculto-percussion test are the special features.
- Treatment: Correction of electrolytes, stomach wash using Eswald’s stomach tube, TPN and truncal vagotomy with posterior gastrojejunostomy. Pyloroplasty, HSV or gastrectomy are not done for pyloric stenosis due to chronic duodenal ulcer.

Barium Meal X-ray of Carcinoma Stomach

- Irregular filling defect.
- Margin of the lesion projects outward from the ulcer/lesion into the gastric lumen—Carmann’s meniscus sign.
- Distorted and altered gastric folds with asymmetry.
- Kirklin complex.
- If growth is in the stomach, features of gastric outlet obstruction due to narrowing may be observed.
- In linitis plastica, there is small shrunken stomach with diffuse mucosal changes—leather bottle stomach.
- Carcinoma stomach is common in greater curvature.

Fig. 4.96: Barium meal X-ray showing secondary diverticula—trifoliate duodenum due to chronic duodenal ulcer. Primary duodenal diverticula are congenital with involvement of all layers of duodenum.
Fig. 4.98: Barium meal X-ray with irregular filling defect in the body of the stomach.

Figs 4.97A to C: Barium meal X-ray showing gastric outlet obstruction. It is due to scarred chronic duodenal ulcer (commonly)/or due to growth in the pylorus.

Fig. 4.99: Barium meal X-ray showing polypoid carcinoma in the body of the stomach.
Barium Meal X-ray Showing Extrinsic Compression

There will be smooth inward indentation over the wall/curvature of the stomach with a visible extrinsic mass lesion. Mucosal pattern of the stomach looks normal. It could be lymph nodal mass/retroperitoneal mass/pancreatic mass/gastric wall mass. CT will give the definitive idea about the lesion.

SMALL BOWEL ENEMA – ENTEROCLYSIS

It is visualisation of entire length of small intestine to assess anatomical problems. Indications are small bowel/ileocaecal tuberculosis, stricture, small bowel tumours, partial obstruction and Crohn’s disease.

Technique: Patient is prepared overnight with empty stomach and laxatives. Nasojejunal tube is passed. Prokinetic drug like metoclopramide is given. Micro barium sulphate solution (50% w/v) or gastrografin or water soluble iodine dye solution is (500-800 ml) passed through the tube. Under fluoroscopic guidance X-rays are taken as required. Features such as narrowing, smooth/irregular filling defect, localised dilatation, obstruction or features of specific conditions are looked for. In conditions like ileocaecal tuberculosis enteroclysis and barium enema X-rays are combined. Problems with enteroclysis are poor patient acceptance, and technical difficulty. Capsule endoscopy or enteroscopes are better options to visualise the small bowel.

When nasojejunal tube is not able to pass barium meal follow through X-ray is done by taking late films of barium meal.

Barium Enema X-ray

Indications for barium enema are:
- Carcinoma colon.
- Ileocaecal tuberculosis—combined with enteroclysis.
Fig. 4.102: Enteroclysis/small bowel enema X-ray. Nasojejunal tube should be seen in proper enteroclysis. Here tube is removed prior to taking X-ray film. Microbar solution or water soluble dye or gastrograftin is passed through a nasojejunal tube which is negotiated under C arm guidance. Prokinetic drugs are given. X-rays are taken. It is done in small bowel tumours/small bowel tuberculosis/stricture/partial obstruction/ileocaecal tuberculosis.

- Ulcerative colitis.
- Crohn’s disease.
- Ischaemic colitis.
- Colonic polyps.
- Intussusception.
- Congenital megacolon.
- Gastrojejunocolic fistula.
- Congenital diaphragmatic hernia (Bochdalek).

**Technique of barium enema X-ray**

24 hours liquid diet, laxatives for two nights and enema on previous night are the required preparations for barium enema X-ray.

About one liter of barium sulphate/micro barium sulphate solution (25% w/v) is infused per anally into the colorectum using an enema tube from an enema can. Patient will be initially in left lateral position and later in prone position. In children a Foley’s catheter with inflation is used to maintain the retention of enema. Procedure often is observed under fluoroscopy. Injection buscopan is injected (20 mg IV) to relax the colon. X-ray film is taken after complete filling. Patient is asked to evacuate the barium and later post evacuation film is taken. Air is insufflated into the colon to get air contrast film. Additional different view films are taken to see the suspected area properly.

**Different Findings**

a. **Hirschsprung’s disease**

Barium enema is done to look for the extent of disease and three zones. Foley’s catheter should not be used while doing barium enema in case of Hirschsprung’s disease. Here barium in dilute saline is used – not in water.

I. **Distal immobile spastic segment** i.e. aganglionic zone.

II. A proximal, **middle transitional zone** of about 1-5 cm length with less, sparse number of ganglions. (Cone).

III. A still more proximal, **hypertrophied dilated segment** is actually the normal ganglionic area.
Figs 4.104A to C: Barium enema X-rays taken after complete filling and evacuation of barium sulphate enema solution. Air is insufflated per anum into the colo-rectum which delineates the mucosa better to visualise small ulcers/small polyps.

Figs 4.105A and B: Barium enema X-ray showing features of congenital megacolon (Hirschsprung’s disease). It shows distal narrow segment, middle cone and proximal dilated segment.

Fig. 4.105C: Barium enema X-ray in new born taken for congenital megacolon.
b. *Carcinoma colon*
   - Irregular filling defect.
   - Apple core lesion especially on left side.
   - Metachronous growths (growths in different parts of the colon) should be looked for – 5% common.
   - Narrowing: left sided lesion.

**Fig. 4.106:** Barium enema X-ray showing growth with stricture in the ascending colon.

**Fig. 4.107:** Air contrast barium enema X-ray showing irregular filling defect in the ascending colon.

**Figs 4.108A and B:** Barium enema X-ray showing irregular filling defect in hepatic flexure with intussusception in one X-ray and in splenic flexure in other X-ray (carcinoma colon). Note growth in splenic flexure is narrow – stricture/obstructive type *apple – core lesion*. X-ray of hepatic flexure growth presented as intussusception.
c. **Ulcerative colitis**
- Loss of haustrations.
- Contracted smooth colon.
- Presence of pseudopolyps.
- **Collar button ulcers** – contiguous mucosal involvement.
- **Hose pipe/pipe stem** lesions.
- Increased presacral space more than normal (normal is < 1 cm).
- Reflux ileitis.
- Rectum is almost always involved.

d. **Ileo caecal tuberculosis**
- Pulled up caecum due to fibrosis and contraction.
- **Obtuse ileo caecal angle** (normal angle is acute)
- Hurrying of barium due to rapid flow – **Stierlin sign**.
- Narrow ileum with thickened ileocaecal valve, **Fleischner – inverted umbrella sign**.
- Incompetent ileocaecal valve.
- Ulcers and strictures in terminal ileum – **napkin lesions**.
- **Gooseneck appearance** – ileum hanging from fibrosed, pulled up caecum.

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**Fig. 4.109:** Barium enema X-ray showing stricture colon. Causes for stricture colon are tuberculosis, carcinoma and post surgery.

**Figs 4.110A to C:** Barium enema X-ray showing features of ileocaecal tuberculosis in different patients. Note the obtuse ileo caecal angle; pulled up caecum; incompetent ileo caecal valve.
e. **Crohn’s disease**
   - Aphthoid ulceration.
   - Skip lesions.
   - Rectum is not commonly involved.
   - **String sign of Kantor.**
   - **Cobble stone appearance:** Pseudosacculations.
   - **Raspberry/rose thorn** appearance.
   - Fistula or strictures.

f. **Sigmoid diverticula**
   - **Saw teeth appearance** of sigmoid colon – concertina like: Serrated appearance.
   - **Champagne glass sign:** partial filling of barium with stercolith inside the diverticula.
   - Fistula to adjacent structures.

g. **Intussusception**
   - **Claw sign:** Coiled spring sign – pincer end.
   - Empty right iliac fossa: Mainly in plain X-ray abdomen with multiple air fluid levels (on ultrasound: **Target sign/pseudo kidney sign/bull’s eye sign**).
**Intravenous Urogram (IVU)**

**Indications**

1. Hydronephrosis
2. Congenital anomalies
   - Horse-shoe kidney
   - Duplex kidney and double ureter
   - Ureterocele
   - Polycystic kidney disease
   - Retrocaval ureter
3. Renal cell carcinoma
4. To see the function of the kidneys in bilateral diseases
5. After surgery for urinary diseases
6. Renal injury

**Findings**

- Clubbing of calyces
- Flower vase appearance
- Adder (cobra) head appearance
- Spider leg appearance
- Reverse ‘J’ sign with hydronephrosis
- Irregular filling defect
- Bilateral stones, obstructive uropathy
- To see the function of kidneys and outcome of the surgery
- To see the function of other kidney (A very specific investigation)

**Contraindications for IVU**

1. Iodine sensitivity- may go for anaphylaxis. Hence, all precautions must be taken and essential drugs should be available while doing IVU
2. Multiple myeloma and hypergammaglobulinaemias (Acute renal failure may be precipitated due to dehydration)
3. Toxic thyroid

**Other signs in barium enema X-ray**

- **Thumb print sign** in splenic flexure.
- **Stacked coin appearance** due to submucosal haemorrhages in Henoch Schonlein purpura.
- Scalloped edges in colon in pneumatosis intestinalis.

**INTRAVENOUS UROGRAM (IVU)**

**Procedure:**

Renal function must be normal.

1. Overnight fasting for 8 hours is advised. Laxatives are given to reduce bowel shadow and get a good quality film.
2. First a plain X-ray KUB is taken (IVU should not be read without doing KUB).
3. Then 1 ml test dose of sodium diatrizoate (urografin) or Meglumine iothalamate IV is injected and waited for 5-10 minutes. If no adverse reaction occurs, then full dose - 1 ml/Kg body weight IV of (300 mg of iodine per Kg of body weight) urografin is given. (about 40-50 ml).
4. X-ray is taken in 1—5 minutes which shows the nephrographic and secretory function of the kidneys.
5. Later, at 15 minute and then at 20-30 minute films are taken.
6. Further films are taken depending on the need.
7. Film can be taken as late as 72 hours. Late films show bladder pathology as well as residual urine.
Figs 4.114A and B: Bilateral hydronephrosis with hydroureter. It could be due to BPH, stricture urethra, bladder tumour, extrinsic compression of both ureters and bilateral congenital PUJ obstruction.
Figs 4.115A and B: Extrarenal pelvis presenting with hydronephrosis. 80% of renal pelvis is extra-renal. In this type of pelvis hydronephrosis causes less renal parenchymal damage. It is easier to operate in such patient than with intra-renal pelvis hydronephrosis (20%).

Fig. 4.116: IVU showing flower vase appearance in case of horse shoe kidney. Fusion of one of the poles of the both kidneys causes horse shoe kidney. Usually fusion occurs in lower pole. Fusion at the upper pole is rare. Fused isthmus is in front of the vertebra and aorta; and often derives its blood supply from aorta. It is more prone for infection, hydronephrosis and stone formation. Angiogram and IVU are diagnostic.

Fig. 4.117: IVU showing right sided hydronephrosis and proximal hydroureter. Note the clubbing of calyces.
Figs 4.118A and B: IVU showing right-sided hydronephrosis. Note the clubbing of the calyces. In second X-ray there is hydroureter also. Secretion is normal on left side (cup shaped calyces are normal).

Fig. 4.119: IVU—late film with bladder phase showing enlarged median lobe in the urinary bladder (BPH).

Fig. 4.120: IVU showing stricture distal ureter with proximal hydroureter. Common cause is tuberculosis. It is confirmed by cystoscopy; selective urine sample for specific culture (for tuberculosis) (Dr Navinchandra Shetty, HOD, Radiology, KMC Mangalore).
8. In case of renal failure with high blood urea, dose of dye is increased to 2ml/Kg (600 mg/Kg) body weight to get a better film -Infusion IVU. Often diuretics are used in these patients to have better secretion.

9. Compression over lower abdomen for 10 minutes can be done to have better definition of calyces; but not done in children and patients with abdominal aortic aneurysm.

10. Minute IVU- In case of renal artery stenosis, within first minute many films are taken to see nephrographic (proximal convoluted tubules are seen) shadow—where a small, concentrated kidney is seen.

11. Upper part of ureter is visualised in supine films whereas lower part in prone films.

12. Nonvisualisation of kidney: Here no contrast is seen in the film even after 12 hours.

**Retrograde Pyelography (RGP)**

*Indications*

1. Failure of showing any secretions in an IVU as late as in 72 hours film.

2. Urinary tuberculosis.

3. Urothelial tumours from the renal pelvis.

*Procedure*

Under G/A cystoscope is passed. Ureteric orifice is visualised. Ureteric catheter is passed. Dye, sodium diatrizoate is injected. Patient is put in 15° head down position to allow the dye to reach upper urinary system. X-ray is taken.

*Advantages*

a. Prior to dye injection selective urine sample can be taken from each ureter.

b. Brush biopsy from suspected urothelial tumours of upper urinary tract can be taken.

c. Better-delineation of anatomy (due to more concentration of dye).
**Disadvantages**
Anaesthesia is required and is laborious.

**RENAL ANGIOGRAM**

*Procedure:*
Retrograde Seldinger technique: Through femoral artery, selective angiogram is done to visualize tumour vascularity, narrowing or anomalies.

Therapeutic embolisation, transluminal balloon angioplasty for renal artery stenosis can also be done. Translumbar approach can also used for angiogram (through aortogram).

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**Renal angiogram**

*Indications*
1. Renal artery stenosis
2. Renal artery atheroma
3. Renal artery aneurysm
4. Occasionally renal cell carcinoma
5. Arterial anomalies

*Complications*
- Paraplegia
- Embolism
- Dissecting aneurysm
- Bleeding
- Renal tubular necrosis

Renal pharmacoangiogram: Noradrenalin is injected along with the dye. Normal vessels will constrict in response to noradrenalin. Since tumour is autonomous, vessels in renal cell carcinoma do not respond to noradrenalin and so *tumour blush* is seen.

**Micturating Cystourethrography (MCU)**

*Indications*
- Vesico ureteric reflux.
- Posterior urethral valve.

*Procedure:* Catheter is passed into the bladder. Dilute iodine dye is infused. X-ray is taken during micturition. Free reflux is looked for. X-ray is taken following applying pressure over the suprapubic region. Pressure reflux is studied.

Vesicoureteric reflux is graded depending on the severity of the reflux as—
- I. Ureters seen.
- II. Ureters and pelvis are seen.

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Figs 4.123A and B: Micturating cysto-urethrogram showing concomitant existence of posterior urethral valve (causing dilatation of proximal urethra) and vesico-ureteric reflux (left side) (By Dr NC Shetty, Radiologist, Mangalore).
X-rays

III. Ureters, pelvis, cayces are seen.
IV. Calyces grossly distended.
V. Tortuous elongated serpentine ureters.

It can be unilateral or bilateral. Often it is associated with posterior urethral valve. It is often complicated by infection, pyonephrosis and renal failure.

Investigations: MCU, IVU, ultrasound, blood urea and serum creatinine.

Treatment: Tailoring of ureter with reimplantation.

Ascending Urethrogram

It is the investigation of choice for stricture urethra. Red rubber catheter is passed through the external meatus. Water soluble iodine dye is injected through the catheter. Oblique X-ray films are taken to visualise the urethra. Site, size, extent of stricture and extravasation can be seen.

Stricture Urethra

Classification I:

Aetiological—
2. Inflammatory:
   a. Post-gonococcal is commonest 70%.
      - Common in the bulb of urethra especially in the roof.
      - Here multiple strictures are common.
   b. Tuberculous.
   c. Other infection (Urethritis).
3. Traumatic: Bulbous, Membranous.
5. Postoperative: Prostate surgery, Urethrostomy.

Classification II: According to portion involved
1. Proximal: Common in bulbous urethra. (70%).
Classification III:
1. Permeable: Permits urine to pass.
2. Impermeable.

Classification IV:
1. Passable: Allows catheter to pass.
2. Impassable.

Classification V:
It can be single or multiple.

Classification VI: According to part involved.
In the roof (commonest) or in the floor.

Clinical Features
- Poor urinary stream.
- Forking and spraying of the stream.
- Incomplete emptying.
- Frequency, dysuria.
- Retention and often with overflow.
- Pain, burning micturition, suprapubic tenderness.
- Thickening and button like feeling in bulbar urethra. (Clinically bulbous urethra is felt in midline in the perineum by lifting the scrotum).

Investigations
- Urine microscopy and culture.
- Blood urea and serum creatinine.
- IVU to see hydronephrosis and function of kidney.
- Ultrasound abdomen.
- X-ray of pelvis to see old fracture with history of trauma.
- Ascending urethrogram is an essential investigation: To see the site, type, extent and false passage. Dye is injected into the bladder through suprapubic needle puncture and visualisation is done using C-ARM image intensifier.
- Urodynamic studies.
- Urethroscopy.

Treatment
1. Intermittent dilatation:
Gradual dilatation is done initially with thin dilators, later with thicker dilators of increasing size. Dilatation should be done in OT under aseptic precaution. One should avoid forcible dilatation or over dilatation.

Dilatation is done ‘once a week for one month, once a month for one year, and later once a year on his birthday.’

Dilators used:
- Lister’s dilator (has got olive tip (blister)).
- Clutton’s dilator.
- Filiform bougies.

Complications of dilatation:
- Infection and bleeding due to trauma.
- False passage.
- Fistula formation.

2. Visual internal cystoscopic urethrotomy or stricturotomy: Here using cystoscope, stricture is visualised and is cut at 12 O’ clock position, until it bleeds (fibrous tissue is cut completely). After that Foley’s catheter is passed and kept in position for 48 hours.

3. External urethrotomy by open method. Not commonly done presently as cystoscopic urethrotomy is more popular. It is presently done as an initial stage surgery for urethroplasty (Wheelhouse’s operation).

4. Urethroplasty: Stricture is excised and urethra is reconstructed using prepuceal skin or scrotal skin. (Johanson’s urethroplasty).

Problems in urethroplasty—
- Staged procedure and so prolonged hospitalisation.
- Infection.
- Necrosis of skin flap.
- Leak and fistula formation.
- Re-stenosis.

Complications of strict urethra
- Retention of urine.
- Urethral fistula.
- Infection—urethritis, cystitis, pyelonephritis.
- Urethral diverticula.
- Periurethral abscess.
- Bilateral hydronephrosis.
- Stone formation.
- Renal failure.
- Due to straining—hernia, haemorrhoids, rectal prolapse.
**Duplication of Renal Pelvis**
- Most common congenital anomaly of the upper urinary tract (4%).
- Usually unilateral. Common on the left side. In 3% of cases it is associated with duplication of ureter. Upper renal pelvis is small, drains the upper calyces. Lower renal pelvis is larger, drains from middle and lower calyces.
- When associated with double ureter, it may be partial where two ureters join in lower third or complete where upper ureter opens into the bladder at a lower level and lower ureter opens into the bladder at the upper normal ureteric orifice. This is called ‘Weigert-Meyer Law.’
- In partial duplex, there is reno-renal reflux resulting in infection, stone formation and hydronephrosis.

*Investigation:* IVU is diagnostic. Ultrasound is done to look for complications. Cystoscopy shows double ureteric orifices on the same side.

*Treatment:*
- Ureteric meatotomy is done if there is narrowing of the orifice.
- Co-existing complications are treated.
- Often heminephrectomy, including removal of corresponding ureter may be essential as treatment.

**Retrocaval Ureter**
- It is due to developmental defect of IVC, as a result of which ureter passes behind the IVC, causing right sided hydronephrosis with upper third hydroureter.
- IVU shows hydronephrosis with ‘reverse J sign.’
- Treatment: Anderson Hynes’ operation.

**Ureterocele**
- It is a cystic enlargement of the intra mural portion of ureter due to congenital atresia of the ureteric orifice. Its wall contains mucous membrane only.
Fig. 4.127: IVU reveals left sided ureterocele with duplex kidney. Note the characteristic Cobra (Adder) head pattern of left ureterocele. One can observe left sided double ureter-complete type.

- It is common in females, and often it is bilateral (10%).
- It causes hydronephrosis, infection, and calculi formation.
- Investigations: IVU-shows Adder-head appearance or cobra head appearance and cystoscopy - shows translucent cyst which is thin walled surrounding the ureteric orifice.
- Treatment: Cystoscopic ureteric meatotomy with the removal of cyst wall. In addition, co-existing complications like stone, obstruction, infection should be treated.

ORAL CHOLECYSTOGRAM (OCG; GRAHAM-COLE TEST)

Patient is advised to have fat free diet for 3 days. Previous night 6 tablets of iopanoic acid (Telepaque) is given orally. Next morning plain X-ray abdomen is taken to visualise the gall bladder.

Later fatty meal is given and X-rays at 10, 15, 30 and 60 minutes are taken to see the change in the size of the gall bladder (which should
IV Cholangiograms

It is done to visualise bile ducts and biliary tree, by injecting IV *Meglumine ioglycamate* (Biligram) and taking X-Ray abdomen. It can be combined with OCG.

Problems with this method are poor visualisation, drug reaction. It is not very useful if serum bilirubin is >3mg%.

ERCP (Endoscopic Retrograde CholangioPancreatography)

Through a side viewing gastro duodenoscope, sphincter of Oddi is cannulated, dye is injected and biliary and pancreatic tree is visualised. It is done under C-ARM guidance. It is done under sedation like midazolam or using propofol anaesthesia. Patient is placed in prone position with the head turned towards right. After passing gastroduodenoscope, sphincter is identified and cannulated. Under visualisation 3 ml of water soluble iodine contrast, is injected into the bile duct and pancreatic duct. When cannula goes upwards beside vertebra, it is in bile duct; and if cannula goes across the vertebra it is in pancreatic duct.

**Indications**

- Malignancy: irregular filling defect.
- Chronic pancreatitis - chain-of-lakes appearance.
- Congenital anomalies, stones.
- Stricture of biliary tree.
- Choledochal cyst.
- For sampling of biliary and pancreatic juices for analysis and cytology.
- Brush biopsy from tumour site.

**Therapeutic uses**

- Extraction of biliary duct stone.
- Nasobiliary drainage.
- Stenting of tumour in the CBD or in the pancreas.
- Dilatation of the biliary stricture.
- Endoscopic papillotomy.

Contraindications: Patients with serum bilirubin > 3 mg%, acute cholecystitis.

OCG is not done now.

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Fig. 4.129: Oral cholecystogram with smooth filling defect (Cystic duct stone).

Fig. 4.130: OCG done to see the function of the gallbladder.

be less in size compared to the earlier film, as the gall bladder contracts on stimulation if it is functioning normally). Smooth filling defect signifies non-opaque stone.

**Contraindications:** Patients with serum bilirubin > 3 mg%, acute cholecystitis.

OCG is not done now.
Figs 4.131A to C: ERCP being done. Note the gastroduodenoscope with injection of dye. Finding in ERCP 1 is filling defect in the CBD. In ERCP 2 there is dilatation of biliary radicles. In ERCP 3 there is radiolucent stone (smooth filling defect) in distal CBD which can be removed through ERCP. Antibiotics should be given to prevent cholangitis.

**Complications**
- Pancreatitis.
- Duodenal injury.
- Cholangitis
- Bleeding

**Relative contraindications**
- Acute pancreatitis.
- Previous gastrectomy.
- Altered prothrombin time (corrected by injection Vitamin K, FFP).
- Bleeding disorders.

**Percutaneous-Transhepatic Cholangiography (PTC)**

It is done in case of severe obstructive jaundice under coverage of appropriate antibiotics and after control of any bleeding tendency.

With the help of fluoroscopy, *Chiba or Okuda needle* which is long, flexible, thin, blunt, without beveled end, is passed into the liver through right 8th intercostal space in mid axillary line. Once needle is in the dilated biliary radicle, bile is aspirated (sent for culture, cytology, analysis); and then water soluble iodine dye is injected into the same so as to visualise the dilated biliary radicles, also the site and extent of any obstruction. (i.e. tumour, stricture).

Procedure can be used for therapeutic stenting across the biliary tree through any obstruction.
either in the hepatic ducts or in the CBD into the duodenum (PTBD).

**Complications**
Bleeding, biliary leak, biliary peritonitis and septicaemia.

**Magnetic Resonance Cholangio Pancreatography (MRCP)**
Magnetic Resonance Cholangio Pancreatography (MRCP) is a non-contrast imaging method, better than ERCP as diagnostic tool in biliary and pancreatic diseases. T2 T1 images are used.

**Per-operative Cholangiograms**
It is done during CBD exploration for - stricture, residual CBD stones, atresia, choledochal cyst, and cholangitis.

Fine polythene catheter is passed into the CBD through cystic duct and dye is injected. Under C-ARM image-intensifier, any block, stricture can be identified and completion of the procedure can be confirmed.

**Postoperative T-tube Cholangiogram**
After choledochotomy, Kehr’s T- tube is placed in CBD. After 10-14 days water soluble dye is injected into the tube and x-ray is taken. Initially T-tube is flushed with 20 ml of normal saline to flush out any air bubble. Air bubble, when present will be dense black area which shifts with change in position. 3 ml of urograffin is injected into the T-tube. Under guidance, X-ray film is taken. Complete free flow of dye into the duodenum indicates that there is no blockage. T-tube can then be removed safely. Usually T-tube is removed by gentle traction without any anaesthesia. Block indicates residual CBD stones.

Residual CBD stones can be removed by
- *Burhenne technique*: After 6 weeks once T tube track is matured, stone is removed through the existing track after dilatation under guidance (C-ARM) using—
  - Dormia basket
  - Fogarty catheter
  - Choledochoscope
  - ERCP and stone removal with CBD stenting
  - Heparinised saline (250 ml of saline with 25,000 units of heparin daily for 5 days) or bile acid flushing through the T-tube.
  - ESWL to retained stone along with endoscopic sphincterotomy to flush down the residual stone
  - Resurgery – choledochojejunostomy / transduodenal sphincteroplasty

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Figs 4.133A to C: Plain X-ray showing T tube in place in postoperative period. Once dye is injected T tube cholangiogram is taken which shows free flow of dye in duodenum without any shadows (in second film). In third film radiolucent residual stone is present in distal CBD.
ANGIOGRAMS

Angiograms are X-rays or imaging modalities used to visualize the arterial system. First carotid angiogram was done by Moniz (got Nobel Prize). It is used to find out the site of block, collaterals, distal run off and severity of the disease. In TAO block is segmental with adequate collaterals initially. It usually affects medium sized vessels. In atherosclerosis block is diffuse. Angiogram is also used to visualize aneurysms, A-V malformations and A-V fistulas in limbs, cranium, lungs and in other organs. Angiogram is useful in arterial injuries and renal hypertension. Four vessel angiogram of cranium (2 internal carotids and one vertebral artery – another vertebral artery fills by reflux) is useful tool in detecting and planning the therapy for various intracranial diseases. Coronary angiogram is done to find out the type and extent of the block in ischaemic heart disease. Celiac angiogram is useful in detecting upper GI bleed. Superior and inferior

Fig. 4.134: Cholecystocholangiogram. It shows dilatation of CBD and proximal biliary tree. There is block in distal CBD, most probably due to growth. CT scan and ERCP are useful investigations. ERCP facilitates the stenting of CBD as well as biopsy of the lesion.

Fig. 4.135: Angiogram showing plenty of collaterals

Fig. 4.136: Angiogram showing common iliac artery block on right side

Fig. 4.137: Angiogram showing atherosclerosis of both iliac vessels.
Figs 4.138A and B: Seldinger technique showing Seldinger catheter in femoral artery. In other film block in superficial femoral is seen but deep femoral shows adequate flow.

Fig. 4.139: Angiogram showing tibial artery block with formation of collaterals and adequate distal run off.

Fig. 4.140: Fistulogram of a track in the neck. Fistula can be congenital/acquired. Sinus is a blind track which comes to an epithelial surface. Fistula is an abnormal communication between lumen of one viscus to another or between one viscus to surface. Congenital causes may be branchial, tracheo-oesophageal, A-V fistula, or umbilical. Acquired causes may be trauma, post surgery, osteomyelitis, specific infections like Actinomycosis/tuberculosis or malignancy. It also may be due to lack of rest, epithelialisation, fibrosis, distal obstruction, presence of foreign body like sutures/sequestrum or irradiated surface. Features are—discharging sinus which is nonmobile with raised indurated edge and without floor. Opening of sinus/fistula may be evident with sprouting granulation tissue. Fistulogram is done to find out the extent/type (straight or curved)/number (single or multiple tracks) and communicating organ. Study of discharge (culture, AFB, cytology), edge biopsy, CT sinusogram are other investigations to be done. Probing of fistula, if needed should be done carefully with gentleness.

Mesenteric angiograms are useful in finding out cause for lower GI bleed.

Angiograms can be continued as therapeutic procedure in bleeding conditions by intra-arterial embolisation using coils, clot, spheres etc.

Types of Angiograms

- Conventional angiogram – dye (non ionic is better) is injected into the artery and under fluoroscopy/C-ARM image intensifier or computer monitoring, flow in the arteries is visualized to find out the block. Translumbar
SRB's Bedside Clinics in Surgery

is not commonly done now. It can cause bleeding, thrombosis or spinal cord ischaemia.

• **Seldinger retrograde angiogram** through femoral artery of one side – femoral artery is cannulated using arterial needle. Guide wire is passed. Through that arterial catheter is passed. Dye is injected. Films are taken or recorded in computer/C arm. Complications are – infection, spasm of artery, bleeding, thrombosis and dissection of the artery. It is a commonly done procedure.

• **CT angiogram** – It is more reliable and better.

• **MR angiogram** – It is also very useful type of angiogram.

• **DSA (Digital Subtraction Angiogram)** – Here dye is injected to artery or vein and bone is subtracted using computer so that bone image will not be there in the film and vessel is visualized better.

• **Pharmacangiogram** – dilute solution of noradrenaline is injected along with the dye, constricts the normal vessels but not tumour vessels as they are autonomous. It delineates tumour better with a tumour blush and also shows tumour vascularity. It is often used in renal cell carcinoma in renal angiogram.
Newer Imaging Modalities

Section 5
ULTRASOUND

Ultrasound contains waves with a frequency of more than 20,000 cycles/second which the human ears cannot hear.

In medical sonography frequencies used are commonly 2-10 MHz. The transducer or the probe works as both transmitter of sound waves and receiver of echoes. The Piezo electric crystal (PZT lead zirconate titanate) is the producer of ultrasound waves. Received signals from the patient are fed into the computer which forms the image. Sound speed in body is 1540 m/s.

There are three types of ultrasound image display.

1. **A-mode**: Only one dimensional static display as spikes obtained. It is used only in eye scan. It is Amplitude mode.
2. **B-mode**: Two dimensional real time images in the form of grains. It is most widely used type. Using this mode Transverse, Longitudinal or Oblique sections can be taken (Grey scale U/S).
3. **M-mode**: Here images are recorded as dots. It is mainly used in moving parts like Echocardiography. M-mode is also called as TM Mode, i.e. Time Motion Mode.

**Uses**

1. All abdominal and pelvic conditions, often in thoracic conditions.
2. Ultrasound of thyroid is very useful method to differentiate between solid and cystic lesions.
3. U/S is used in testicular tumours, epididymo-orchitis, trauma to testis, erectile dysfunction.
4. U/S breast to differentiate solid from cystic tumours.
5. Soft tissue and musculoskeletal system U/S.
6. Ocular U/S is ideal method to image eye and intraocular structures - A mode.

**Advantages**

- Painless.
- Low cost
- Availability even as portable machines.
- For superficial USG high frequency 7-10 MHz is used. Routine abdominal USG 3-5 MHz is used.

**Disadvantages**

- Interpretation can be inadequate.
- Bowel shadow may prevent proper visualization.
- In obese patient image will be inadequate.
- Acoustic cavitation may occur in small organs.

Interpretation is based on echogenicity either hyperechogenic or hypoechoogenic. Stones are well visualized with posterior acoustic shadow.

**Advanced Ultrasound Techniques**

1. Endosonography (EUS) used in visualization of walls of oesophagus or stomach through gastroscopy.
2. Transvaginal US.
3. Transrectal US to see prostate.
4. Doppler US to study arterial and venous diseases.

**Ultrasound as Therapeutic Use**

1. To guide aspiration of amoebic liver abscess, pericardial tap.

![Image of ultrasound showing abdominal aortic aneurysm]
Newer Imaging Modalities

Fig. 5.2: Ultrasound showing choledochal cyst. It is saccular type. Todani classification type I– fusiform type is commonest. Type II– saccular; Type III is choledochocele; Type IV is CBD and intrahepatic biliary dilatation; Type V is intrahepatic dilatations with cysts. Incidence of carcinoma in choledochal cyst is 30%.

Fig. 5.3: Ultrasound showing roundworm in gallbladder.

Fig. 5.4: Ultrasound showing liver, kidney and ascites probably due to tuberculosis.

Fig. 5.5: Ultrasound showing thyroid enlargement.

Fig. 5.6: Ultrasound showing features of ureterocele – Adder Head appearance of ureteric orifice. (By Dr Raghavendra Bhat, Radiologist; Balmatta Scan Center)

2. On table US to assess the operability of tumour. (During laparotomy to assess the extent of tumour, lymph node status, etc.).

**DOPPLER (CHRISTIAN JOHANN DOPPLER)**

Doppler effect is a change in the perceived frequency of sound emitted by a moving source. Frequency shift of moving object is recorded. So it measures blood flow. Spectral Doppler waveform and ultrasound image are combined in *duplex scanning.*
Types
1. Continuous waves.
2. Pulsed waves—gives exact velocity waveform.
   Doppler will provide both audio and video signals.
   *Colour Doppler imaging* displays flowing blood as **red** when direction of flow is towards the transducer. Image will be **blue** if flow is away from transducer.

Uses
- To study cardiovascular system.
- To study vascularity of tumours.
- To study blood flow and velocity in arterial diseases so as to assess stenosis (its extent, cause, etc.) like in atherosclerosis, TAO, cervical rib, aneurysm, A-V fistulas.
- To find out deep venous thrombosis (DVT), varicose veins, perforator incompetence.
- To study grade of varicocele in males.
- In portal hypertension, renovascular hypertension, IUGR, etc.

Advantages
1. It has replaced Venogram and Angiogram in many places as a diagnostic tool.
2. It is reliable and non-invasive.

CT SCAN
Computerized tomography scan was invented by **Godfrey Hounsfield** in 1963. He was a Physicist. He received **Nobel Prize** (1979) for the same. The first CAT scan is in the London museum (By EMI, electron musical instrument Middlesex England).

Narrow X-ray beams are passed from rotating X-ray generator through the **gantry** where patient is placed. When X-rays pass through the tissues, some of the X-rays get absorbed and some pass through, depending on the tissue density. The different grades of absorption in different tissues are detected through sensitive detectors which are translated to a Grey scale image by a computer.

Density of tissues is numbered as **Hounsfield Number (H.N.)** *(Hounsfield units)*

- Air - Minus 1000 HN.
- Water - Zero HN.
- Fat - minus 100 HN.
- Bone - Plus 1000 HN.
Other tissues come in between air and bone with different HNs.
Both Plain and Contrast CTs are done whenever required.

Advanced CT Methods
- **Spiral CT scan** has become popular. They are faster and in a single breath holding time, whole CT scan can be taken. It is based on principle of volumetric acquisition.
- **Multislice CT**: It is mainly used in coronary angiography.
- **Electron beam CT**.
- **High resolution CT (HRCT)**: Mainly for lung diseases. Thin collimation; small field of view; high resolution bone algorithm are the principles. Contrast enhanced CT (CECT).
- **CT angiography**.

Contrast Agents
- **Ionic**: Water soluble iodide dyes like Sodium diatrizoate, Meglumine iothalamate (Conray, Urograffin, Angiograffin). They are cheaper but often toxic and cause anaphylaxis. Ionic agents are hyperosmolar. Iodine component decides the radio opacity and it depends on iodine atoms and particle ratio. In ionic it is 3:2 and in non-ionic it is 6:1. Adverse reactions are idiosyncrasy (anaphylactoid reaction – not a true anaphylaxis; adrenaline 1 in 1000 of 0.3 to 1.0 ml S/C or IM may be given to relieve angioneurotic oedema/bronchospasm) and problems of hyperosmolar contrast media like hypervolaemia, blood-brain barrier damage, cardiac depression and damage to red cells and endothelium.
- **Non-ionic** are safer but expensive, like monomers—Iohexol (Omnipaque), IOVERSOR (optiray) or dimmers like Iodixanol. Nonionic agents are low osmolar.
- In abdominal CT, contrast agents can be given orally to delineate bowel properly.
Indications
- **Trauma** like head injury, chest injury, abdomen trauma. In trauma only *plain CT scan* is taken.
- **Neoplasms**: To see the exact location, size, vascularity, extent and operability. E.g. Brain, abdominal, retroperitoneal, thoracic and spinal tumours.
- **Inflammatory conditions** in various places also. E.g. Psoas abscess, pseudocyst of pancreas.

Advantages of CT Scan
- One to two mm sized sections are possible.
- Amount of X-ray exposure is less.
- More accurate, sensitive, and specific.
- Small lesions are also detected.
- CT guided biopsies are done at present safely.

Disadvantages
- Interpretation by an experienced radiologist is important.
- Artifacts can be present.
- Cost factor and availability.

Findings
- Extradural haematoma—*Biconvex lesion*.
- Subdural haematoma—*Concavo Convex lesion*.
- Smooth margin in benign condition.
- Irregular margin in malignant condition.

Advantages of Spiral CT Scan
- Reduced scan time. Useful in children and critically ill patients.
- Imaging in both arterial and venous phases is possible.
- Improved lesion detection. Missing a lesion is uncommon.
- Multiplanar and 3-Dimensional analysis like CT Angiography, Complex joint imaging, Facial bone imaging is possible.

High Resolution CT
High resolution CT *(HRCT)* is a CT technique used in chest scan where thin sections are taken to have better quality images.

MAGNETIC RESONANCE IMAGING (MRI)
Earlier named as *Nuclear magnetic imaging*, the term is not used now. Invented by Laterbuer and Mansfield – got Nobel Prize.
Fig. 5.9: CT scan showing mediastinal lymph node mass – could be lymphoma or secondaries. Mediastinoscopy and biopsy is needed. Later radiotherapy or chemotherapy is the treatment.

Fig. 5.10: HRCT chest. Invert film.

Fig. 5.11: CT scan chest showing lung abscess right side.

Fig. 5.12: CT abdomen showing cyst in the liver. It could be simple cyst or hydatid cyst.

Fig. 5.13: CT scan showing gallbladder stone in Hartmann’s pouch causing obstruction.

Fig. 5.14: Pancreatic ductal stones – multiple calcified stones. It needs pancreatico-jejunostomy.
Newer Imaging Modalities

Fig. 5.15: CT showing extrinsic compression of stomach from a gastric teratoma in a newborn.

Figs 5.16A to D: CT scan showing secondaries in liver. Secondaries are usually multiple. Primary may be abdominal or extra-abdominal. One has to evaluate for primary by upper/lower endoscopy; chest CT; clinical methods for primary in breast/thyroid/melanoma. Treatment is palliative. Solitary secondary can be resected if primary is from colon or well differentiated. Segmentectomy is done. Often one large secondaries with small remaining secondaries can occur.
Fig. 5.17: CT picture showing primary carcinoma in stomach with secondaries in liver. Note the thickening of the wall of the stomach with mucosal irregularity.

Fig. 5.18: Carcinoma pancreas with dilated common bile duct (CBD). Whipple’s pancreaticoduodenectomy is needed to this patient.

Fig. 5.19: CT picture showing features of cystadenocarcinoma of pancreas. It often attains large size; presents as mass abdomen without jaundice.

Fig. 5.20: CT picture showing features of hepatocellular carcinoma right lobe. Hepatoma is usually large, solitary mass in one of the lobes. AFP, liver biopsies are other investigations. Early growth is treated by hemihepatectomy. If there is cirrhosis, hemihepatectomy is technically difficult.

Figs 5.21A and B: CT scan showing carcinoma ascending colon. Note the narrowed lumen with irregularity.
Fig. 5.22: CT scan showing narrowing and irregularity in the rectal mucosa – a feature of carcinoma rectum.

Fig. 5.23: CT scan showing pelvic tumour

Figs 5.24A and B: CT scan showing renal cell carcinoma (RCC) right side.

Fig. 5.25: CT scan showing retroperitoneal tumour left sided

Fig. 5.26: CT scan showing retroperitoneal tumour encasing the aorta with hydronephrosis of right kidney due to ureteral obstruction.
Fig. 5.27: CT picture showing ascites.

Figs 5.28A and B: CT scan showing pseudocyst of pancreas. It needs cystogastrostomy/cystojejunostomy.

Fig. 5.29: CT scan showing hydronephrosis of left kidney

Figs 5.30A and B: CT scan of head showing extradural haematoma. EDH is biconvex in CT. It needs immediate burr-hole surgery to decompress. Same side weakness, same side ocular constriction with altered reflex (Kernohan’s notch effect), features of intracranial hypertension like hypertension, vomiting and headache and often with ‘lucid interval’ are the features. In ‘lucid interval’ patient after trauma becomes alright and in 12-24 hours again develops features of compression and deteriorates. It is due to slow bleeding causing late compression features. It is dangerous as while symptom develops patient may be away from hospital.
Fig. 5.31: CT scan of head showing concavo-convex lesions on both sides – feature of bilateral subdural haematoma.

Fig. 5.32: CT head showing hydrocephalus.

Fig. 5.33: CT picture showing astrocytoma—common primary malignant tumour of brain.

Fig. 5.34: CT scan showing features of meningioma.
Fig. 5.35: CT showing secondaries in brain. Note the multiple lesions in brain. Secondaries are the commonest malignant tumour in brain. Primary may be from breast, lungs, thyroid or sarcomas. Treatment is external radiotherapy, chemotherapy, anticonvulsants. It has got poor prognosis.

Fig. 5.36: CT head showing secondaries in skull. It may be from follicular carcinoma of thyroid or from adrenal neuroblastoma. Secondary in skull with thyroid primary is well localised, warm, vascular and pulsatile. Secondaries in bone from other primaries are diffuse, hard and tender.

**Principle**

When patient is placed in an external high magnetic field, protons of hydrogen atoms rotate in phase with each other and gradually return to their original position releasing small amounts of energy which is detected by sensitive coils. Proton density and Relaxation time are assessed by Radiofrequency pulse and the computer generates a Grey scale image from this data.

- Magnetic field strength is measured in Tesla (T).
- T1 relaxation time is the time taken to return to original axis. T1 images are used to find out normal anatomical detail. It has got high soft tissue discrimination. Here fluid (CSF) looks black. Fat is white in T1 images. It is spin lattice relaxation time.
- T2 relaxation time is the time taken by the proton to diphase. It is used to assess pathological processes. In T2 images fluid/water looks white. It is spin-spin relaxation time.
- In Proton density images fluid looks in between black and white.
- The magnet is kept under intense cold conditions to maintain a state of super conductivity. Coiled wires rest inside a double walled apparatus that is bathed in liquid helium. The apparatus is kept in a vacuum which is left inside a liquid nitrogen filled tank. MR scanner is enclosed in a stainless shield or copper shield called as Faraday cage which blocks the radiofrequency signals from local radio/TV stations. Gradient coils are used as magnetic devices. This coils because of immense magnetic forces bang against mooring causing loud rhythmic noise. Radiofrequency coils transmit and receive radiofrequency signals.
- It can be Plain MRI or Contrast MRI. Contrast agent is Gadolinium given Intravenously.

**Uses of MRI**

- It is very useful in Intracranial, Spinal and Musculoskeletal lesions including joint pathologies.
- It gives direct anatomical sections of the area with lesions at a high resolution.
- MR angiogram is done without injecting IV contrast agents.
- Cardiac MRI is very useful.
- Breast MRI is used in multifocal recurrent cancers.
- Magnetic resonance cholangiopancreatography (MRCP) is a very useful noncontrast diagnostic
Figs 5.37A and B: CT angiogram renal trauma – some are reconstructed images. Note absence of secretion right side. Probably right renal artery is injured or has undergone for spasm.
**Figs 5.38A and B:** MRI showing compression of T12 spine – tuberculosis of spine. MRI is ideal investigation for spinal pathology.

**Figs 5.39A and B:** MRI showing destruction of L4, L5 spine secondaries in spine. Patient presented with neurological deficit in lower limbs. Patient needs immediate radiotherapy and surgical decompression of spine.
tool which may replace diagnostic ERCP. Here heavily T2 weighted images are used.
• *MR Spectroscopy* is chemical analysis of elements in a tissue to differentiate between tumour, inflammation, and degeneration.

**Advantages**
- Artefacts are not common.
- More sensitive and specific than CT scan.
- High soft tissue contrast; multiplanar imaging,
- No ionizing radiation-so safer in pregnancy.
- Better for bone marrow, spinal diseases and posterior fossa lesions.

**Contraindications**
Patients with Prosthesis in the body, metallic foreign bodies, pacemakers, Cochlear implants, cranial aneurysm clips *should never* undergo MRI.

**Precaution**
Before entering the MRI room, the patient and other personnel should remove all magnetically attractive materials.
Figs 5.43A to C: CT scan and MRI pictures of craniopharyngioma

Fig. 5.44: MRI showing glioma brain

Disadvantages
- Availability and cost factor.
- It is time consuming.
- Patient compliance is poor.
- It is not feasible in patients suffering from Claustrophobia.
- It is not ideal in emergencies and critically ill patients.
- It is not useful in lung pathology and subarachnoid haemorrhage.

RADIOISOTOPE IMAGING
- It is discovered by Henri Becquerel – 1896
- Technetium 99 m is most commonly used radioisotope. It has got half-life of 6 hours. It has got less radiation effect to patient but adequate dose to show metabolic activity. It emits mainly gamma rays and low energy electrons with less beta emission (high energy). So there is no high energy radiation to patient. Gamma rays easily get escaped from body to get detected by gamma camera. Technetium can form tracers for different tissues or organs to get high level bioactivity. Technetium 99 is derived from molybdenum 99 (half-life 66 hours) which decays progressively into technetium 99.
- Radioisotope can be used individually or can be combined with organ specific molecule like DTPA.
• Radioactivity can be detected by gamma camera which contains scintillating detector – sodium iodide.

Different isotopes are:
• DTPA Tc 99 scan – functional aspect of kidney.
• MAG3 has got better functioning capacity but costly.
• DMSA Tc 99 scan – anatomical static images of kidney.
• Captopril DTPA scan is used for renovascular hypertension.
• HIDA scan/PIPIDA scan for cholecystitis
• Gallium scan (Ga 67) for inflammatory conditions–half-life 78 hours.
• Indium131 for leucocyte tagging.
• Thallium201 scan for cardiac imaging–73 hours half-life.
• I131 for thyroid scan in borderline toxicity/ectopic thyroid/follicular carcinoma thyroid secondaries/retrosternal goitre–half-life 8 days.
• Thallium – Tc99 subtraction scanning is used to detect parathyroids. Sestamibi scanning is also used for parathyroid imaging.
• MDP Tc99 (Methylene DiPhosphonate) scan is used for bone. It is best for early detection of acute osteomyelitis.
• Tc 99 sulfur colloid scan is used for reticulo-endothelial system in liver by making Kupffer cells to take up the isotope. It is sensitive in follicular nodular hyperplasia of liver.
• Radioisotope Tc 99 labeled RBC can detect bleeding as low as 0.1 ml/minute from GI bleed. It is more sensitive than angiography (detects 0.5 ml bled/minute).
• Meckel’s diverticulum can be detected by technetium 99 pertechnate scanning:
• MIBG (Meta Iodo Benzyl Guanidine) scanning is useful in adrenal tumours.

**POSITRON EMISSION TOMOGRAPHY (PET)**

• It is a functional imaging method using 18 Fluorodeoxy glucose (18 FDG) for metabolic agent localizes tumour. Perfusion agents are labeled NH3, Rb-81. It is useful to distinguish between high grade tumours from low grade tumours and also from benign tumours.
• SPECT is Single Photon Emission Computed Tomography which gives three dimensional image as opposed to a planar image by routine radionuclide imaging.

*Note:* Most of the figures in this chapter are from Dr Raghavendra Bhat and Dr Ravichandra, Radiologists, Balmatta Scan Center, Mangalore.
Instruments

Section 6
Surgical instruments are essential for any surgery, whether minor or major. All instruments should be sterilised prior to use to prevent infection.

Parts of an instrument –
- Two finger bows for holding.
- A ratchet or lock.
- A pair of shaft or body.
- Joint either box type (with a slot) or pivot (attached by a screw).
- Pair of blades at terminal part.

**CHEATLE’S FORCEPS**

It is used to pick sterilised articles like instruments and drapes so to avoid touching of the instruments while transferring them from one tray/table to other. It is kept dipped in antiseptic solutions like savlon/cidex. It does not have lock. It is heavy metallic forceps with curved blades with serrations. One blade of proximal handle has got rounded ring for finger and other blade has got free hook to have proper grip.

**SPONGE HOLDING FORCEPS (RAMPLEY’S)**

It has got fenestrated, serrated flat distal end. It is used to clean the operative field. Because of the length, the surgeon’s hand will not get contaminated while cleaning the patient. It is also used to swab the cavities, to mop the oozing area, to hold gallbladder or cervix or tongue or bowel or stomach during surgeries, for blunt dissections or as ovum forceps. It can also be used to dry the operative field using a gauze.

**MAYO’S TOWEL CLIP**

- It is used to fix drapes in operative field. It is light but strong with small curved blades. Curvature helps to hold entire thickness of drapes firmly and easily. Two sharp teeth one on each blade cross each other but do not approximate (cross action tip).
- It is used to fix suction tubes, diathermy wires, and laparoscopic cables in operative table.
- It is used to fix ribs in flail chest.
- It can be used to hold cord in hernia or to hold tongue if specific instruments are not available.
- It can be used to hold dental wiring; patella during patellectomy; in faciomaxillary fractures.
Instruments

**BACKHAUS’ TOWEL CLIP**

It has got a ratchet catch, curved sharp ends which approximate each other, but do not cross each other (Approximating tip, but no cross action in tip).

**MOYNIHAN’S TETRA TOWEL CLIP/FORCEPS**

- It is used to hold the cut skin edges of the incision to the four corners of the draped tetra towels so as to isolate the operative field.
- Isolation also can be achieved by suturing the drape margins to the subcutaneous tissue at different points or using adhesive plastic drape to skin and through the drape skin incision is made.

**DOYEN’S TOWEL CLIP**

It is a short instrument with curved ends with sharp points. Handles join at proximal ends. When handles are pressed tips open and when handles are released tips close and firmly grip the towels.

<table>
<thead>
<tr>
<th>Towel clips</th>
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<tbody>
<tr>
<td>Mayo’s</td>
<td>– cross action tip; no approximation</td>
</tr>
<tr>
<td>Backhaus’</td>
<td>– approximating tip; no cross action</td>
</tr>
<tr>
<td>Doyen’s</td>
<td>– tension blades open when pressed and vice versa</td>
</tr>
</tbody>
</table>

Fig. 6.4: Mayo’s towel clip.

Fig. 6.5: Backhaus’s towel clip.

Fig. 6.6: Moynihan’s tetra towel clip – it is with long blades with a curvature with two teeth in each blade (total four).

Fig. 6.7: Doyen’s towel clip.
Moynihan’s tetra forceps/towel clip – to isolate cut edge of the skin incision for isolation; has got two teeth on each blades
Bull dog towel clip – has got cross section action with tapering points
Gray’s towel clips – not used now

**ARTERY FORCEPS (HAEMOSTAT)**

**Types**

**Based on Size**
- Small or mosquito artery forceps – *Mosquito forceps* is so called because of its fine tip which even can catch the proboscis of a mosquito.
- Medium sized artery forceps.
- Large artery forceps.

**Based on Shape**
- Straight artery forceps.
- Curved artery forceps.

**Features of Artery Forceps**
- Distal blades are having transverse serrations which are well apposed.
- Lock in the proximal part.

**Uses**
- To catch bleeding points.
- To open the facial planes in different surgeries.
- To pass a ligature and to hold it.
- To hold fascia, peritoneum, aponeurosis.
- To hold sutures.
- To drain an abscess like a sinus forceps.
- To hold gauze as pea-nut.
- To crush the base of the appendix.
- To clamp a catheter in between the hinge and ratchet of the haemostat.
- To catch prepuceal skin in circumcision.
- Mosquito forceps is used in paediatric surgery/micro surgery/cleft surgery/plastic surgery.

**NEGUS ARTERY FORCEPS**

It is stout long jawed instrument (forceps) with distal part of the jaws are bent like a hook with transverse serrations. It is used to catch bleeding
part of the tissues prior to ligation. Initially bleeding area is clamped with haemostat and later Negus artery forceps is clamped underneath and artery is released. It facilitates easier passage of the ligature across the bleeding vessels or tissues.

**RIGHT ANGLE FORCEPS—MEIGSTER’S/LAHEY’S**

It has got 90° curves in terminal 1 cm part of the blades. Blades are longitudinally serrated. It has got a ratchet. Tip is blunt. It is used to dissect pedicles and to pass ligatures, to dissect the vagus and ligate in vagotomy, to hold bleeding vessels in depth, to dissect major vessels, to dissect and pass ligatures to cystic duct and cystic artery in cholecystectomy and in thyroid, biliary, splenic, gastric, renal and pelvic surgeries.

**WELL’S ARTERIAL CLAMP**

It has got doubly right angled distal blades with longitudinal serrations in the jaw. It is used to clamp pedicles like in nephrectomy or splenectomy.

**BULLDOG CLAMP**

Light bulldog clamp has got pinch cock action to open and close. Blades have got fine transverse serrations. Pott’s bulldog clamp is paper clip like instrument with strong jaws (with serrations) with spring loaded handle which permits a
secure grip of the vessel. Bulldog clamp is used to clamp vessels during vascular anastomosis like for creating AV fistula in patient with renal failure; major vessel surgeries as for aorta, inferior vena cava, portal vein, etc. With a firm grip it blocks the vessel without injuring the vessel wall and without any chance for slippage. Pott’s bulldog clamp is used for large vessels like aorta, vena cava.

SATINSKY VASCULAR CLAMP

It is light atraumatic long instrument with C shaped distal blades which has got fine teeth within. It has got a ratchet. It can be applied to part of the circumference of the vessel in portal vein, iliac veins, inferior vena cava while removing tumor thrombus in renal cell carcinoma, in pancreatectomy, major vessel surgeries. Vascular anastomosis can be done using it.

DE BAKEY’S VASCULAR CLAMP

Its blades are long and well angulated so that it can be used to clamp vessels/bleeders in the depth with good grip without damaging the vessel wall.

PEDICLE CLAMPS

A pedicle clamp is a stout haemostat with straight or curved blades with a ratchet. Entire blades are serrated here. It can be with or without teeth.
Instruments

Fig. 6.18: Robert's pedicle clamp.

Fig. 6.19: Maingot's pedicle clamp.

Fig. 6.20: Kocher's forceps.

Fig. 6.21: Allis’ tissue holding forceps.

- **Spencer-Wells' pedicle clamp/artery forceps** has blunt tip without teeth. It can be straight or curved. Its blades are entirely serrated. It can be small/straight/large.

- **Robert's pedicle clamp** It is stout curved instrument with transverse serrations in the distal blades on entire length with a ratchet. Tip is without teeth. It is used to clamp major pedicles during surgeries like nephrectomy/splenectomy.

- **Maingot's pedicle clamp** has got longitudinal ridge on one of the distal blades and a groove to receive in the other blade. Tip has got one – in – two teeth. It has got ratchet. It is a crushing clamp. It is stronger than Kocher’s forceps/clamp.

- **Kocher's forceps/clamp** It has got transverse serrations with one- in-two teeth at the tip. It has got a ratchet. It can be curved/straight.

- **Mayo's pedicle** clamp is stout and large with curved long blades with serrations. It is useful in clamping major pedicles.

**Kocher’s Forceps**

- It has got serrations in the distal blades and opposing tooth in the tip. It holds the tissues/pedicle well and prevents slippage of the tissues and retraction of the vessels/bleeders.

- It is used to hold pedicles, tough structures, cut ends of the muscles like-in thyroidectomy/haemorrhoidectomy/mastectomy/polypectomy/hysterectomy.

- It is used to hold tough/fibrous structures like in palms/soles/scalp to prevent retraction of vessels during surgery.

- It is used to hold peanuts (gauze pellets of 3-4 mm sized used in blunt dissection).

- It is used to hold gauze for blunt dissection, to hold resected bowel, to hold ribs during rib resection.

**ALLIS’ TISSUE HOLDING FORCEPS**

- Here distal blades are not apposing each other

- Tip has got teeth in each blade which are apposing.

- It has got lock.

- It is used to hold skin flaps, fascias, fibrous tissue, aponeurosis, Galea (in craniotomy) and
bladder wall. It is essential instrument in any surgery whether major or minor. It can be small/medium/large. Large Allis is used in hysterectomy to hold vaginal wall and tough structures.

**BABCOCK’S FORCEPS**

Their distal parts of distal blades are curved with triangular fenestra in it which allows soft tissues to bulge out. Tip is non-traumatic with transverse serrations/ridges on it. It has got a lock.

It is used to hold any part of the bowel, fallopian tubes, appendix, urinary bladder, ureter, cord, lymph node.

![Fig. 6.22: Babcock’s forceps.](image)

**LANE’S TISSUE HOLDING FORCEPS**

It has got thick, stout distal blades with oval fenestra in each blade with a curvature at the end. It has got apposing tooth in the tip. It has got lock.

It is used to hold bulky and tough structures (like to hold breast during mastectomy; to hold salivary glands while excising), to hold lymph nodes, to hold tumour tissue. It is also used as towel clip, as sponge holding forceps.

**MORRANT-BAKER’S APPENDIX HOLDING FORCEPS**

It is like Lane’s forceps but with apposing serrations proximal to the tooth. These serrations give a good grip on mesoappendix while holding appendix in appendicectomy. Its use is replaced by Babcock’s forceps.

![Fig. 6.24: Morrant-Baker’s tissue holding forceps.](image)

**MOYNIHAN’S TISSUE FORCEPS**

It is the tissue holding forceps with thinner and curved blades. Its uses are like Allis’ forceps.

![Fig. 6.25: Moynihan’s tissue forceps.](image)

**KOCHER’S GLAND HOLDING FORCEPS**

It has got terminal curved rings on each blade with two spikes on each with inward direction.

![Fig. 6.26: Kocher’s gland holding forceps.](image)
These spikes create a secure grip of lymph nodes while holding.

**YOUNG’S GLAND FORCEPS**

It has got long blades with each blade having rounded flat end with a fenestra without any serrations on its inner aspect. It is atraumatic. It has got ratchet. It is used to hold lymph nodes, cyst wall during surgical excision.

![Young's gland holding forceps](image)

**DISSECTING FORCEPS**

**Plain Non-toothed Dissecting Forceps**

It is used to hold delicate soft, friable structures like peritoneum, vessels, bowel, nerves, and tendons. It can not be used to hold skin or tough structures. During surgical dissection it is used to hold/fix/steady/stretch the structures as needed. It is also used to hold bleeding points, to cauterize small vessels.

**Toothed-dissecting Forceps**

It is used to hold skin and tough structures like fascia, aponeurosis. It is not used to hold delicate structures like bowel/vessel/nerve. It can have one in two teeth or two in three teeth. Small, fine forceps used for fine works is called as Adson’s forceps. Adson’s forceps can be toothed or non-toothed. Victor-Bonney’s forceps is heavy toothed dissecting forceps.

**KOCHER’S THYROID DISSECTOR**

It has got a curved blade with vertical grooves on it. There is an eye on its tip. It is used to

![Kocher's thyroid dissector](image)
dissect the upper pole of thyroid in thyroidectomy and to place as a surface while cutting the superior pedicle. Through eye ligature can be passed.

**SINUS FORCEPS (LISTER’S)**

It has got straight, long blades with serrations in the tip. It does not have lock. Tip is broad. It is used to drain pus from abscess cavity (Hilton’s method). It is called as sinus forceps because it is initially originated to pack the sinus cavities. It is also used to pack nasal cavity and ear. It is less traumatic.

**RUSSIAN FORCEPS**

This forceps has got clubbed tip in the blades with serrated inner surface. It is used to hold skin while skin suturing. It gives a very good grip over the skin while suturing without injuring it.

**RETRACTORS**

A retractor is an instrument used to retract tissues away from the operating field, to expose surgical field properly, to carry out surgery precisely and also to prevent damage to adjacent structures while conducting operation. It also prevents the unnecessary handling of the adjacent tissues.

**Types of Retractors**

- **Light retractor** is used to retract vessels, nerves, tendons or any delicate structures.
- **Heavy, stout retractors** are used to retract abdominal wall, ribs, sternum, etc.
- **Broad, flat retractors** are used to retract at curved different angles like for liver, spleen, kidney, bowels, etc.
- **Hook retractors** are used to retract soft tissues.

Retractor may be plain/non – self-retaining/manual (which is held by an assistant and its position is adjustable time to time) or self-retaining (fixed retraction and continuous non - altered). Retractor can be self-illuminating also with a power lamp at the corner of the blade. Assistant is getting fatigue by continuous retraction is draw back of the manual retraction. Adjustments and release of retractions whenever needed are possible in manual retraction. Over retraction and injury is possible here. Self retaining retractor will not allow regular relaxation of tissues and non-adjustable. It is also bulky. But it maintains
fixed position and assistant hands are free for additional work.

<table>
<thead>
<tr>
<th>Uses of retractors</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Retraction of cut edges of the incision</td>
</tr>
<tr>
<td>• To hold important structures like liver/spleen, etc. away from surgical field</td>
</tr>
<tr>
<td>• To steady the tissues</td>
</tr>
<tr>
<td>• To control bleeding</td>
</tr>
<tr>
<td>• To avoid inadvertent trauma to adjacent structures</td>
</tr>
</tbody>
</table>

**Remember** – retraction should be gentle and adequate. Over retraction can cause injury to the retracted organ/tissues and often bleeding.

**SINGLE HOOK RETRACTOR**

It is used to retract the skin. It is used in excision of swellings like cyst, lipoma, and neurofibroma. It is used to hold skin flaps while raising the flaps.

**VOLKMANN’S RETRACTOR/CAT’S PAW**

It is used to retract fascias in soles and palms. There are multiple hooks with pointed edges. Uses are same as single hook retractor.

**FISCH NERVE HOOK**

It is a fine delicate blunt nerve hook used to retract nerves during surgery. Examples—spinal accessory nerve, hypoglossal nerve retraction in block dissection; ilio-inguinal nerve in hernia surgery, lingual and hypoglossal nerves in submandibular surgeries, facial nerve in parotidectomy.

**LANGENBECK’S RETRACTOR**

It has got a long handle and a small solid blade. It is used in hernia surgery or any superficial surgeries to retract skin, fascia and aponeurosis etc. It can be single bladed or double bladed.
hernia, laparotomy especially during closure. Bleeders in the edge can be identified and cauterised easily.

**RIGHT ANGLE RETRACTOR**

Here handle and blade are at right angle to each other.

**MORRIS’ RETRACTOR**

It may be single blade type or double blade type. It has flat transversely curved blade. There is a blunt projecting ridge with backward projection to have a better hold.

It is used to retract abdominal wall incisions/loin incisions/subcostal wounds/any wounds in depth.

**‘C’ SHAPED RETRACTOR—ROUX**

It is C shaped with curve at both ends. It is used to retract wounds like in hernia, appendicectomy, wide excisions, etc. C shape gives a proper grip.

**‘S’ SHAPED RETRACTOR**

Here blunt curves on each end are in opposite directions. Uses are like C shaped retractor.
DEAVER’S RETRACTOR
It is a instrument like a question mark (?). It is stout but atraumatic. Its action is levering of the tissues not by push or pull or traction. Moist mops should be kept underneath prior to placing this retractor. It is a retractor with a broad, gently curved blade.

![Deaver's retractor](image1)

Fig. 6.42: Deaver’s retractor (manual).

DOYEN’S RETRACTOR
It is used in pelvic surgeries and in laparotomies. It has a curved blade with convex edge with a long handle.

![Doyen’s retractor](image2)

Fig. 6.44: Doyen’s retractor.

KEYLAND’S RETRACTOR
It has got flat wide blade with a right angle handle. It is used like Deaver’s retractor.

![Keyland’s retractor](image3)

Fig. 6.43: Keyland’s retractor (manual).

BALFOUR’S SELF-RETAINING RETRACTOR
It has got different adjustable blades so as to retract abdominal wall and tissues during surgery. It has got quadrangular metal frame. Two side heavy blades are hook shaped to fit into the wound sides. There is a detachable third

![Balfour’s self-retaining retractor](image4)

Fig. 6.45: Balfour’s self-retaining retractor.
blade to retract the viscera. One of the side blades has got screw to adjust the width of the retraction by side blades. Detachable blade is also fixed through an adjustable screw with a slot. Closed instrument is inserted into the wound and adequately widened as required to have its use. Tissues/bowel/organs should not be trapped while widening and adjusting.

**MILLIN’S SELF-RETAINING RETRACTOR**

It has got three-sided triangular metal frame with two flat side blades and one long ‘S’ shaped adjustable blade which has got two curves to retract urinary bladder or lower abdominal wall by each as needed. It is used in Millin’s open prostatectomy and other pelvic surgeries.

**JOLL’S THYROID RETRACTOR**

It is a self retaining retractor specifically used for thyroid/parathyroid surgeries. It is a semi-circular retractor with two blades attached with a handle. End of the blades are sharp like a towel clip with a catch/ratchet on it. Handle has got a screw by which instrument can be opened or closed. Upper and lower skin flaps in thyroid surgery is retracted well using this instrument.

**KOCHER’S THYROID RETRACTOR**

This instrument has got two side adjustable multihooked terminals (adjustable with screws) over two side flanges which are connected with a lockable joint. It is used in thyroidectomy.
MOLLISON’S MASTOID RETRACTOR

It is stout instrument with curved long blades which has got sharp outward curved teeth to retract tissues. Proximal shaft has got ratchet with finger bows. It is self retaining, haemostatic and gives wide exposure of the field. It is used in mastoid surgery, laminectomy, to retract scalp in neurosurgery, limb surgeries, etc. When shafts are approximated blades will open.

Fig. 6.49: Mastoid’s retractor.

BLADDER NECK RETRACTOR

It is thin, long instrument with two thin long distal blades. Proximal thin shafts have got a ratchet. When ratchet closes, the blades will open. It is used in retracting bladder neck in bladder surgeries.

Fig. 6.50: Bladder neck retractor.

CHEEK RETRACTOR

It is single piece instrument with acutely-angled blade with inward curled round margin. It is
used to retract cheek to inspect the oral cavity as well as to take biopsy of a lesion for diagnosis; dental extractions; interdental wiring; excision of lesions in jaw, gums and oral cavity (epulis, papillomas, mucus cysts, etc).

**SCAPULA RETRACTOR**
It has got a long stout handle with broad right angled blade with serrations. It is used to retract scapula during thoracotomy.

**KIDNEY HILUM RETRACTOR**
It has got curved ‘C’ shaped small blade with a long malleable shaft which is slightly curved. It is used in extended pyelolithotomy (Gilvernet’s) to retract renal hilar tissues so as to reach the pelvis. Intrarenal pelvis is approached by this manner to remove the stone.

**MORRIS KIDNEY RETRACTOR**
It has got blade of 6.5 × 5 cm in size with a curve. There is a blunt projecting ridge directed inwards. It is used in renal surgeries like nephrolithotomy, pyelolithotomy, pyeloplasty, nephrectomy.

**ALLISON’S LUNG RETRACTOR**
It has got long handle with light blade. Blade is made up of wires. Blade is right angle to the handle. It is used to retract lungs. Lung can expand between wires of the blade. It is atraumatic.
**RIB RETRACTOR (TUFIER’S)**

There is a strong short shaft with blades attached to it at right angles. One blade is fixed whereas other one is adjustable which can be fixed with a screw at required width. Blades are deep with outer flanges so as to hold with a proper grip. It is used in thoracotomy in lung/oesophageal and cardiac surgeries (trauma, tumours, mitral valvotomy, mediastinal tumours, diaphragmatic hernia, oesophagectomy, etc). It is a self retaining retractor. Other rib retractor used is Quervain’s rib retractor which is stronger with wing like blades, fixed with a screw.

**DOYEN’S RIB RASPARATORY**

It has got a stout handle with a curved semi-circular distal blade to pass under the rib surface for separating the periosteum after incising the periosteum of the rib. Using periosteal elevator periosteum is elevated and rasparatory is passed under the periosteum from upper margin of the rib to prevent injury to intercostal vessels. There are separate instruments for right side and left side. Handle is held with blade facing forward and upward to determine the side.

**FARABOEUF’S RASPARATORY**

It is a periosteal elevator with a corrugated thumb rest, flat grooved handle and a broad rectangular blade (beveled edge). It is used in elevating the periosteum in cervical rib resection, rib resection for empyema, rib resection in chondromas, in kidney exposure, in osteomyelitis of ribs. Periosteum is retained so that regeneration and remodeling can occur; intercostal vessels and nerves are protected. It is not used to elevate the inner surface of the ribs where Doyen’s rasparatory is used.

**RIB SHEAR**

It has got large rough handles. One blade has got groove with serrations and is blunt. It is passed underneath the rib as a protector to the adjacent tissues. Other blade is cutting one which apposes over the groove of first blade. It cuts the rib from front. Instrument is used for rib resection.
RIB APPROXIMATOR

It has two strong curved blades with teeth; proximal blade is mobile but can be fixed by a screw whereas distal blade is fixed. It is used to approximate the ribs during closure of thoracotomy. Two blades are placed adjacent to ribs and proximal blade is apposed adequately and fixed with screw. Thoracotomy wound is closed in layers. Screw is loosened to remove the rib approximator.

Fig. 6.60: Rib approximator.

BICKFORD’S BRONCHIAL CLAMP

It has got long distal blade which has got two bends with longitudinal serrations and spikes on the inner surface. It is used to clamp the bronchus as it holds the cartilaginous part firmly.

Fig. 6.63: Bickford’s bronchial clamp.

SURGICAL NEEDLES

Types

Based on the Edge

- Round body needle: It is round and smooth on cross section. It is used to suture muscles/intestines/soft tissues/vessels/nerves/tendons/peritoneum.
- Conventional cutting needle: Here needle is triangular on cross section with apex facing inward. It is used to suture skin/aponeurosis/tough structures.
- Reverse cutting needle: Here needle is triangular (reverse) on cross section with apex facing outward. It increases the strength and is less likely to bend while suturing.
- Taper cut needle: Here tip of the needle is reverse cut in section but eventually tapers into the body as round in section. It improves the penetration of needle but minimises the trauma.
- Blunt pointed needles are used to suture friable organs like liver/spleen/kidneys.
- *Spatulated side cutting needle* (saber lock)—is like a spatula with two lateral side cutting edges.
- *Micropoint needles*, either round bodied or reverse cutting or spatulated are used in ophthalmic and micro surgery. It has got an extra honing process.
- *Trocar point needle* is stout strong cutting end with a robust round body. It is used in obstetrics and gynaecology.
- *Tru taper needle* is one with tip angle of needle is 22 degrees (unlike conventional angle is 32 degrees). It is used in vascular surgery.
- *Visiblack needles*: Needles coated with black so that they are visible better in red background. It also prevents the glare from the focus lights by the needles.
- *Dolphin nose needle*: Specially designed needle used for surgeries in patients with hepatitis and AIDS which minimises the risk of puncturing the gloves and fingers of the surgeon.
- *JB needle* (Juergen-Breunner needle): Oval round bodied needle with a steep curve at the distal half to have easy passage of the needle through bowel in gastrointestinal surgeries.
- *Port closure needle* in laparoscopic surgeries
- *Ski needle* with a ski-shaped curvature in the distal part so as to have easy passage through the port for laparoscopic intracorporeal suturing.

**Based on Curvature**
- Straight needle.
- Curved needle. Half circle; 5/8 circle, etc.

**Based on Existence of the Eye**
- *Atraumatic needle* is eyeless. Here suture material is attached to the needle by *swaging* (Mr Merson of England). Size of the suture material and that of needle is same and so tissue trauma is less. Needle once used is disposed. (Not reusable). It is available as sterilised pack. These needles can be round body or cutting.
- *Traumatic needle*: It is eyed needle. Needle in the eye area is wider than the body of the needle and so tissue trauma is more. These needles are re-usable.

**Parts of a surgical needle**
- Eye or suture end
- Body—straight/curved
- Needle point is tip
- Circumferential length of the needle
- Needle chord length—distance between the tip and eye
Note –
- Weakest part of the needle is part near the eye.
- Needle is sterilised in cidex/Lysol. It should not be autoclaved as tip gets blunt.
- The needle is held at its center by placing it at the junction of the proximal 2/3rd and distal 1/3rd to have optimal grip, control and precision.
- Needles can be 1/4 circle, 1/2 circle, 3/8 circle or 5/8 circle at their curvatures. Refer diagram for the same. Different curvature needles are used at different places depending on the depth of the suturing.
- Needles are made up of stainless steel.

- Atraumatic needles are available as sterilized packs. They are sterilised by ethylene oxide or gamma sterilisation along with the sutures which they coexist.
- Gallie’s needle is large eyed needle which was earlier used in hernias to suture the defect using fascia lata strips.
- Lane’s needle is half circle cutting needle with a large eye.
- Mayo needle is obstetric needle with a large square eye and is strong.
- Hagedorn reverse flattened point fish hook needle used for suturing inaccessible sites.
- Symonds round bodied fish hook needles.
- Bonney Reverdin needle is a special needle with an eye which is open to one side with small slender shutter which can slide and closed after passing the suture material.
- Kous Netzoff aluminium needle is used to suture the liver tear.

### NEEDLE HOLDER

Smaller distal blades with criss-cross serrations often with a groove in the middle are the features of a needle holder. Often there is a longitudinal groove in the middle of the distal blade between serrations. Ratio of length of handle to blades is 4:1.

It may be straight or curved. It may be available in different sizes. While holding a needle in a needle holder one should get a good control and good grip. This is achieved by placing the needle at junction of proximal 2/3 and distal...
1/3 of the blade. Needle holder should be held between thumb and ring finger. Curved needle holders are available to hold the needles and work at the depth like in pelvis/thoracic cavity for better maneuverability and visualisation. Needle holder is sterilised by autoclave. Tungsten – carbide inner surface coated needle holder is available which has got longer duration of life due to reduced wear and tear of the instrument because of tungsten coating.

**BARD PARKER’S HANDLE (BP HANDLE)**

Bard parker’s handle is a flat stainless steel instrument with a slot on narrower side on both surfaces to attach scalpel blade. 3, 4, 5 and 7 numbered blades are available. Number 4 handle is wider. Scalpel blades 10, 11, 12, and 15 fit in to Bard Parker handle numbers 3, 5 and 7. Scalpel blades 18, 19, 20, 21, 22, 23 and 24 fit in to slot of Bard Parker’s blade number 4. New blade is used in to the slot of the handle for each patient and so sharpness of the blade is maintained. BP handle is sterilised by autoclave.

**Different ways of placing incisions—**
- *Dinner knife position* is used while making lengthy incision.
- *Pen holding/writing position* is used to make incision over the vessels/nerve/tumours.
- *Fiddle-bow position* is used to make incisions with less pressure on delicate tissues.
- *Grasping position* is used to make long sweeping cuts.

Fig. 6.67: Bard Parker’s handles—3, 4, 5 and 7

**SURGICAL BLADES**

They are detachable blades. Number 11 blade is stab knife blade which is used in incision and drainage of an abscess and in making small incision like for drains. Number 12 blade is curved one, used for tonsillectomy. Here cutting edge faces surgeon. Number 15 is used in plastic surgery, head and neck surgery, face surgeries. Numbers 20, 22 and 24 used in skin incisions of major surgeries like laparotomy, thoracotomy, craniotomy, incisions in limb. Blades are sterilised by gamma radiation with aluminum foil packing. Commonly blades are used only once and then disposed. If sterilisation is needed it is done using cetrimide/Lysol immersion (not autoclave or boiling).

Fig. 6.68: Surgical blades of different numbers. Blades are detachable and used only once.

Fig. 6.69: Different positions/methods used to hold knife while making incisions or doing dissections in different surgeries.
Principles in making incision

- Incision should be planned well prior to surgery for adequacy, for possible need for extension during course of the surgery, and indeed be cosmetically acceptable. Ideally incision site should be marked using sterile marker or methylene blue.
- Clean single stroke firm incision should be made with required depth. Repeated strokes and movements should be avoided.
- Knife should be perpendicular to skin to begin with, with blade pointing perpendicular to skin. But later blade should be parallel with curvature/belly of the blade on the site of the incision.
- While making lengthy incision like in abdomen, incision area should be stretched between thumb and index fingers of other hand of the surgeon.
- Care should be taken to avoid injuries to deeper structures like muscle/nerves/vessels/bowel while making incisions.

TENOTOMY KNIFE

Tenotomy knife straight/curved with a short cutting edge with a fixed handle is used in congenital torticollis to cut sternomastoid muscle, congenital talipes equino varus, adductor tenotomy and lateral sphincterotomy for fissure in ano.

ANEURYSM NEEDLE

Aneurysm needle is stout instrument with a deep hook in one end with an eye opening in the blunt tip. Eye proceeds as a deep groove in the needle proximally which allows the ligature to stay firmly. This facilitates the passage of the ligatures across the deeper plane around the blood vessels; to ligate the vessel in continuity; in venesection; to pass the ligature around any tubular structures. Earlier it was used to ligate the artery while treating the aneurysm. It is sterilized in glutaraldehyde or Lysol but never by boiling or autoclave.

SCISSORS

Scissors has got various purposes in surgical field like dissection, cutting tissues, cutting suture materials, opening tissue planes, venesection, cutting bandages, corrugated/tube drains and dressing, ophthalmic or microsurgeries, etc. It can be straight, curved, small, medium or long scissors.

Different scissors are
- Mayo's scissors are long and stout scissors. It can be blunt tipped/pointed tip/straight or curved.
- Mc Indoe scissors is having fine small blade. It is used mainly for dissection and in cutting delicate structures.
- Metzenbaum scissors has got long blades in comparison to shaft. It is used in depth dissection like vagotomy, cholecystectomy, pelvic surgeries, etc.
Instruments

Fig. 6.72: Different scissors used in surgical practice.

Heath suture cutting scissors—has got long shaft, small curves angled blades with tip is having fine serrations which ensures the proper grip of the suture material to be cut. Suture is held with dissecting forceps and is cut using Heath’s scissors between knot and skin where suture enters.

Steele’s scissors is like Metzenbaum scissors with similar use.

Lister’s bandage/dressing cutting scissors has got flat lower blade to avoid damage to skin. Lower blade has got a knob at the terminal.

**BOWEL OCCLUSION CLAMPS**

**Moynihan’s Occlusion Clamp (Gastric)**
- It has got long distal blades with transverse serrations with a longitudinal fenestration one on each blade.
- It may be straight or curved.
- It is nontraumatic, noncrushing type.
- It occludes lumen of the bowel/stomach and so prevents spillage of the content of the bowel.
- It also occludes the vessels in the wall of the bowel and so prevents bleeding during surgery.
- It is used during anastomosis of the stomach and other parts of the bowel.

**Kocher’s occlusion clamp (gastric):** Blades have longitudinal serrations without fenestration.

**Doyen’s intestinal occlusion clamps (straight or curved):** Have longitudinal serrations with apposing blades.

**Lane’s paired gastrojejunostomy clamps (straight or curved):** It is used in gastrojejunostomy. It steadies the anastomosing parts well. It has got a hook at the tip and a screw on the blade to fix each other.

Fig. 6.73: Moynihan’s occlusion clamp.

Fig. 6.74: Doyen’s occlusion clamp.
Fig. 6.75: Lane's paired gastrojejunostomy clamps with hook and screws used for gastrojejunostomy.

Carwardine's twin intestinal occlusion clamps: It has got a slot on one part shaft and a corresponding screw on the other part shaft. These slot and screw fits into each other to facilitate proper intestinal anastomosis.

Fig. 6.76: Carwardine’s twin intestinal occlusion clamp with screw and slot to fix. It is used to have easier intestinal anastomosis.

Payr's gastric occlusion clamp: It has got longitudinal serrations on the inner surface of the blades with several ball like projections along the sides which interlock each other of the opposite blade to have a firm grip on the stomach/bowel while using.

Moynihan's gastrojejunostomy clamp: It has got long fenestrated blades with oblique serrations. Central and one lateral blade are straight where jejunum is placed while doing gastrojejunostomy and third lateral blade is 'L' shaped within which stomach occupies while using. Serrations and L shape prevents slippage of the bowel while anastomosing.

CRUSHING CLAMPS

Fig. 6.77: Payr's gastric occlusion clamp

Fig. 6.78: Moynihan's gastrojejunostomy clamp.

Payr’s crushing clamp gastric/intestinal/appendix crushing.
• It is stout and heavy instrument with double lever in the handle with longitudinal serrations.

• Once applied it crushes the bowel. So before applying it, line of resection of stomach/bowel should be assessed properly. It is applied to the part which has to be removed. Viability of the bowel is lost once it is applied.

• It is used in gastrectomy, resection and anastomosis of the bowel.

• It can be gastric crushing or intestinal crushing or appendix crushing clamp. All are similar; only size of the blades is smaller in intestinal and appendix crushing clamps.

Parker Kerr’s crushing clamp is a stout, heavy crushing clamp with longitudinal serrations.

Fig. 6.79: Payr’s crushing clamp.

Fig. 6.80A: Parker Kerr crushing clamp.

Fig. 6.80B: Desjardins’ choledocholithotomy forceps.

Lawson-Tait Choledocholithotomy Forceps/Alligator Forceps is used which has got alligator jaws that facilitate passage through a narrow duct with lesser chances of dilating the duct.

BAKE’S DILATOR

It is long malleable metallic instrument with club at the terminal end. It is available in different sizes.

It is used to assess the CBD, duodenal papilla for patency or block. Dilator is passed through the choledochotomy opening downwards to reach the metal tip (olive blunt tip) to duodenum. It signifies the patency. It is called as steel sign. Gradually from lesser diameter to higher diameter sized dilators are passed.

Fig. 6.81: Bake’s dilator.

CHEATLE’S GALLSTONE SCOOP WITH OR WITHOUT HOOK

It is flexible long instrument with a blunt scoop on one side with a handle. Few instruments often contain a hook on other side. Scoop is to remove the debris
from the gallbladder or common bile duct; and also to support or push the stone while removing. Hook is used to dislodge the impacted stone.

**CHOLECYSTECTOMY FORCEPS**

These instruments are used to hold the fundus and Hartmann’s pouch of the gall bladder during cholecystectomy. It is also used to dissect the cystic duct and artery and to pass ligature around the cystic duct and artery.

*Henry Gray’s cholecystectomy forceps* is similar but has right-angled blades with transverse serrations.

**GALLSTONE PROBE**

It is a long malleable instrument with an olive on one or both ends with a handle. Its diameter is 6 mm. It is used to explore the common bile duct and hepatic ducts for patency, and presence of stones. Small stones in common bile duct can be pushed into the duodenum. If stone is impacted, its exact location can be found by passing it.

**MAYO ROBSON’S CHOLECYSTOENTEROSTOMY CLAMP**

It has got long curved semicircle like blades. It is used while bypassing the biliary tree—cholecystoenterostomy done as a palliative procedure in obstructive jaundice (in carcinoma head of the pancreas or periamputary or
carcinoma distal common bile duct). This clamp is used to clamp the gallbladder to keep in position while doing cholecysto jejunostomy. But choledocho jejunostomy Roux-en-Y is a better palliative bypass procedure because narrow cystic duct may get blocked later causing re-obstruction of the biliary tree. Cystic duct may end into the common bile duct lower down and its junction may get involved by the tumour invasion causing re-block and so failure of the palliative procedure.

KEHR’S ‘T’ TUBE

• It is used after opening of CBD (choledochochotomy). CBD is closed with ‘T’ tube in situ
• It is made up of latex or red rubber. ‘T’ tube has got horizontal part which is kept in the CBD and vertical part which is allowed to come out to drain bile. Amount of bile draining is measured daily.

Before removal of ‘T’ tube, patency of CBD should be confirmed.

It is done by following methods:
• The vertical limb (done in 10-14 days) is clamped and observed for development of pain, fever and jaundice in 24 hours. If normal then one can presume that there is no obstruction in the CBD.
• Water soluble iodine dye is injected through the tube to visualise biliary tree and free flow of dye into the duodenum. (Postoperative ‘T’ tube cholangiogram). It is done in 14 days which is the time required to develop fibrous track. Once there is free flow tube is removed and track gets closed on its own.

Complications/problems of T tube
• Kinking/block/break in T tube.
• Displacement/slipping of T tube out of common bile duct may cause biliary peritonitis.
• Improper pancreatic duct drainage due to tube.
• Impaired enterohepatic circulation.
• Biliary infection, secondary haemorrhage, bile leak and peritonitis, foreign body reaction
• Difficulty in removal even after adequate pressure is managed by gradual continuous pressure and occasionally exploration may be needed.

SUCTION INSTRUMENTS

These are essential instruments needed in all surgical practice to suck out blood from the surgical field, pus, infected fluid, fluid in peritoneal/thoracic/cranial cavities. It has got a suction tip of varying type, suction tube which connects tip to the suction apparatus and suction creating system, either central suction system or power suction system with two suction glass bottles connected to each other or manual suction apparatus (now not used). Suction tip has got a long bent tube with openings at one end to suck the fluid, with a stout handle which has got a proximal ridged part at the other end to

Fig. 6.85: Mayo Robson’s cholecysto enterostomy clamp.

Fig. 6.86: Kehr’s ‘T’ tube.
which suction tube (rubber or plastic) is attached, which in turn is connected to suction apparatus. Suction tip and suction tubes should be sterile. They are sterilised by autoclave.

**Types of Suction Tips**

- **Adson’s fine suction tip**: It is angled with a vent/thumb rest to control the suction as needed. It is a fine suction tip which is used in meticulous surgeries like plastic, vascular and reconstructive surgeries. It can not be used when large quantity of blood/pus/ fluid/clot needs to be sucked out.

- **Yankauer’s suction tip**: It is large suction tip used mainly in peritoneal cavity after lavage, in haemoperitoneum, in peritonitis, in pelvis, in thoracotomy, etc. It has got central hole with outer small multiple holes. It creates strong suction and so may suck omentum; bowel wall, etc. and so with one hand bowel and omentum should be pushed aside while sucking the fluid. Often its tip is supported by a rubber tube. When it is present, care is taken to see that it is not left inside the peritoneal cavity by inadvertent slippage.

- **Poole’s multi-perforated suction tip**: It has got outer and inner tubes – one inside the other. Outer tube has got multiple holes with blunt closed tip so that bowel/tissues will not be sucked inside. Inner tube has got one terminal and another proximal side holes. Inner tube will be inside the outer tube attached with a screw on proximal aspect. Outer tube has got a thumb rest hole/vent which when closed with thumb, only then the suction tube will function. With thumb placed on the vent suctioning is done in the peritoneum or other cavities, while removing the suction tube thumb is released so that sucking effect on the bowel or omentum or vessels or over the stoma is prevented while withdrawing the suction tip. It acts by sump action principle. It can also be used for decompressing the distended bowel.

**TRACHEOSTOMY TUBE**

**Types**

1. **Fuller’s bivalved tracheostomy tube**: It has got outer tube and inner tube. Outer tube is bифlanged and so insertion is easier. Inner tube is longer with an opening on its posterior aspect. Inner tube can be removed and re-inserted easily whenever required.
2. **Jackson’s tracheostomy tube**: It has got outer tube, inner tube and an obturator.
4. PVC tracheostomy tube.
Instruments

**TRACHEAL DILATOR (TROUSSEAU’S)**

Here blades open up while approximating the handle. Blades have got club-shaped blunt tip. It is used to dilate the tracheal opening during tracheostomy and to keep it open while introducing the tracheostomy tube.

**TRACHEAL HOOK**

It is single blunt hook/sharp hook with a handle which is used to stabilise the trachea and retract strap muscles and isthmus during tracheostomy by placing under the cricoid to pull it upwards. Sharp hook is used to stabilise the trachea. Blunt hook is used to retract strap muscles.

**CRICOID HOOK**

It has got thin shaft and two curved prongs at the end of the blade with a handle. It is used to retract the isthmus during tracheostomy.

**ENDOTRACHEAL TUBE**

It is a gently curved tube used to pass in to the trachea via the nasal/oral route. It is made up of India rubber or portex. It may be cuffed or

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Modern tracheostomy tubes are made of plastic. They are soft, least irritant and disposable. They have inflatable cuff which makes it easier to give assisted ventilation. Cuff should be deflated at regular intervals to prevent tracheal pressure necrosis. (For assisted ventilation endotracheal tube can be kept for 7 days. Beyond that period patient needs tracheostomy for further ventilation).

**Indications for Tracheostomy**

- In head, neck and facial injuries.
- Tetanus.
- Tracheomalacia after thyroidectomy.
- Laryngeal oedema/spasm.
- Major head and neck surgeries like Commando’s operation, block dissection, etc.

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**Fig. 6.90A and B: Tracheostomy tube (A) Fuller's (B) Jackson’s tracheostomy tube.**

**Fig. 6.91: Tracheal dilator.**

**Fig. 6.92: Tracheal hook.**

**Fig. 6.93: Cricoid hook.**
noncuffed (plain). Cuff is present on the distal part of the tube which is inflated using air through a fine tube present on the body of the endotracheal tube. Small pilot balloon on the proximal part is present to check the tension of the cuff. Cuff prevents aspiration and air leak. Capacity of the cuff is 4 ml. and often tip is radio-opaque. When noncuffed tube is used, ribbon gauze should be packed around it to protect air way from aspiration. Its distal end is beveled – 38 degrees towards left as tube is passed from the right angle of the mouth of the patient. It has got a thick black mark which should pass just beyond the vocal cords. Cuff should be 3 cm beyond vocal cords in adult and 1 cm beyond vocal cords in infants. Different sized tubes are available depending on age of the patient. Number 6.5 to 8.0 in females and 8.0 to 9.5 in males are used. Styllet is often used while passing the endotracheal tube for easy intubation.

It is used in general anaesthesia, to maintain airway in emergency in patients with trauma, in patients with respiratory distress, in cardiac arrest. It is a life saving tube used during resuscitation. It is usually kept for 7 days. If patient needs further continuation of artificial ventilation then tracheostomy is done.

Types
- **Cole tube**: Here distal part is narrow and is used in pediatric anaesthesia.
- **Lindholm tube**: It has 90° curve at oropharynx.
- **Rae preformed tracheal tube**: There is bending in the part of the tube that remains outside. It can be oral or nasal bends.
- **Spiral embedded/armored/reinforced**: Middle segment of the tube is spirally embedded with nylon/metal filaments to make it resistant for kinking and tolerable in high pressure.
- **Endotrol tube** has got cable like mechanism to have a control over the tip.
- **Hi-low jet three**: Lumen tracheal tube with main lumen for ventilation, another for jet ventilation, suctioning, oxygenation and bronchoscopy and third one for irrigation and sampling from trachea.
- **Laser shield** endotracheal tube which is made up of silicon with impregnation of metal particles.
- **Oxford endotracheal tube**: Here 2 cm of nasal end of the tube is bent at 90 degrees and is used in cleft lip and cleft palate surgeries.

**Complications of Endotracheal Tube**
- Oesophageal intubation—most dangerous should be identified by ventilation, auscultation, absence of vapour in the proximal part of the tube. It should be removed and reintroduced immediately.
- Trauma to oral/nasal/pharynx/larynx.
- Right sided intubation as right bronchus is shorter, wider than left and it is in line with tracheal lumen. Left side will not get ventilated in this situation.
- Bronchial obstruction/aspiration.
- Infection—bronchopneumonia, septicaemia.
- Kinking, blocking of the tube.
- Tracheal dilatation/erosion.
- Inadvertent extubation/difficult extubation.
- Laryngeal/pharyngeal oedema, laryngitis.
- Vocal cord dysfunction/laryngeal or tracheal narrowing.

**MAGILL’S FORCEPS**

It is long, sidewise angulated with fenestrated blades with rings in the handle without ratchets. Angulation helps while using in proper vision
Instruments

of oropharynx. It is used to assist in endotracheal intubation, removal of dentures, teeth, foreign body from the oropharynx in anaesthetised patient. It is used to pass nasogastric tube under vision in anaesthetised patient.

DRAINS

A drain is a created channel which allows any collected fluid to come out after closure of the main wound.

Types

1. **Corrugated rubber drain**: It drains by capillary action and gravity. It is cheaper and technically easier. But it allows soaking of dressings and causes discomfort to the patient.
2. **Tube drains**
   - Malecot catheter can be used as tube drain.
   - Penrose soft latex rubber tube.
   - Multiple perforated tubes.
3. **Closed suction tube drain system**.
4. **Glove drain**.
5. **Wick drain** is a gauze drain to drain pus, discharge, etc.

**Advantages of tube drains**

- Quantity of fluid like bile, pus can be measured
- It can be kept for longer time
- Skin excoriation will not occur
- Patient will be more comfortable
- Infection rate is less
- Removal is easier
- Dye can be injected and cavity or communication can be assessed using ‘C-ARM’

**Classification of Drain System**

1. **Open (static) drains**: e.g. corrugated drain, Penrose drain (soft latex rubber tubing). Infection rate is higher.
2. **Closed siphon drains**: Here drain is connected to a sterile bag with or without one-way valve. It reduces the infection.
3. **Closed suction drains**: Here negative pressure of –100 to –500 mmHg is used to create vacuum to drain the secretions.

**Fig. 6.95**: Magill’s forceps.

**Figs 6.96A to C**: Drains (A) Corrugated rubber drains (B) Multiple perforated drains (C) Tube drain.

**Fig. 6.97**: Romovac suction drain. Here suction is created by pressing the suction corrugation. There is a sharp metallic introducer to pass the tube into the required area after puncturing the skin. It is used for thyroidectomy, mastectomy, radical dissection, wide excisions, flap surgeries, etc.
4. **Sump suction drain**: Here negative suction with a parallel air-vent is used to prevent the adjacent soft tissues being sucked into the lumen of the drain.

5. **Under water seal drain** to drain pleural space.

**Indications for Drains**
- In drainage of an abscess.
- In bleeding surgical conditions like trauma, peroperative bleed.
- In haemo, pyo or pneumothorax.
- In acute abdominal conditions like peritonitis, haemoperitoneum.
- In major abdominal surgeries like of pancreas, biliary tree, stomach, etc.
- In thyroid surgery.
- In hydrocoele surgery.

**Problems in Drains**
- Infection through the drain.
- Displacement.
- It may not drain adequately and can give a false information.
- It may interfere with healing process inside.
  Presently keeping a drain itself is a questioned debate and controversy all over. Older dictum was ‘when in doubt keep a drain and the surgeon can sleep happily’—is questioned at present.
  Drains if not used properly may be counterproductive.

**Note:**
A drain should be placed always in most dependent position and should be brought out through shortest straight route with a separate stab incision. It should be anchored to skin securely. Corrugated drain should be kept with adequate length otherwise it may get into the abdominal cavity during phases of respiration.

**INTERCOSTAL DRAINAGE TUBE**
It is made up of portex with proximal end having multiple holes which is inserted in to the pleural space. Other end is connected to a glass tube the tip of which is dipped inside the under water bottle which allows the expulsion of air outside.

This tube end should be dipped in the water column properly. Smaller glass tube often bent in between is not dipped inside the water column which allows the air to go out. It is used in haemothorax/pneumothorax/empyema/after thoracic/oesophageal surgeries. In haemothorax/empyema, chest tube is inserted in the mid axillary line in 6th intercostal space. It is easier to pass the tube in this line as muscles are thin and patient will be comfortable if tube is in this position.

**PAUL’S DRAINAGE TUBE**
It is a bent glass tube with two ends. Edge with two collars is passed through the enterotomy
in to the intestine and fixed with a purse string suture. End with a single collar is attached to a rubber tube to remove the bowel contents from distended bowel. It is not used now.

**CATHETERS**

They are hollow tubes used to relieve urinary retention, obtain urine for analysis, irrigate bladder and to instill drugs into bladder.

**India Rubber Catheter**
- Red in colour contains high sulfur.
- Heat resistant.
- Causes more irritation.

**Latex Rubber**
- Softer, smooth, less irritant.
- Can be kept for long time.
- Sterilised by boiling, autoclave or gamma radiation.

**Metal Catheters**
- Female and male catheters are different.
- Used in difficult catheterisation.
- To empty bladder prior to vaginal hysterectomy.

**Polyethylene Catheters**
- Transparent and stiffer.

**Gum Elastic Catheters**
- From gum resins with cotton/silk impregnated.
- Formalin vapour sterilisation.
- Boiling or autoclave cannot be done.
- Not used now.

**Types**
- Non self-retaining catheter: Simple red rubber catheter.
- Self-retaining catheter: Foley’s catheter, Malecot’s catheter, Gibbon’s catheter, De-Pezzer catheter.

**Types of Catheterization**
- Indwelling catheterisation: When a catheter is left behind in bladder and remains so it is called an indwelling catheter.
- It is achieved by
  - Balloon tip of catheter -Foley’s catheter.
  - Flower tip of catheter - Malecot’s catheter, De-Pezzer's.
  - Strapping catheter externally - Gibbon’s catheter.
- Intermittent catheterisation: A sterile catheter is introduced intermittently by the patient or by others.

**FOLEY’S CATHETER (FREDRICK EUGENE BASIL FOLEY AMERICAN UROLOGIST)**

It is a self retaining urinary catheter made up of latex. It has got a balloon near the tip into which distilled water is infused to make it self-retainable. Usually Foley’s catheter is kept for 7 days. It is sterilised by \( \gamma \)-radiation.

**Size:**
- Adults -16 F
- Children- 8 F or 10 F
  (F- French unit, Charriere unit, where each unit equals 0.33 mm). 16 F means circumference of the catheter is 16 mm. Diameter is one third of circumference.)
SRB’s Bedside Clinics in Surgery

**Uses**
- To pass per urethrally in retention of urine of any cause (BPH, stricture, trauma)
- To measure the urine output in renal failure, postoperative patients, and terminally ill patients, and patients under critical care
- After prostatectomy or TURP – three way catheter is used for irrigation also. Here it is also used as haemostatic by inflating more distilled water in to the balloon and giving traction causing tamponade effect
- Paraplegia/neurogenic bladder—initially Foley’s catheter is used later condom drainage is better
- To give bladder wash in haematuria, infection, etc.
- Percutaneous suprapubic cystostomy
- Cholecystostomy
- To drain fistulas
- To control bleeding from nostrils/post haemorrhoidectomy secondary haemorrhage
- In children to give enema or to do barium/contrast enema X-rays.

**Complications**
- Infection.
- Encrustation.
- Bleeding.
- Stone formation.
- Blockage, false passage.
- Stricture.
- Difficulty in removal of the catheter due to blockage of the balloon channel. Here bulb of Foley’s can be punctured from above under ultrasound guidance or injection of ether into the balloon so as to burst it but it may cause chemical cystitis or passing a stilette into the channel.

**Types**
1. Two-way Foley’s.
2. Three way Foley’s- To give bladder irrigation e.g. Following TURP.
3. Silicone coated Foley’s: To reduce reaction and so as to keep for longer period (3 months).

**Procedure**
After cleaning under strict asepsis, lignocaine gel is lubricated into the urethral meatus. Catheter is passed into the urethra. Sometimes Maryfield introducer is used to pass Foley’s catheter. Once catheter is in the bladder, urine will flow out. It is now connected to an urosac bag. Balloon is inflated with 20-30 ml (amount is written on the catheter) of distilled water to make it self retainable. During removal of the catheter same amount of water should be removed from the balloon before pulling out the catheter.

**Complications**
- Infection.
- Encrustation.
- Bleeding.
- Stone formation.
- Blockage, false passage.
- Stricture.
- Difficulty in removal of the catheter due to blockage of the balloon channel. Here bulb of Foley’s can be punctured from above under ultrasound guidance or injection of ether into the balloon so as to burst it but it may cause chemical cystitis or passing a stilette into the channel.

**MALECOT’S CATHETER**
It is self-retaining urinary catheter with an umbrella or flower at the tip. It is made of red rubber, contains sulphur and so it is radio-opaque.
It is never introduced per urethrally. It is sterilised by boiling.

**Advantages**
- Malecot’s catheter can be kept for a long period of time (3 months)
- It drains fluid adequately.
- Less infection rate.
- Removal is easier.

**Disadvantage**
Surgery (Open method) is required to insert the catheter.
SUPRAPUBIC CYSTOSTOMY (SPC)

It is placing of Malecot catheter into the bladder above the pubis by open method, or percutaneously under guidance using Foley’s catheter. It is a temporary opening through the abdomen into the bladder.

Prerequisite: Bladder must be full and is confirmed by dullness below the umbilicus or by ultrasound.

Indication: Retention of urine when urethral catheterisation fails.

Procedure: Under local anaesthesia (Xylocaine 2% above the pubis, in the midline) or G/A, a vertical midline incision of 3 cm in length is placed through linea alba. Skin, fascia, anterior rectus sheath are incised. Recti are retracted. In extraperitoneal space, peritoneum with pad of fat is reflected upward. Bladder is identified by detrusor muscle pattern and vesical venous plexus and is confirmed by aspirating urine through a syringe. The bladder is opened near the fundus. Urine is aspirated. Bladder wall is inspected for any pathology. Malecot’s catheter is straightened using artery forceps and placed in the bladder. Sutures are placed around the Malecot’s catheter. Wound is closed in layers. In percutaneous SPC, Foley’s catheter is passed into the bladder using trocar and cannula.

Complications

- Injury to bowel, peritoneum.
- Infection.

SIMPLE RED RUBBER CATHETER

It is a nonself-retaining urinary catheter. It is stiffer than Foley’s catheter. Its tip is rounded and blunt. Opening is only on the side wall (In flatus tube opening is present on both sides and also at the tip). Here English unit is used to number – diameter is 1 + catheter number/2.

Uses

- Suprapubic cystostomy (SPC).
- In case of urinary retention when Foley’s catheterisation fails (after two trials)
- For diversion of urine following bladder, prostate or urethral surgeries
- To continuous drainage of abscess cavities–
  - Perinephric abscess
  - Pyonephrosis
  - Subphrenic abscess
  - Amoebic liver abscess
- Cabot’s nephrostomy
- Cholecystostomy
- Infected pseudocyst of the pancreas
- Gastrostomy, caecostomy (tube type)

Uses

- Used to drain urine from the bladder temporarily in retention of urine.
- To find out residual urine. After passing urine, catheter is introduced into the bladder. The amount of retained urine is measured. If it is more than 30-50 ml it signifies obstruction. It often increases more than 200 ml in conditions like BPH and indicates significant obstruction that needs surgical intervention like TURP.
- While doing cystography to infuse dilute iodine dye in to the bladder.
• Single gentle passage of the red rubber catheter is tried as a diagnostic method to identify the urethral/bladder/renal injuries. Haematuria signifies urinary tract injury. Measured normal saline is infused into the bladder and return volume is collected; if it is less, then it indicates injury to bladder.
• For administration of intravesical chemotherapy or therapeutic BCG infusion into the bladder per urethrally in bladder carcinoma
• To collect urine from the bladder for culture and sensitivity.
• To identify the urethrally in perineal surgery/urethral surgery/penectomy.
• To dislodge and push back the calculus impacted in the urinary meatus or in the urethra.
• To administer nasal oxygen.
• For suction of throat/endotracheal tube/tracheostomy tube.
• As a tourniquet for venesection and surgeries of fingers and toes.
• Used as a sling in many places like to hold cord, to hold vagus, to hold pedicles, to hold oesophagus/bowel/ureter.
• To irrigate and clear the pus after opening the abscess cavity/or any other cavities in depth.
• To irrigate common bile duct after choledochotomy; to irrigate ureter/renal pelvis after stone removal.

**DEPEZZER’S CATHETER**

It is a self-retaining catheter with a bulb at the end which makes it self-retaining. Its uses are like Malecot’s catheter. It can not be passed per urethrally. Usually 24 French size is used.

**CATHETER INTRODUCER**

It is used to negotiate the catheter in to the urethra or in other places wherever it is used.

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**GIBBON’S CATHETER**

It is a self-retaining catheter made up of plastic with a stillete in it which makes its passage easier through urethra. There are different sizes for males and females because of the difference in length of the urethra in male and female. Catheter has two ribbons attached which can be used to fix to the genitalia by adhesive plaster. Gibbon's catheter is least irritant to urethra.
TIEMANN CATHETER
It is made up of PVC with beaked, stiff tip. Different colour codes are used on the beaked tip for different numbers of the catheter. Side holes are located proximal to the colour codes.
No. 12—White
No. 14—Green
No. 16—Vermilion
No. 18—Red
No. 20—Yellow
No. 22—Maroon
No. 24—Blue

METAL CATHETERS
They are metal catheters which are stiff and can be passed in to the urethra even if other catheters fail.

Types: These are of two types.
a. Male metal catheter: It is long tube with a curve at the tip. Tip is rounded and blunt with side holes. Two rings near the base help in holding the catheter. It is used to empty the bladder in retention of urine when other types of catheter fail. With prior lubrication of urethra using adequate quantity of lignocaine jelly, it is passed like a dilator with all aseptic precautions. Catheter is passed through the external meatus into the urethra. Once it reaches the bulbar urethra a resistance is felt, then handle is rotated across the inguinal ligament, groin towards the midline over to the abdomen. Sudden release of resistance of catheter entering in to the bladder is felt. Urine will come out of the catheter easily. Catheter will stay there firmly only if entered properly.

b. Female metal catheter: It is short metallic catheter. Tip is rounded with multiple side holes. It has got one flat curved handle. It is used to empty the bladder in pelvic surgeries like vaginal hysterectomy.

URETERIC CATHETER
It is thin slender flexible radio-opaque tube of 70 cm length with a black mark at every 5 cm junction. French unit is used. 3-8 French (F) are available. Initially cystoscope is passed and under visualisation ureteric catheter is passed through ureteric orifice with a stillete. Stillete maintains the stiffness and patency of the catheter. It can be olive-tipped; whistle; coude'; or open-ended. It is used while doing retrograde pyelography (RGP); to collect selective urine sampling in tuberculosis; to assess and relieve the ureteric obstruction; as an ureteric stent.

URETHRAL DILATORS
- Lister’s dilator.
- Clutton’s dilator.
- Filiform bougies.
- Gum elastic bougies.
- Olivary tip bougies.
- Whip bougies.

**LISTER’S URETHRAL DILATOR**

It has got olive tip with a rounded handle. Handle is rounded with numbers marked. Denominator is circumference in mm at the base of the Lister’s dilator. Numerator signifies circumference just proximal to the olive tip (narrowest point). Difference between denominator and numerator is 3 mm. So each dilator is narrowed for 3 mm from base to proximal end of olive tip. Circumference of olive tip is equal to circumference in the base. Numbering is based on English scale (diameter in mm = Number/2 + 1. It is used dilate stricture urethra; to pass catheter by open rail road technique in rupture urethra.

With all aseptic precautions urethral dilatation is done (proper cleaning and draping). It is done under local lignocaine jelly application or under general anaesthesia. Dilator is passed up to the bulb when a resistance is felt. Then handle is gently curved over the inguinal ligament, groin and over the abdomen towards midline. A feel of entry in to the bladder is felt while entering the bladder. Once left like that dilator stays there firmly with free side-to-side movement otherwise it will fall back.

Persistent pain; severe resistance and bleeding per urethra are the features to consider failure of the dilator entering in to the bladder.

False passage; bleeding; infection and fistula formation are the complications of urethral dilatation.

**CLUTTON’S DILATOR**

It is a long metallic instrument with a curve and blunt tip at the end. Handle is violin shaped. It is numbered in English units. Denominator of the part signifies the circumference in the base and numerator suggests the circumference in the tip. Difference between denominator and numerator is 4. Numbers are like 6/10; 8/12; 10/14 — so on. Set 12 of dilators are available.

**FILIFORM BOUGIES**

It is a small cylindrical hygroscopic instrument used in tight strictures to negotiate one of the bougies. Bougies are passed in bunches in to the urethra. One of the bougies will be negotiated across the stricture by trial and error maneuver. That particular bougie is left in place which absorbs the urethral fluid and secretions; and gets swollen causing required dilatation. Later metallic dilators like Lister’s or Clutton’s dilators are passed to achieve adequate dilatation. Many types of filiform bougies are furnished with threaded hollow mounts at the proximal ends.
It is not used now. It can be used as urethral dilator.

**THOMPSON-WALKER’S SUPRAPUBIC CYSTOLITHOTOMY FORCEPS**

It has got a spoon shaped elongated concave blades with spikes on the inner surface which gives secure grip of the stone from the bladder. It has no ratchet. Shaft has got a ring for placement of thumb and another is curved open to place four fingers. It is used to hold and remove stones from the urinary bladder in suprapubic cystolithotomy.

**BOOMERANG NEEDLE**

It is sharply curved needle attached to a special holder with a spring within it. Needle has got sharp point and a slot. Suture material is passed through the slot to pass deep in to the tissues. When handle is compressed through spring, needle rotates inwards passing through the tissues in front. It is used in suturing prostatic capsule in open prostatectomy.
NASOGASTRIC TUBE/RYLE’S TUBE

It is one meter long which is made up of red rubber or plastic. Original Ryle’s tube was made up of moulded red rubber. Presently used nasogastric tubes are made up of polyethylene or portex. Tip is blunt without opening. Subterminal multiple openings are present on all the sides. It is sterilised by gamma rays.

Fig. 6.114: Ryle’s tube.

It has got three lead shots in the tip which makes it radio-opaque. It also facilitates easy passage of the tube through the oesophagus. Once the tube is inside the stomach, bile/gastric juice will come out of the proximal end, often confirmed by aspiration. Stethoscope is placed over the stomach; syringe with air is pushed in to the tube; if tip of the tube is in the stomach air entering in to the stomach can be heard through the stethoscope.

It is passed through one of the nostrils using xylocaine 2% jelly. Under anaesthesia it is passed using Magill’s forceps. It should be fixed securely to the nostrils otherwise it may get displaced or come out. It should be replaced with new tube in 2 weeks. Intermittent suction or continuous open drainage can be done depending on requirement. In postoperative period, it is removed once patient passes flatus; adequate bowel sounds are heard; content in the tube is reduced to less than 50 ml.

It has got markings at different levels:
- At 40 cm distance, indicates the level of gastro-oesophageal junction.
- At 50 cm distance, indicates the level of body of the stomach.
- At 60 cm distance, indicates the level of the pylorus.
- At 65 cm distance, indicates the level of the duodenum.

Indications

Diagnostic:
- For gastric function tests. To assess free acid and total acid – in gastric/duodenal ulcers; pyloric obstruction/carcinoma stomach (exfoliative cytology); achylia; Zollinger – Ellison syndrome; pernicious anaemia; saline load test to confirm gastric motility and outlet obstruction; small bowel enema.
- Hollander’s test for completion of vagotomy.
- To diagnose tracheo-oesophageal fistula.
- Baid test for pseudocyst of the pancreas.

Therapeutic:
- In acute abdominal conditions like peritonitis/obstruction, etc.
- In abdominal trauma.
- After abdominal surgeries.
- In pyloric stenosis.
- In upper GIT bleeding.
- In paralytic ileus, gastric dilatation to decompress the bowel.
- For feeding purpose in comatose patients, faciomaxillary injuries, major head and neck surgeries, head injuries, pharyngolaryngeal surgeries; cleft palate;

Ryle’s tube is British type, made up of red rubber, usually 75 cm in length, with lead shot in the tip. It is available as different sizes from 8 French to 18 French units.

Levin’s tube is American tube made up of portex, 125 cm in length. Now it is commonly used tube.
Complications
- Injury to nostrils and bleeding.
- Pharyngitis/rhinitis.
- Discomfort/unacceptancy.
- Ulceration in the pharynx/oesophagus.
- Aspiration pneumonia as lower sphincter is kept open—dangerous complication—may cause death also.
- Perforation of oesophagus.
  Nasogastric tube is contraindicated in corrosive oesophageal burns in initial phases for 2 weeks.

**INFANT FEEDING TUBE**

It does not have lead shots and no markings. It is used in children and infants similar to Ryle’s tube.

**FLATUS TUBE**

It is made up of India rubber, 45 cm in length. There is one opening in the tip and another on the side proximal to the tip. (Urinary catheter like red rubber catheter has no opening on the tip, only side opening is present). It is used in sigmoid volvulus to decompress and derotate; in paralytic ileus; in subacute intestinal obstruction. It is passed per anal in to the rectosigmoid area. Proximal end is connected to water container to observe the quantity of air bubble which signifies the amount of gas getting deflated.

**HERNIA BISTOURY**

It has got a handle and a flat blade with a small cutting edge on one side near the tip. Tip is blunt. Instrument is used to divide constriction band...
in strangulated hernia, to cut lacunar ligament in femoral hernia. It helps to protect adjacent structures while cutting the band.

**CORD HOLDING FORCEPS/RING FORCEPS**

It has got semicircular tips which when approximated forms as ring. It has got a ratchet to have a proper grip. It is used to hold cord structures during inguinal hernia surgery so that hernioplasty/herniorrhaphy can be done effectively.

![Fig. 6.118: Cord holding forceps/ring forceps used to hold cord structures in inguinal hernia surgery.](image)

**TROCAR AND CANNULA**

Trocar has got stout handle with a sharp pointed distal end. Trocar passes through the cannula of different sizes and snugly fits in to proximal end of cannula. Trocar with sheath is punctured in to the needed place and trocar is removed. Through sheath fluid is evacuated. Through the sheath Foley’s catheter can also be passed to keep in place. It is used in percutaneous cystostomy, draining hydrocele fluid, draining pus from gallbladder, pleural cavity, maxillary antrum, etc.

**HERNIA DIRECTOR**

Hernia director is used to protect the bowel in strangulated/obstructed hernia while releasing the narrow constricting band. Key’s hernia director has got grooved gently curved long blade with ridged stout handle. Childe’s hernia director has two wings on sides of the blades as a guard with a handle. Constriction ring is cut using hernia bistoury.

![Fig. 6.120: Key’s and Childe’s hernia directors.](image)

**PROCTOSCOPE (KELLY’S)**

**Indications**

- **Diagnostic:** Piles, fissure in ano, polyps, stricture, to see internal opening in fistula, carcinoma or any rectal bleeding.
- **Therapeutic:** Injection therapy for partial prolapse or piles, cryotherapy for piles, banding for piles, polypectomy, biopsy for carcinoma rectum or anorectum.

**Types**

- **Illuminating** with a bulb at the distal part
- **Nonilluminating**
Instruments

**Parts**

Proctoscope is conical shape, with proximal diameter more than the distal, so as to illuminate the light at the required site properly. Obturator is the inner part which allows the easy insertion of the proctoscope. Usual medium sized proctoscope is 10 cm in length with proximal diameter of 3.5 cm and distal diameter of 2.5 cm – tapering. This tapering allows light to reflect and pass distally. Proximal funnel shaped flange is 5 cm in diameter.

**Positions for Proctoscopy**

- Left lateral position (common).
- Right lateral.
- Lithotomy.
- Knee-elbow position.

**Technique of Proctoscopy**

After doing digital examination, proctoscope with the obturator is introduced inside, through the anal canal in the direction towards the umbilicus. The obturator is removed. Proctoscope is withdrawn and during the course of withdrawal, any pathology has to be looked for.

Acute anal fissure is contraindication for proctoscopy.

**Saint Mark’s Anal Dilator**

It is hollow conical instrument with both ends are closed. Distal end is tapered, smooth and rounded. It is available in three different sizes. It is used for anal dilatation in post anorectal surgeries and in anal stenosis. Xylocaine jelly is applied to the blunt tip and is gently passed through the anal canal to achieve dilatation.

**Fistula Bistoury**

It is a long blade with solid knife with a cutting edge. It is used to lay open the fistula in ano along with Brodie’s fistula probe.
BRODIE’S FISTULA DIRECTOR

It is a long instrument with a winged-flat handle. Shaft is curved, gradually tapering to form a pointed tip with a groove along the curvature longitudinally which allows the knife to pass to do fistulotomy. It is used in probing and treating fistula in ano; to release tongue tie as a guide and protector and in external urethrotomy.

Fig. 6.124: Brodie’s fistula director.

PILE HOLDING FORCEPS

It has got long distal blades ending as a ring. Each has got fenestra with a groove on its inner surface. It is used to hold pile mass during haemorrhoidectomy. It differs from sponge holding forceps which has got serrations on the inner aspect of the ring. Tongue holding forceps is also similar but without groove or serrations on the inner aspect of the ring.

Fig. 6.125: Pile holding forceps has got groove on the inner aspect of the rings in the distal blades.

YEOMAN’S PUNCH BIOPSY FORCEPS

It has got two short stout jaws on the tip. Upper jaw is rectangular, mobile and cutting. Lower jaw is fixed and is having a cup. Through a handle (without ratchet) jaws can be closed and opened. Mobile jaw takes punch biopsy from the rectal lesion whereas fixed jaw accommodates the biopsy tissue in the cup. It is used to take biopsy from rectal lesions like carcinoma, ulcers, polyps, etc.

Fig. 6.126: Yeoman’s punch biopsy forceps.

MOYNIHAN’S GLASS TUBE

This glass tube of 20 cm in length with a bevelled one end and other end connected to a rubber tube with a two circular ridges to facilitate the holding of the purse string suture around the tube. It is used to decompress the proximal bowel in intestinal obstruction without contaminating the peritoneal cavity.

Fig. 6.127: Moynihan’s glass tube to decompress bowel in intestinal obstruction.

DUPUYTREN’S ENTEROTOME

It has a stout distal blade with longitudinal serrations. It has got butterfly nut and screw on the proximal end which when tightened causes crushing effect on the structure between the blades. It is specifically used in colostomy closure extraperitoneally by placing this instrument over
the spur of the colostomy. It is kept in place for 5-7 days and if needed further tightening can be done using screw. Spur gets necrosed and colostomy closes gradually on its own or by placing few sutures in front. Presently colostomy closure is done intraperitoneally by formally suturing bowel wall either single layer or two layers.

**SPIGOT**

It is a glass rod of 10 cm length, with one end narrow and blunt. In colostomy, once a loop of the colon is delivered through the abdominal wound it is used to pass through the mesocolon. It stabilises the loop of colon in position and prevents it from slipping in to the peritoneal cavity. It is rarely used now.

**Hudson's Brace With Perforator and Burr**

Hudson's brace is used to do burr holes in skull bone. Using brace initially perforator is used to reach and open the inner table. Perforator should be carefully used to avoid injury to deeper structures. Later burr is used to widen the hole made by perforator.

**SUTURE MATERIALS**

**Features of Ideal Suture Material**

- Adequate tensile strength.
- Good knot holding property.
- Should be least reactive.
- Easy handling property.
- Should have less memory. Recoiling tendency of the suture material after removal from the packet is called as memory of suture material. Suture material should have poor memory. More memory causes recoiling, difficulty in handling and knotting.
- Should be easily available and cost effective.

**Classification I**

**Absorbable**

- Catgut (Natural absorbable monofilament suture material). It is 99% collagen derived from the submucosa of jejunum of the sheep or serosa of beef (Kit means sheep). After washing, intestine is slit longitudinally into four strands; muscle and fat are removed using water spry-sliming. Chemical bath saponification is also used to remove fat. Strands are spun together, dried with tension and electronically polished. It is absorbed by inflammatory reaction and phagocytosis.

  *Plain catgut* is yellowish white in colour. Absorption time is 7 days. It is used for subcutaneous tissue, muscle, circumcision in children.

  *Chronic catgut* is catgut with chromic acid salt. Twenty percent chromium salt in water with 5 parts of glycerine is used to treat the catgut. It is brown in colour. Its absorption time is 21 days. It is used in suturing muscle, fascia, external oblique aponeurosis, ligating pedicles, etc. Atraumatic sutures are manufactured either by swaging or by
entangling the suture material into the grooved proximal part of the needle by mechanical pressure. Wound suture material in a support card is packed in a foil envelope with isopropyl alcohol. It is sterilised by gamma radiation.

• Polyglactic acid/polyglactin 910/vicryl - Synthetic braided multifilament absorbable.

It is synthetic absorbable suture material – copolymer of glycolide and lactide. It has got excellent tensile strength, long tensile half life, low reactivity, less memory, easy handling and knotting.

It gets absorbed in 90 days. Absorption is by hydrolysis. It is violet in colour. Coating consists of 50% calcium stearate which acts as a lubricant. It is multifilament and braided. It is very good suture material for bowel anastomosis, suturing muscles, closure of peritoneum. It is sterilised by ethylene oxide.

Vicryl plus is vicryl coated with antibacterial material (triclosan). Vicryl rapide is low molecular weight vicryl with rapid absorption of suture material. It is used in circumcision and in subcuticular suturing

• Poliglycolic acid/Dexon/Synthetic polymer of glycolic acid is multifilament absorbable suture material (braided) like vicryl. Usually it is coloured green/natural beige. It is sterilised by two stage ethylene oxide process. It is not affected by infection. Its knot security is poor and so at least 5 knots should be placed for security.

• Poliglyconate/Maxon is a monofilament absorbable copolymer of glycolic acid and trimethylene carbonate. It has got good knot holding/security; suppleness and flexibility. It is used in soft tissues and skin. It can not be used in cardiac/vascular/neural/ophthalmic surgeries. It can be colourless or green coloured.

• Polydioxanone suture material/PDS is synthetic monofilament absorbable suture material. It is cream/blue/violet/in colour or colourless with properties like vicryl. It is costly but better suture material than vicryl. It is relatively inert.

• Polyglecaprone 25/Monocryl is monofilament containing 75% glycolide and 25% caprolactone. It has got smooth surface, excellent handling property, good knot security and adequate tissue compatibility.

• Glycomer/Biosyn monofilament

Uses of Absorbable Suture Materials

• In bowel anastomosis like gastrojejunosotomy, resection and anastomosis vicryl (2 zero) is used.

• In cholecystojejunosotomy (CCJ), choledochojejunostomy (CDJ), pancreatico-jejunosotomy-vicryl is used.

• In suturing muscle, fascia, peritoneum, subcutaneous tissue, mucosa.

• In ligating pedicles, e.g. Ligation of pedicles during hysterectomy. 1–zero chromic catgut or vicryl are used.

• In circumcision usually 3-zero plain or chromic catgut or vicryl rapid are used. Absorbable suture materials should not be used in suturing tendon, nerves, vessels (vascular anastomosis) or in hernia surgery where tissue approximation under stress is needed.

Nonabsorbable Suture Materials

• Silk is natural multifilament braided nonabsorbable suture material derived from cocoon of silkworm larva. It is black in colour, a coating got from a vegetable dye. It is coated suture material to reduce capillary action. Serum proofing of the suture material is also done to reduce the capillary attraction. It has got less memory; good knot holding property; easy handling ability.

• Cotton is twisted multifilament natural non-absorbable suture material. It is white in colour.

• Linen is derived from bark of cotton tree (natural nonabsorbable twisted multifilament suture material). It is made from flax and cellulose in nature. It has got excellent knotting property and is commonly used as ligatures.

• Polyamide is monofilament synthetic non absorbable polymer. Nylon (New York
Instruments

and London) is a polyamide. Multiple pre cut nylon s are available for skin suturing/ligatures. It has got less tissue reaction, easy handling ability, inertness, adequate elasticity and can be used in presence of infection. Ethilon/surgidek/dermalon/sutupak pre cut sutures are different polyamides. Memory is high like that of polypropylene and so causes problem. Polyethylene (Ethylene) is synthetic monofilament nonabsorbable suture mat erial. It is black in colour.

- Polyester is synthetic multifilament braided polymer— non absorbable suture material. Polyester has got high tensile strength and good knot holding property. But it is stiff with difficulty in handling and may cause sawing effect to tissues. Dacron is made up of untreated polymers. It is white in colour. Ethibond is polyester coated with polybutylate— polytetramethylene adipate. It is green in colour. Polydek/tevdek are coated with polytetrafluoroethylene (PTFE). They are green in colour. Black sutulene is impregnated with wax. Silicon treated ticron is white/ blue in colour.

- Polypropylene (prolene) is synthetic monofilament suture material. It is blue in colour. It has got high memory. (Prolene mesh used for hernioplasty is white in colour). It is inert, flexible, strong and least reactive. It can be re-sterilised by autoclave once or twice.

- Polybutester— Novafil is monofilament, blue coloured, synthetic suture material which has got adequate flexibility, suppleness and strength.

- Stainless steel metallic non toxic suture/wire (steel, tantalum, silver) are useful in approximating bones and tough structures, in orthopaedic and thoracic surgeries (sternotomy or thoracotomy), in reconstructive surgeries, surgeries of skull base or head and neck, sinus surgeries, in dental surgeries. Monofilament is called as steel suture/metallic suture. Multifilament is called as metallic/steel wire which can be twisted or braided. Metallic sutures/wires are difficult to handle and to use, may cause injury to surgeons but they are very high tensile strength and low reactivity. Kinking is another problem.

Uses of nonabsorbable suture materials
- In herniorrhaphy for repair.
- For closure of abdomen after laparotomy.
- For vascular anastomosis (6—zero ), nerve suturing, tendon suturing.
- For tension suturing in the abdomen.
- For suturing the skin.

Classification II

a. Natural
- Catgut.
- Silk.
- Cotton.
- Linen.
- Collagen sutures are derived from collagen fibrils of flexor tendon sheaths/ tendo-Achilles of beef. It can be plain or chromic.
- Homologous sutures derived from the patient’s fascia like strips of fascia lata used for hernioplasty or blepharoplasty.
- Cargile membrane is derived from the submucosa of caecum of ox. It is used to cover peritoneum/pleura and to prevent adhesions. It is not used now.
- Kangaroo tail tendon has got high tensile strength— not used now.

b. Synthetic
- Vicryl, dexon, PDS, maxon.
- Polypropylene, polyethylene, polyester, polyamide.

Classification III


b. Twisted: Cotton, linen.

Classification IV


**Classification V**

a. Coated.

b. Uncoated.

**Numbering of suture material**

2—Thick. For pedicle ligation.
1—
1—zero.
2—zero. For bowel suturing.
3—zero.
4—zero.
5—zero. For vascular anastomosis.
6—zero.
7—zero.
8—zero.
9—zero. For ophthalmic surgery. Requires microscopy.

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**Types of Suturing**

1. Continuous suturing.
2. Interrupted simple suturing.
3. Interrupted mattress suturing.
4. Subcuticular suturing.
5. Horizontal tension suturing
6. Vertical tension suturing

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**MITCHEL'S CLIP DEVICE**

- **Mitchel's metal clip:** It has got two sharp points on their teeth to grip the edges of the skin wound when applied.
- **Mitchel's clip applicator:** It has got a groove on the inner surface of each blade with a tooth on the ends of the blades to apply the clips to the edges of skin wound.
- **Mitchel's clip extractor:** It has got short distal blades, one blade has a hood which comes
**Types**

*Bectin Dickenson syringe (BD syringe)*: It is a glass syringe with a glass piston and barrel having a nozzle at the end to fit in to the BD needle. Proximal end of the barrel has got a rim with one side being flat that prevents from rolling and breakage. It is sterilised by boiling. Disposable plastic BD syringes are commonly used now which is sterilised by gamma radiation. BD injection syringes are available as 2 ml, 3 ml, 5 ml, 10 ml, 20 ml, 50 ml and 100 ml capacity. 1 ml tuberculin/insulin syringes, Luer-lock BD syringes (needle can be locked near the nozzle to prevent slipping of the needle) are other modifications.

*Record syringes*: It is like BD syringe with a metallic screw at the proximal end of the barrel which can fix the barrel of the syringe so that piston will not come out.

*Gabriel syringe*: It is used for injection sclerotherapy for internal piles using 5% phenol in almond/olive oil (almond/vegetable oil acts as a vehicle which holds phenol for long period of action). It is a stainless steel syringe with two metallic finger brims near the proximal end. One more metallic finger brim is present on the proximal end of the piston to place thumb while injecting. Special needle which may be straight or curved and sharply pointed is used for injection of haemorrhoids. Patient is placed in left lateral position. Using proctoscope pedicle/upper part of the piles is identified. Sclerosant is injected in to the submucosal plane only which is confirmed by pale bleb with thin vessels over it. If it turns as white patch it means it is more superficial and needle is withdrawn and replaced in submucosal plane. 4 ml at each site with two piles in one sitting is done and further injections are given if needed with a 3 weeks gap until complete sclerosis and obliteration of piles occurs.

*Indications for sclerotherapy in piles*

- 1st and early 2nd degree piles.
- Piles in pregnancy and old individuals.
Contraindications for sclerotherapy
- Infection at the site.
- Secondary piles.
- Association of fissure in ano or fistula in ano.

**ASEPTO SYRINGE/DAKIN’S SYRINGE**

It is made up of glass with broad flanged proximal end to which a rubber bulb can be fitted in to it. It has got a tapered tip through which tubes/catheters can be fit to give wash, to suck the contents. It is used to give bladder wash in infection, in postprostatectomy period, to give wash in different cavities and in depth, to instill methylene blue in to the bladder to find out any fistula, to remove clots from prostate or other cavities during surgery.

**TOOMY SYRINGE**

It is used to give bladder wash through cystoscope while doing transurethral resection of prostate (TURP). It has got a metallic nozzle which fits well in to the cystoscopic sheath. It creates a strong suction force to suck the irrigated fluid.

**DOYEN’S MOUTH GAG**

It has got flat, broad, strong, curved distal blades which has got serrations on the outer aspect so as to have proper grip over teeth. Blades are covered with rubber tubes to prevent injury to enamel. It is used in oral cavity biopsies, dental extraction, tonsillectomy, excisions of small oral cavity lesions.

**JENING’S MOUTH GAG**

It is a self-retaining mouth gag with a thin rim and ratchet. Blades fit in to the alveolar margins not on the teeth. So it is useful in oedentulous patients. It has got a gap to pass endotracheal tube.

**TONGUE DEPRESSOR**

It is a flat steel atraumatic plate with a 90° angle at the centre. Ends are rounded with smooth edge. It is used to inspect posterior third of tongue, oral cavity, tonsils, to take biopsy, etc. Anterior two thirds of the tongue is depressed gently with tongue depressor (Refer page 497).

**AIRWAY**

It is curved metal/plastic hollow instrument with broad proximal end and curved tapered...
between the rods in to the flat leave which has got three knobs which fits exactly in to the openings of the blade. Front leaf has got slots which when pushed gets fixed over the blade. Using firm constant pressure with sawing action split skin is harvested from the thigh. Punctuate bleeding over the donor area confirms the proper skin harvesting. Donor graft is placed over the sterile wooden board. Multiple small window cuts are made to prevent formation of seroma. Skin is placed over the recipient bed and fixed using polypropylene sutures or skin staples. Dressing is placed and part is immobilized. Graft is inspected on 5th day for take up. Donor area is inspected after 10 days and kept open without dressing. Stages of graft intake are—stage of plasmatic imbibition, stage of revascularisation and stage of circulation.

Other knives used for harvesting skin graft are
- Braithwaite’s skin grafting knife: Disposable blade.
- Watson’s skin grafting knife: Disposable blade.
- Thiersch’s skin grafting knife: It has got knife with permanent blade.
- Electrical dermatome.

**MYER’S VEIN STRIPPER**

It is used strip off varicose vein usually long saphenous vein. It is passed from above just below the sapheno-femoral junction. Usually stripping is done up to the middle of the leg. Saphenous neuralgia is a rare complication (Refer page 498).

**BONE CUTTING FORCEPS**

It has got short blades with sharp firm cutting edges to cut bones; with a stout handle.
with ridges. It gives optimum mechanical force to cut bones/bone spurs. Some instruments are supported with leverage system.

**BONE ELEVATOR/BONE LEVER**

It has got curved blade with blunt edge and serrations on concave surface. Proximal long shaft has got ring for grip. Some bone lever has got proximal knife like handle instead of ring. It is used in manipulating the fracture segments in open reduction and so to isolate fracture ends from surrounding soft tissues. It is also used to elevate the fracture segments/bone from the depth for placement of nails/fixation.

**BONE NIBBLER**

It has got sharp edges in the tip with blades being concave. It may be having single action/double action joint. It is used to nibble the bone in pieces like in craniectomy, rib resection, amputations of small bones, etc.

**SEQUESTRECTOMY FORCEPS/SEQUESTRUM HOLDING FORCEPS**

It has a stout blade with thick transverse serrations with a groove in the middle without a ratchet. It is used to remove sequestrum in osteomyelitis. Sequestrum should be formed before removal. X-ray should show clear radiolucency around dense dead bone—a sign of complete separation of the sequestrum.

**FERGUSSON’S BONE HOLDING FORCEPS/LION FORCEPS**

It has got curved blade with stout blunt teeth, looks like jaw of a lion. Bone is held in the gap
between the jaws. It is used to hold bones in open reduction of fractures, maxilla in maxillectomy, and mandible in mandibular fixation.

**CHISEL**

Chisel has got proximal rounded flat head which receives the blows of a mallet. Handle is stout, 10 cm in length. Shaft is of equal size of handle which ends as one side beveled only (abrupt bevelling). It is used to chip the bone using mallet blow. It is also used in bone grafting, sequestrectomy, etc.

**OSTEOTOME**

It is similar to chisel but both sides it is bevelled and beveling is gradual. Shaft has got the marks to find out the length of the osteotome inside the wound. It is used for all ostetomies in different congenital and acquired conditions.

**MALLETT**

Mallet is a hammer made up of stainless steel or lead. It is lighter than conventional hammer. It is used to give repeated blows on the flat surface over the head of chisel or osteotome. Blow should be flat without rebound.

**GIGLI’S SAW**

It is 14 inches long with four flexible metal wires braided together with rough sharp surface.
It has got loops on either ends to hook the handles on it which is essential while cutting the bone. It is used to cut the bones like mandible, maxilla, amputation of femur/tibia, skull bones between the trephine holes. It is originally used to cut the pubic bone in narrow pelvis.
Operations may be *elective* wherein patient is properly prepared with all investigations and precautions or *emergency* wherein immediate surgery is required to save the life of the patient like perforation of bowel, haemorrhage, and trauma.

Patient is admitted 2-3 days prior to date of the elective major surgery. Patient is evaluated with essential investigations like haemogram, urine analysis, ECG, blood electrolytes, chest X-ray, echocardiography, physician and cardiologist’s opinion and treatment. If patient is anaemic prior to surgery, blood transfusion is required. Asthma, respiratory diseases, diabetes has to be managed properly. Electrolyte supplement prior to surgery is required.

**Prior to shifting the patient to operation theatre following rules should be followed:**
- Correct identification of the patient.
- Consent for the surgery should be taken.
- Preparation of the patient according to the requirement.
- Nothing should be given orally 6-8 hours before surgery.
- Bladder should be empty before sending patient to the theatre. If required the patient is catheterised.
- Enema, as by instruction should be given.
- Ornaments, dentures, nail polish, hearing aids, contact lenses should be removed before shifting the patient.
- Head cover, feet covers, theatre dress to the patient is must.
- Premedication, as per instruction should be given.
- Ward nurse should accompany the patient to theatre and should hand over the patient to theatre nurse.

**PREOPERATIVE ASSESSMENT**

**History**
1. Chronic cough, smoking, alcohol, drug intake, drug allergy.

2. Any previous diseases like hypertension, diabetes mellitus, epilepsy, bronchial asthma tuberculosis, hepatitis, cardiac diseases.
3. Drug therapy: Steroids, antihypertensives, sedatives, antibiotics, antiepileptics.

**Examination**

*General*: Posture, teeth, mouth opening, dilated veins, neck movements, tremor, air-way.

*Anaemia, oedema, jaundice, cyanosis.*

*Respiratory system*: To look for asthma, tuberculosis, emphysema, COPD.

*Air-way*: Mouth opening, Malampatti scoring, tymomental distance, temperomandibular joint assessment.

*Cardiovascular system*: Hypertension, ischaemic heart disease, arrhythmias, cardiac failure, valvular diseases.

*Spine*: Curvature, intervertebral space, skin over the back for any infection.

*Other systems*: Abdomen, skeletal system.

**Preoperative Investigations**

Haematocrit, blood sugar, blood urea, serum creatinine, electrolytes, chest-X-ray, ECG, blood grouping, blood-gas analysis, cardiac assessment.

Prothrombin time, bleeding time, clotting time, liver function tests, pulmonary function tests, arterial blood gas assessment-in specific surgical diseases.

**Preoperative Care and Treatment**

- Control of respiratory and cardiac diseases special care with cardiologists, chest therapists, respiratory physiotherapy. To stop smoking (15 days prior to surgery); prophylactic antibiotics; bronchodilators; steroid inhalers; possible need of ventilator after surgery.
• Improvement of Hb% status, if anaemia is present.
• Preoperative antibiotics are given as per instructions of the surgeon.
• Blood should be kept ready for major surgeries.
• Correction of diabetes mellitus, malnutrition
• Purgatives/enema.
• Skin preparation by shaving the area, or depilation using creams. Patient should take proper bath prior to surgery.
• Patient should be kept nil per orally for 8 hours.
• Special preparations for gastric/colonic or biliary surgeries should be done.
  • **Colonic preparation:** Low residue diet for 72 hours; bowel wash with saline; gut irrigation using oral polyethylene glycol with electrolytes taken in two litres of water in 2 hours to clear the entire bowel. It acts also by osmotic hygroscopic action. It is also achieved by oral intake of mannitol for 2-3 days. Bowel antiseptics like neomycin 1 gram three times/day prior to surgery. **Total gut irrigation** by passing nasogastric tube through which infusion of normal saline was done. It is infused (8 litres of saline) until clear saline is passed from anum. (**On-table colonic lavage**) by passing a tube through performed appendicectomy opening (purse string suture is placed) and another opening in distal colon just proximal to obstruction and saline is irrigated from first to second tube continuously to achieve proper cleaning of the colon).
  • **Gastric preparation in gastric outlet obstruction:** Patient is having hypokalaemia, hyponatraemia, hypomagnesaemia, hypochloraemia, hypocalcaemia with metabolic alkalosis and paradoxic aciduria. Correction of dehydration, electrolytes, anaemia (blood), hypoproteinaemia (amino acids, total parenteral nutrition), hypocalcaemia (intravenous calcium gluconate) and alkalosis is essential in these patients. Gastric lavage is given for 5 days prior to surgery by passing stomach (Ewald’s) tube using normal saline to remove residual food, to decrease mucosal oedema, to maintain gastric tone.
• **In obstructive jaundice:** Specific problems are altered prothrombin time (bleeding tendency), hyypoalbuminaemia and malnutrition, sepsis, anaemia, dehydration and diminished carbohydrate reserve. **Hepatorenal syndrome** is specific problem postoperatively—due to endotoxaemia, acute tubular necrosis due to toxins, sludging of bile salts in the renal tubules, hypovolaemia. Management is by – fresh frozen plasma; mannitol infusion; antibiotics; human albumin infusion; injection vitamin K 10 mg for 5 days; intravenous dextrose to improve the carbohydrate reserve.

*Note: Informed consent is absolute need.*

**Premedication**

It is given one hour before surgery:
• **For sedation and relief of anxiety:** Pethidine 50 mg/morphine 10 mg/diazepam 10 mg/Midazolam 1-2.5 mg.
• **To suppress vagal activity:** Atropine 0.6 mg IM.
• **To reduce vomiting:** Promethazine (phenergan) 12.5 mg.

**ASA (American Association of Anesthesiologists) grading of the patient for surgery**

1. Normal individual
2. Mild— moderate systemic disease—Diabetes and hypertension under control
3. Severe systemic disease—uncontrolled diabetes and hypertension
4. Incapacitating systemic disease
5. Moribund status

Class E—Emergency surgery
**OPERATION THEATRE**

**Asepsis**
Asepsis means organisms are prevented to access the patient or individual.

**Sterilisation**
It is freeing an article from pathogens by removing or killing all bacteria, spores, fungi and viruses.

**Disinfection**
It is killing of all bacteria, fungi and viruses but not spores.

**Antisepsis**
Antisepsis is inhibition of growth of microorganisms.

**DIFFERENT METHODS OF DISINFECTION**

**Physical Agents**
- **Burning or incineration** is used to disinfect contaminated articles like dressings.
- **Hot-air oven:** Here temperature used is 160 to 180° for one hour.
- **Boiling:** It kills bacteria but not spores and viruses. Temperature is between 90 to 99°. It is used to disinfect syringes, utensils. It is not useful for gloves, rubber materials.
- **Autoclave:** It is steam under pressure. Temperature attained is between 120 and 135°. It is sterilised for 20 minutes with 15 pounds/sq inch (2 kg per square cm) pressure. It kills all organisms including spores. Completeness of sterilisation is confirmed by using specific gelatin protein which precipitates only in steam under pressure for 20 minutes. Green coloured strip turns black if autoclave is complete (The Bowie-Dick test) (signaloc). Surgical gloves, linen, cotton, paper, bottles, plastics, dressings, surgical instruments are sterilised by this method. Bacillus thermophilus spores are used to assess the completeness of the sterilisation in mass scale. Double autoclaving is done for instruments of orthopaedic or ophthalmic surgeries. Modern rapid autoclaves can sterilise in 3 minutes with 143° temperature or in 10 minutes with 121° temperature.

![Fig. 7.1: Autoclave machine for sterilisation.](image)

- **Radiation:**
  - **Ionising type of radiation:** Atomic gamma radiation is used for commercial purpose to sterilise suture materials, disposable materials in packets. It is viable, safe and cheaper. All disposable materials like gloves, tubes are sterilised by this method.
  - **Nonionizing radiation,** either infra-red radiation or ultraviolet radiation is used to reduce the bacteria in air, water. Bacteria and virus are vulnerable to ultraviolet rays below 3000Å. Exposure to eyes and skin can cause burn injury.

**Chemical Agents**
- **Phenol:** It is used as standard to compare the efficacy of other agents.
- **Cresol** is more powerful and nontoxic. 5% solution is used.
- **Lysol** is emulsified cresol with soap. 2% solution is effective.
• **Chlorhexidine (hibitane)** is useful antiseptic.
• **Hexachlorophane:** It is not used in infants and children because it can get absorbed through intact skin in this age group causing severe neurotoxicity.
• **Dettol (chloroxylenol)** 5% solution is used.
• **Cetrimide** is cationic surfactant (cetavlon) 2% solution is used.
• **Savlon** is combination of cetrimide and hibitane. It is very commonly used antiseptic in operation theatres and wards.
• **Halogens:**
  – **Bleaching powder.**
  – **Sodium hypochlorite.**
  – **EUSOL:** *Edinburg University solution* contains sodium hypochlorite, boric acid and calcium hydroxide.

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Eusol bath is dipping the ulcer bearing part in dilute eusol solution for 30 minutes 2-3 times a day.

– **Iodine.**
– **Iodophors:** These are antiseptics and also sporicidals. They are non-irritant and do not stain skin. *Povidone-iodine* is a good example, which is commonly used.

• **Alcohols:** Ethyl or isopropyl alcohols are used.
• **Formaldehyde:** It is useful to disinfect the rooms like operation theatre. It is effective at a high temperature and humidity of 80-90%. It is commonly used to fumigate the room. 500 ml of formalin with one litre of water is boiled to get formaldehyde vapour. Adding potassium permanganate to the same water can increase the fumigating effect.

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<table>
<thead>
<tr>
<th>Materials</th>
<th>Method of sterilisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>All theatre appliances</td>
<td>Autoclave</td>
</tr>
<tr>
<td>Sharp instruments (scissors, needles, blades)</td>
<td></td>
</tr>
<tr>
<td>plastic materials</td>
<td>Glutaraldehyde 2%, Lysol</td>
</tr>
<tr>
<td>Endoscopes</td>
<td>Glutaraldehyde</td>
</tr>
<tr>
<td>Rubber equipments</td>
<td>Glutaraldehyde</td>
</tr>
<tr>
<td>Syringes</td>
<td>Autoclave, hot air oven, gamma radiation</td>
</tr>
<tr>
<td>Heart-lung machine</td>
<td>Ethylene oxide</td>
</tr>
<tr>
<td>Disposable articles</td>
<td>Gamma radiation</td>
</tr>
<tr>
<td>Operation theatre and rooms</td>
<td>Ideally by UV radiation or by formaldehyde</td>
</tr>
<tr>
<td>Sera and biological materials</td>
<td>Filtration</td>
</tr>
<tr>
<td>Lab glassware</td>
<td>Hot-air oven</td>
</tr>
<tr>
<td>Ward, sick room, furniture</td>
<td>Formaldehyde, iodophor spray, glutaraldehyde</td>
</tr>
<tr>
<td>Clothes, bed sheets especially for burns patients</td>
<td>Autoclaving</td>
</tr>
<tr>
<td>Soiled dressings, materials, animal carcasses</td>
<td>Incineration, Lysol, iodophors</td>
</tr>
<tr>
<td>Excreta</td>
<td>Lysol, iodophors</td>
</tr>
<tr>
<td>Cleaning of skin before surgery</td>
<td>Iodophors 2%, savlon, spirit</td>
</tr>
<tr>
<td>For cleaning infected wounds</td>
<td>Iodophors, acriflavine, savlon, $\text{H}_2\text{O}_2$</td>
</tr>
<tr>
<td>To remove slough from the wounds</td>
<td>EUSOL, $\text{H}_2\text{O}_2$</td>
</tr>
<tr>
<td>Before injection</td>
<td>Spirit is used to clean the skin</td>
</tr>
<tr>
<td>Cleaning the ward</td>
<td>Phenol, cresol, lysol</td>
</tr>
<tr>
<td>Hand wash</td>
<td>Chloroxylenol, savlon, spirit, iodophors</td>
</tr>
<tr>
<td>Bladder wash</td>
<td>0.1% potassium permanganate solution (Condy's lotion), solution of acetic acid and silver nitrate</td>
</tr>
<tr>
<td>Water</td>
<td>Chlorination, potassium permanganate</td>
</tr>
<tr>
<td>Fruits, vegetables</td>
<td>Potassium permanganate</td>
</tr>
</tbody>
</table>
solution can create formaldehyde vapour. Room is kept closed for 12 hours.

- **Glutaraldehyde** (cidex 2%): It is used to sterilise sharp instruments. Instruments should be dipped for 10 hours to achieve complete sterilisation. It is potent bactericide, sporicide, fungicide and viricide.
- **Hydrogen peroxide** ($H_2O_2$): It is used as topical oxygen therapy. Because of its effervescence and release of nascent oxygen it removes the tissue debris. It is used to clean wounds, cavities, ulcers and as mouth wash, as ear drops to clear ear wax.
- **Acriflavine and proflavine** are orange-red coloured dyes used as antiseptics. It is effective against gram-positive and few gram-negative organisms. It retains its activity in pus and body fluids.

**OPERATION THEATRE ROOM**

Operation theatre is like a temple to all surgeons.

**Theatre Plan**

- Every operation theatre should have a waiting area, entrance, surgeon’s changing and relaxing room, changing room and relaxing room for nurses, autoclave and sterilisation room, OT scrub area, all sets of instruments, instruments for anaesthesia, adequate number of racks, toilets, air – conditioned ventilator, OT tables, trolleys to shift patients, OT laundry, good light, C-ARM image intensifier.
- Operation theatre should have an adjoining postoperative ward. This ward should be close to the OT, easily accessible (as surgeon and anaesthetist should able to rush to the postoperative ward in short period without changing their OT dress).
- In many theatres light music are played to calm the patient just before inducing.
- Easy to clean floor, roof and walls must be present.
- Instrument cleaning, washing, and arranging unit is present which keeps the instruments ready, packed and autoclaved as directed.
- Pathology room with facilities for frozen section and relaxing room for pathologists.

**Principles of an Operation Theatre**

- An airconditioning is a must to have a filtered continuous flow of air.
- Doors and windows should be kept closed as much as possible.
- Ward nurse should handover the patient to theatre nurse with all details, case sheets, tag, side of surgery, blood to be transfused, premedication details. While shifting the patient, ward nurse must take care of the air way and IV line of the patient, must keep tongue depressor, swabs, air-way in the trolley.
- Patient should be shifted to theatre always in a trolley. Patient should remove all jewellery and wear theatre gowns, cap, feet covers.
- Patient must be transferred from ward trolley to theatre trolley, which should have modern accessories like oxygen, side guards, drip stand, oxygen masks, pulse oximeter placing area, tiltable couch.
- Patient’s trolley and ward blankets should not be taken inside the operation theatre.
- Initially patient should be kept in pre-operative room and later should be shifted to theatre. Anesthetist and surgeon and also theatre nurse should accompany the patient.
- Theatre nurse should confirm the consent form, case sheets, site and side of the surgery, etc.
- Separate theatre shoes should be worn by surgeons, anaesthetists, theatre nurses and assistants.
- Unnecessary movements, talking loudly, laughing, commenting should be avoided as patient may be awake especially when spinal anaesthesia is given.
- All persons entering the theatre should wear theatre dress (pant and shirt), cap, mask, footwear or shoes (shoes are ideal). Material for dress should be smooth, non-woven fabric, which is easily boilable. Cap should cover and conceal hair fully.
• Clothes, dresses should be washed, cleaned, ironed and kept ready every day. Fresh, clean cotton blanket should be used to the patient in theatre.
• Ideally all mobile phones should be switched off inside the theatre.
• Any public person or relative of the patient should not be allowed inside the theatre. Selected people may be allowed only by prior permission from medical director of the hospital and from operating surgeon.
• One senior nurse is made in charge of all activities in the theatre like shifting patients, arranging theatre tables, autoclave and other sterilisation methods, cleaning the instruments, packing the instruments for autoclave. She decides the duties of her junior nurses and makes a list of nurses for that day surgical scrubbing. Operation theatre assistant and technicians are also under her supervision and should follow her instructions strictly. She should be answerable for any default and problems in the theatre occurred or created by her fellow nurses and theatre boys.
• Scrub nurse is the one, who washes to assist the surgeon, arranges the instrument table and gives instruments to surgeon during procedure. She should be well aware of the steps of surgery, and instruments required. She should be alert, quick, and understandable.
• One nurse in each theatre works as a circulating nurse who provides additional instruments required during surgical procedure. She also takes care of the counting of the surgical mops and swabs used. Used mops or swabs should be kept hanging in mop rack or swab rack which should be visible to the operating team. Name, procedure and number of mops collected and used should be written on a blackboard. Scrub nurse and circulating nurse are fully in charge and responsible for swab counts. She also will be legally questioned and penalised along with the surgeon if there is negligence in mop counts.
• Theatre nurse and OT assistant should accompany the patient while handing over to postoperative nurse from OT.
• Patient should be shifted outside the OT once anaesthetist confirms the fitness for shift. It is the anaesthetist who decides when to shift, how to shift and how long the patient should be in postoperative ward.

Modes of infection and sepsis in OT
• Patient’s skin
• Surgeon, nurses and OT technicians, by unclean hands, nostrils, throat, skin
• Contamination of OT floor and wall
• Improper sterilisation
• Poor handling of instruments
• Poor packing and poor storage of instruments
• Theatre clothes, footwear and shoes
• Not disinfecting the OT properly and adequately after using the OT for infected cases

Scrubbing and Wearing OT Gown and Glove
• Both hands, forearms up to elbow joints should be rinsed with running water and soap. Any ring, jewellery, wristwatch should be removed prior to the scrub.
• Using brush and soap, finger nails, hands on both sides are cleaned. Then forearm is brushed and washed. Procedure is repeated three times (presently whether need to brush the hands are controversial).
• After thorough rinsing the hands by running water, hands are washed with antiseptic solution and then with warm water.
• Once fully scrubbed, she/he should not touch with hands any objects or his/her own face or parts of body. She should keep her hands and fingers tucked with each other with forearm and hands outstretched.
• Using a sterile towel, forearm and hands are dried up. Both hands are inserted into the armholes of the sterile gown. The gown is not touched or pulled but both arms kept
outstretched. Circulating nurse will pull the back tapes of the gown and ties it over the back.

- A back wrap gown, has got two tapes to tie on the front aspect. After wearing gloves, one tape is given to the scrubbed scrub nurse/surgeon who has already with gown and gloves. She/he will encircle the gown round and bring it in front and give to the surgeon to tie it with other tape.

### Theatre technique of wearing gloves

**A.** After using glove powder, with the bare hand inner aspect of the cuff of the glove is held. It is pulled over the hand. It should not be wrapped over the wrist cuff of the gown at this stage

**B.** Fingers of this gloved hand should hold the cuff of the other glove from outside and it is slid over the fingers and hand

**C.** Now cuff of the glove is pulled proximally over the wrist of the gown using other gloved fingers

### Circulating Nurse

One who supplies all additional instruments and mops. She also keeps the mop counts.

### Duties of Circulating Nurse

- Keeping counts of instruments, mops given to scrub nurse. Instruments are kept in bundles of five, ten and so on. So counting is easier.

- Taking care of swab rack and collecting the used mops from scrub nurse and hanging the mops in groups of five. Mops presently used in many theatres are having radio-opaque threads so to identify when needed by taking X-ray or through a C-ARM.

- Collection of specimens, pus, fluids and labelling with name, unit, number. It may be for culture, cytology or for histopathology.

- Keeping account of the disposable instruments and suture materials, drugs and fluids used in each procedure.

- Noting the duration of the surgery, quantity of blood transfused, type of anesthesia
Prevention of infection
- Cleaning of the patient’s skin where incision is placed by povidone iodine, cetrimide, spirit
- Isolation of surgical area by proper draping with green towels
- Transparent sheeting of the skin through which skin incision is placed
- Adhesive films to the skin
- Use of on table parenteral antibiotic in major cases
- Always clean cases are done first and then infected cases
- Proper sterilisation
- Double autoclaving for orthopaedic and ophthalmology cases

Figs 7.5A to D: Different materials required to give anaesthesia – air way; Boyle’s apparatus; direct laryngoscope; Laryngeal Mask Airway – a special device tube to give anaesthesia.

Fig. 7.4: OT mop rack to keep used mops during surgery.
• Documenting in record-book or theatre computer.
  Theatre nurse should not discuss or reveal about the procedure or technique done outside theatre with anybody. It is surgeon’s duty to explain about the patient’s condition, procedure done and problems. She will never comment about anything in theatre.

**Septic Operation Theatre**

- All infected cases like abscess drainage, amputation for gangrene, slough excision, dressing of large ulcers should be done in a separate OT. Otherwise clean surgeries may get infected. It is especially important when orthopaedic surgeries are going on.
- Entrance to septic OT must be separate from that of main OT.
- Staffs working in septic OT should not enter main OT.
- Instruments should be kept separate for septic OT.
- Drapes, towels, mops should be placed in a plastic bag after use and sent to laundry immediately. It should be labelled as infected.
- Circulating nurse should wear gloves while working in a septic OT.
- Disinfection of shoes is essential once it is used in septic OT.
- Daily disinfection of OT is essential.
- Swab culture of the OT materials at regular intervals is needed.
- Separate Boyle’s apparatus is used in septic OT.
- Dress is changed when one comes out of septic OT and enters the main OT.

**Precautions in an Operation Theatre**

- In the absence of proper safety measures and precautions, OT is a place where one is prone for accidental trauma and injuries, which may be danger to patient as well as theatre personnel.
- Main danger exists in some anaesthetic agents, which may cause life-threatening explosions. It may cause burns, loss of vision, hearing loss, damage to OT, may also sometimes cause death. Ether is one, which can be explosive.
- An OT has got high power electric supply for its basic needs like aircondition, lights, machines, cautery, suction apparatus, other modern instruments like laparoscope, C-ARM, etc. Because of the presence of too many electric circuits and possibility of dangers of static electricity, theatre staff should take enough precautions to prevent any electric injury to patients and theatre personnel.
- Good earthing is essential.
- It is ideal to use theatre dresses made of cotton (cotton clothes) to patient, surgeon and nurses. Drapes and other materials should also be made of cotton.
- Rubber should be used wherever required like in wheel of trolley, Boyle’s apparatus, mattresses, floor, wall of the theatre.
- When cautery is used, electric shock is common and so enough precautions has to be taken. Often cautery burns can occur to the patient.
- An electrician should be immediately available whenever there is problem like power failure, short circuit, default in any of the electrical instruments.

Beware of possible anaesthetic explosions and electrical injuries in OT.

<table>
<thead>
<tr>
<th>Most important people in OT</th>
</tr>
</thead>
<tbody>
<tr>
<td>First and foremost is the <strong>patient</strong></td>
</tr>
<tr>
<td>Next are surgeon and anesthetist</td>
</tr>
<tr>
<td>Essential are theatre nurses and theatre assistant</td>
</tr>
<tr>
<td>Surgery is a team work. All are important</td>
</tr>
</tbody>
</table>
URINARY CATHETERISATION

Catheters used—simple non-self retaining red rubber catheter, Foley’s self retaining catheter, Gibbon’s catheter, metal catheter.

Indications
- Retention of urine due to BPH, stricture urethra, trauma (with all care and precaution gently one trial is done).
- In major surgery postoperative period.
- In acute conditions and in shock patients to measure the hourly urine output.

Causes of Retention of Urine
- Bladder outlet obstruction.
- BPH, carcinoma prostate.
- Prostatitis, prostatic abscess.
- Bladder carcinoma close to bladder neck.
- Bladder stone obstructing bladder neck.
- Hypertrophy of bladder neck muscle.
- Stricture at bladder neck.
- Causes at urethral level.
- Urethral stricture—may be due to trauma or inflammatory (gonococcal/nonspecific) or neoplastic or after catheterisation/cystoscopy or after surgery (TURP/urethral surgery/perineal urethrostomy).
- Urethral stone.
- Tumours.
- Posterior urethral valve.
- Urethral trauma.
- Meatal stenosis.
- Pinhole meatus/phimosis.
- Other causes—
  - Postoperative period.
  - Postsurgery—of haemorrhoidectomy/fissurectomy/fistul ectomy.
  - Spinal injury/spinal surgery/spinal anaesthesia.
  - Drugs like anticholinergics, antidepressants or antihypertensives.

Foley’s catheter is commonly used. Urosac bag, gloves, sterile towel, 2% xylocaine jelly and distilled water are needed.

Procedure
- Explain the patient about the procedure. Sterile gloves are worn after hand wash. Patient will be in supine position with legs apart. Genitalia are cleaned with povidone iodine solution. Draping is done using sterile towel.
- Prepuce is retracted and glans is cleaned again. 20 ml of 2% xylocaine jelly is taken in a syringe and pushed into the urethra through the external meatus.
- After 5 minutes, penis is held vertically (so that urethra gets straightened to make easier passage of the catheter) and Foley’s catheter tip is lubricated with jelly and is gently passed into the urinary bladder. Urine flow through the catheter confirms that it is inside the bladder.
- It is advanced further more and balloon near the tip is inflated using distilled water. Air is not used for this purpose. Normal saline may get crystallised and so ideal is distilled water (Note: in endotracheal tube only air is used inflate the balloon. Water should never be used as if balloon bursts aspiration can occur). Quantity inflated should be noted in the case sheet. Usually 20 ml is used. It is actually written in the Foley’s catheter. After inflation catheter is pulled out to confirm that balloon is inflated properly.
- Catheter is connected to urosac bag. Prepuce is placed in normal position otherwise paraphimosis can develop.
- In adult 16 F catheter is used. F-French unit—16 mm circumference (Charriere unit). Usual Foley’s catheter is kept for 7-10 days. If there is a need to keep catheter for more than 10 days then silicon coated Foley’s catheter is used as it is least reactive. Foley’s catheter is made up of latex. In children 10 F or 8 F is used.
- Three-way Foley’s catheter is used to irrigate the bladder with normal saline/glycine solution continuously in post-TURP (Transurethral Resection of Prostate) or after bladder surgery or after bladder trauma.
- Foley’s catheter often is reinforced with tension wires to prevent block and is called as haematuric Foley’s catheter.
- Maryfield introducer is used often to pass the Foley’s catheter into the bladder. It has got a curve with a groove over the convex part to accommodate the catheter.
- Balloon should be deflated completely before removal of the catheter otherwise urethral injury and haematuria can occur.
- In females labia majora are retracted apart to identify the urethral orifice to pass the catheter.

Complications of Catheterisation
- Infection.
- False passage.
- Bleeding.
- Inability to deflate the balloon while removing the catheter. In such occasions, following methods are used—
  - Inflating the balloon further with ether/air/water and bursting the balloon.
  - Passing guide wire of the ureteric catheter via the inflating channel.
  - After giving traction to catheter so as to make balloon nonmobile and fix, long, fine needle is passed per-abdomen in suprapubic place so as to puncture the balloon.

Causes for Inability to Pass the Catheter
- Urethral stricture, BPH.
- Non-cooperation by the patient.
- Meatal stenosis.

INSERTION OF A NASOGASTRIC TUBE

Indications
- For decompressing stomach in intestinal obstruction, after abdominal surgery. It prevents aspiration and distension of intestines.
- For gastric function tests.
- In gastric outlet obstruction to decompress the stomach and also to give stomach wash. Stomach tube is better (Ewald’s tube) for this.
- For feeding purpose.
- Baid test: Passed Ryle’s tube will be palpable per abdomen in pseudocyst of pancreas as stomach is stretched forward.
- Ryle’s tube will not enter the stomach in Boerhaave’s syndrome.

Procedure
- Procedure is explained to the patient. Usually no. 16 tube is used in adult. It is one meter long usually of plastic (earlier red rubber) with three lead shots in the tip. Lead shots in the tip make it easier to pass. (Infant feeding tube does not have lead shots). It has got different marking ring/rings (2, 3, and 4). First ring signifies O-G junction (40 cm). Two rings for body of stomach (50 cm), three for the pylorus (60 cm) and four for duodenum (70 cm).
- Xylocaine jelly 2% is lubricated to the tube. It is passed one of the nostril (wider one) horizontally until it reaches the posterior pharyngeal wall. Patient is asked to swallow if needed with the help of cup of water. Tube passes through the relaxed cricopharyngeus and then into oesophagus. Afterwards it is easier to pass into the oesophagus. Once it is in the oesophagus adequately tube is fixed to nostril.
  Confirmation of the tube in the stomach is done by aspirating the bile and also by injecting 30 ml of air into the stomach through the tube which can be heard in the epigastrium with a stethoscope as a gurgling sound.
  Tube can be used for continuous drainage or drainage hourly or at regular intervals.

Problems with Ryle’s Tube
- Discomfort to the patient.
- Blockage.
- Coiling in the mouth.
- Displacement.
**ABSCESS DRAINAGE**

Abscess is a localised collection of pus lined by granulation tissue covered by pyogenic membrane. It contains pus in loculi.

**Bacteria Causing Abscess**
- *Staphylococcus aureus.*
- *Streptococcus pyogenes.*
- Gram-negative bacteria (*E. coli, Pseudomonas, Klebsiella*).
- Anaerobes.

**Factors Precipitating Abscess Formation**
- General condition of the patient: Nutrition, anaemia, age of the patient.
- Associated diseases: Diabetes, HIV, immunosuppression.
- Type and virulence of the organisms.
- Trauma, haematoma, road traffic accidents. 
  
  *Abscess should be drained only once it is formed under the cover of antibiotics.*

**Features of formed abscess are**
- Pointing tenderness
- Visible pus
- Excruciating pain
- Localized swelling
- Induration (browny induration)

**Abscess is Drained by Hilton’s Method**

Under general or regional anaesthesia, after cleaning and draping, using needle with syringe pus is aspirated and confirmed. Adequate incision is made over the skin in longitudinal to neurovascular bundle. Pyogenic membrane is opened using sinus forceps. Pus is collected for culture and sensitivity. All loculi should be broken. Wound is washed with saline. Gauze drain or corrugated drain is placed in the wound. Antibiotics are continued. Wound is allowed to granulate and heal.

Local anaesthesia may not act as pus is acidic in nature and xylocaine will not be effective in this acidic media.

**Complications**
- Improper drainage and residual abscess.
- Septicaemia.
- Sinus formation.
- If abscess is near the major vessels, sloughing of the wall of the vessel and torrential haemorrhage can occur occasionally.
  - Sarcoma and aneurysms may mimic pyogenic abscess especially when it is deep seated and so necessary investigations like CT scan and aspiration of the content should be done before incision and drainage.

**Abscess in Special Locations**

Abscess in special locations may not show features of formed abscess. In those locations abscess should be drained without waiting for features of formed abscess-pointing, fluctuation. They are—
- Parotid abscess.
- Breast abscess.
- Ludwig’s angina—It is actually a cellulitis not an abscess but needs exploration and decompression.
- Thigh abscess.
- Ischiorectal abscess.

**Parotid Abscess**

Parotid abscess presents as severe pain and tender swelling in the parotid region in front of the tragus. Often patient will be toxic, dehydrated with trismus. Parotid abscess is drained.
under general anaesthesia with endotracheal tube in place. Blair’s vertical incision is placed in front of the tragus. Abscess cavity is opened using sinus forceps with multiple horizontal incisions in deeper plane. Care should be taken not to traumatize the facial nerve. After draining pus and proper saline wash drain is placed into the wound. Loose sutures in the skin may be placed. Facial nerve injury, septicaemia, laryngeal oedema and local spread of sepsis are the complications. Infection when spreads to pharynx/larynx/parapharyngeal space needs tracheostomy.

Breast Abscess
Breast abscess is commonly due to Staphylococcus aureus. It is common in lactating women. It should always be drained under general anaesthesia. There will not be any localization. Diffuse swelling and tenderness all over the breast is common. Occasionally tender axillary lymph nodes may be palpable. After cleaning and draping, pus is aspirated and confirmed initially. Either circumareolar or submammary incision is made. After draining pus and braking loculi, a counter-incision is made on the upper part. After proper saline wash of the wound, drain is placed across the incision and counter-incision. If patient is lactating, suppression of lactation is done using Bromocryptine 2.5 mg. Regular expression of milk either manually or using breast pump should be done. Otherwise recurrent infection or fistula can occur.

Axillary Abscess
Axillary abscess is drained under general anaesthesia with axilla in hyper extended position and a sand bag under the shoulder. A 5 cm incision is made under the anterior axillary fold longitudinally. Skin and superficial fascia is incised. Using sinus forceps deep fascia is opened in parallel to the line of the axillary vessels. Care is taken not to injure axillary vessels (vein). After draining pus and saline wash, gauze/corrugated drain is placed. Antibiotics are continued.

Ischiorectal Abscess
It is drained under general/spinal anaesthesia. Procedure is done in lithotomy position. After cleaning and draping, cruciate incision is placed over more indurated/more prominent area of the ischiorectal fossa. Incision is deepened. Parts of the angles of the flaps are excised so as to prevent it to close to form recurrent abscess formation. Sinus forceps is inserted to enter the fossa and to drain the pus. Using finger all loculi are broken. Rectal examination is done to find out the possibility of existing fistula. Cavity is packed with gauze and dressing is done using ‘T’ bandage. Antibiotics and regular dressings are required.

Axillary Abscess

Ludwig’s Angina
• It is an inflammatory oedema of sub-mandibular region and floor of the mouth, commonly due to streptococcal infection. There is bilateral browny cellulitis of sublingual and submandibular region.
• It is common in severely ill and in advanced malignancy, causing trismus, laryngeal oedema. Extension of infection into parapharyngeal space may lead to dreaded internal jugular vein thrombosis.
• As the infection is deep to the deep fascia in a closed fascial plane, it spreads very fast causing dangerous complications.
• Clinical features: Fever, toxicity, diffuse swelling, dysphagia, dyspnoea, and trismus.
• **Treatment**
  - Antibiotics—penicillins (high dose 20 lacs 4th-6th hourly), cefaperazone, sulbactum, metronidazole—antimicrobial.
  - IV fluids for adequate hydration.

![Incision for draining of Ludwig's angina.](image)

- **Decompression of the submandibular region is done**, by making a deep incision extending into the deep fascia and also cutting both the mylohyoid muscles. Either it is left open or delayed suturing is done, (better option) or it is loosely sutured with a drain in situ.

• **Complications**
  1. Laryngeal oedema and respiratory distress may require tracheostomy.
  2. Septicaemia.
  3. Extension of infection into parapharyngeal space.

**Cold Abscess**

It is due to caseation necrosis and localisation due to tuberculous infection. There will not be any signs of inflammation. It is well localised, soft, cystic, nontender swelling without any warmth. It is commonly due to tuberculous lymphadenitis, but can occur in tuberculosis of spine, kidney or other areas. FNAC shows caseation necrosis, macrophages and typical epithelioid cells. Cold abscess is drained using nondependent incision. After drainage wound is sutured without placing a drain.

**Tuberculous Lymphadenitis**

*Causative organism: Mycobacterium tuberculosis* (Not M. bovis).

*Site:* Common in neck lymph nodes.

  - Common in upper deep cervical (jugulodigastric—54%) lymph nodes.
  - Next common is posterior triangle lymph nodes (22%).

*Mode of infection:* Usually through the tonsils, occasionally through blood from lungs.

  - It may be associated with pulmonary tuberculosis or renal tuberculosis.

**Stages of tuberculous lymphadenitis**

1. Stage of infection and lymphadenitis
2. Stage of periadenitis with matting
3. Stage of caseating necrosis and cold abscess formation
4. Stage of formation of collar stud abscess
5. Stage of formation of sinus which discharges yellowish caseating material

**Types**

<table>
<thead>
<tr>
<th>Hyperplastic</th>
<th>Caseating</th>
</tr>
</thead>
<tbody>
<tr>
<td>20% common</td>
<td>80% common</td>
</tr>
<tr>
<td>Discrete, firm or hard</td>
<td><em>Mattted</em> due to periadenitis</td>
</tr>
<tr>
<td>Occurs in the cortex of lymph node</td>
<td>Involves medulla</td>
</tr>
<tr>
<td>Host immunity is good</td>
<td>Body resistance is not adequate</td>
</tr>
<tr>
<td>Drugs act better</td>
<td>Drugs do not reach in proper concentration and may not be effective</td>
</tr>
<tr>
<td>Drug resistance is uncommon</td>
<td>Drug resistance is common</td>
</tr>
<tr>
<td>No cold abscess or sinus formation</td>
<td>Cold abscess or sinus are common</td>
</tr>
<tr>
<td>Blood spread</td>
<td>From tonsils</td>
</tr>
</tbody>
</table>
• Often fibrosis and calcification can occur with or without treatment.
• **Gross pathology**: Firm, matted, lymph node, with cut section showing yellowish caseating material.
• **Microscopic**: Epithelioid cells with caseating material are seen along with Langhan’s type of giant cells
• Disease can also occur in other lymph nodes like, axillary lymph nodes, para-aortic lymph nodes, mesenteric lymph nodes, inguinal lymph nodes. Disease may be associated with HIV infection, lymphomas.

**Clinical Features**
- Swelling in the neck which is firm, matted.
- Cold abscess is soft, smooth, nontender, fluctuant, without involvement of the skin.
- As a result of increased pressure, cold abscess ruptures out of the deep fascia to form collar stud abscess which is adherent to the overlying skin.
- Once collar stud abscess bursts open, discharging sinus is formed.
- Tonsils may be studded with tubercles and so clinically should always be examined.
- Associated pulmonary tuberculosis should also be looked for.

**Differential Diagnosis**
- Nonspecific lymphadenitis.
- Lymphomas.
- Secondaries in the neck.
- Branchial cyst mimics cold abscess.
- Lymph cyst mimics cold abscess.
- HIV with lymph node involvement.
- When there is discharging sinus—actinomycosis.

**Investigations**
1. Haematocrit, ESR
2. FNAC of lymph node.
3. HIV test.
4. Open biopsy when FNAC is inconclusive.
5. Chest X-ray to look for pulmonary tuberculosis.

**Treatment**
Antituberculous drugs have to be started:
- Rifampicin 450 mg OD on empty stomach. It is bactericidal. It discourses urine red. It is also hepatotoxic.
- INH. 300 mg OD. It is bactericidal. It causes intolerance, neuritis, hepatitis (INH).
- Ethambutol 800 mg OD It is bacteriostatic. It causes GIT intolerance.
- Retrobulbar neuritis (green colour blindness).
- Pyrazinamide 1500 mg OD (or 750 mg BD). It is bactericidal. It is hepatotoxic, also causes hyperuricaemia and increases psychosis. Duration of treatment is usually 6-9 months.
Treatment of Cold Abscess

- When there is cold abscess, initially it has to be aspirated. (Needle is introduced into the cold abscess in a nondependent site along a ‘Z’ track (in zigzag pathway) so as to prevent sinus formation).
- But if it recurs, then it should be drained. Drainage is done through a nondependent incision. After draining the caseating material, wound is closed without placing a drain.
- Surgical removal of tuberculous lymph nodes— It is done by raising skin flaps and removing all caseating material and lymph nodes. Care should be taken not to injure major structures.

<table>
<thead>
<tr>
<th>Pyogenic abscess</th>
<th>Cold abscess</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red, warm, tender, with signs of acute inflammation</td>
<td>No signs of acute inflammation</td>
</tr>
<tr>
<td>Pyogenic bacteria are nonspecific organisms (Streptococci, staphylococci)</td>
<td>Tuberculous bacteria</td>
</tr>
<tr>
<td>For drainage, dependent incision is used</td>
<td>Nondependent incision is used</td>
</tr>
<tr>
<td>Suturing of the wound is not done</td>
<td>Wound is curetted and sutured</td>
</tr>
<tr>
<td>Drain is placed</td>
<td>Drain is not placed – if placed sinus may form which is difficult to treat</td>
</tr>
<tr>
<td>Heals well and rapidly once drainage is adequate</td>
<td></td>
</tr>
</tbody>
</table>

Indications for surgical removal of tubercular lymph nodes

- There is no local response to chemotherapy
- When sinus persists

Midtracheostomy: Ideal and commonly used. It through 2nd and 3rd rings behind isthmus. It is approached by dividing thyroid isthmus.

Low tracheostomy: Below the isthmus level. It is deep and impinges the suprasternal notch. It can cause turrectial bleed which is difficult to control.

**TRACHEOSTOMY**

Tracheostomy is making an opening in the anterior wall of trachea and converting it into a stoma on the skin surface.

**Types**

- Emergency tracheostomy.
- Elective tracheostomy.
- Permanent tracheostomy.

High tracheostomy: Above the level of isthmus. It can cause tracheal stenosis. It is above second ring.

**Tracheostomy Tubes**

1. Fuller’s bivalved tracheostomy tube: It has got a outer tube and a inner tube. Outer tube is biflanged and so insertion is easier. Inner tube is longer with an opening on its posterior aspect. Inner tube can be removed and reinserted easily whenever required.
2. Jackson’s tracheostomy tube: It has got outer tube, inner tube and an obturator.
4. PVC tracheostomy tube.

Modern tracheostomy tubes are made of plastic. They are soft, least irritant and disposable. They have inflatable cuff which makes it easier to give assisted ventilation. Cuff should be deflated at regular intervals to prevent tracheal pressure necrosis (For assisted ventilation, endotracheal tube can be kept for 7 days. Beyond that period patient needs tracheostomy for further ventilation).

**Indications for Tracheostomy**
- In head, neck and facial injuries.
- Tetanus.
- Tracheomalacia after thyroidectomy or bilateral recurrent laryngeal nerve palsy.
- Laryngeal oedema/spasm.
- Major head and neck surgeries like Commando’s operation, block dissection.
- Acute laryngitis as in diphtheria.
- Carcinoma larynx, foreign body larynx, burns mouth, pharynx, larynx.
- Respiratory paralysis like bulbar palsy.
- Respiratory failure due to asthma, ARDS.

**Indications for tracheostomy**
- Respiratory obstruction due to
  - Acute infections causing oedema larynx
  - Trauma
  - Neoplasms—benign/malignant
  - Foreign body
  - Bilateral abductor palsy
  - Congenital causes

**Respiratory secretions due to**
- Inability to cough—tetanus, head injury, neurological causes, strychnine poison
- Painful cough in chest injuries, pneumonia
- Aspiration of secretions

**Respiratory insufficiency due to**
chronic lung diseases like emphysema, chronic bronchitis, bronchiectasis

**Technique of Tracheostomy**
Neck of the patient is hyper extended by placing sand bags under the shoulder. Vertical (midline) or horizontal incision is made. Deep fascia is opened. Strap muscles are retracted laterally. Isthmus is divided or retracted upwards. A few drops of lignocaine are instilled into the trachea to suppress the cough reflex. Trachea is fixed with tracheal hook. Second and 3rd or 3rd and 4th tracheal rings are opened and circular opening is made. Tracheostomy tube is placed. It is tied around the neck.

**Note**
- First tracheal ring should never be used to do tracheostomy as perichondritis of cricoid cartilage with stenosis can occur.
- Skin should not be sutured or loosely sutured to prevent development of subcutaneous emphysema.
- Cautery should be used during tracheostomy as much as possible to prevent oozing/bleeding from places like muscles, tracheal cut edge. Often torrential haemorrhage known to occur which may need a re-exploration to control bleeding.

**Tracheostomy Care**
- Regular suctioning of the tube.
Functions of the tracheostomy
- Alternate pathway for respiration bypassing the upper air-way
- It decreases the dead space by 50% and reduces the resistance to airflow so as to improve the ventilation
- It prevents aspiration in bulbar palsy, coma, haemorrhage from larynx/pharynx
- In injuries of head, chest, abdomen, in respiratory paralysis lower airway is kept clean and patent by doing suction of the secretions through the tracheostomy tube
- Tracheostomy is better and ideal for intermittent positive pressure ventilation (IPPR)
- To give general anaesthesia when endotracheal intubation is not possible

Complications of Tracheostomy
- Bleeding.
- Aspiration, sudden apnoea.
- Pneumothorax.
- Surgical emphysema in the neck.

- Cleaning of tracheostomy tube.
- Humidification of the inspired air using normal saline/ringer lactate/acetylcystine mucolytic agent to liquefy secretions or crusts so that to prevent blockage.
- Constant observation of the patient for block, bleeding.
- Periodic deflation of the cuff of the tube for short period to prevent pressure necrosis of tracheal mucosa.
- Prevention of infection.
- Decannulation of tracheostomy should be done with care especially in children as sudden respiratory distress can occur and in such occasion emergency reinsertion of the tube should be done.
- Flexible brochoscopy may be needed to clear the lower air-way through the tracheostomy tube.
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Fig. 7.13: Permanent tracheostomy is done in a patient who underwent total laryngopharyngectomy for carcinoma larynx. Patent is on nasogastric tube for feeding purpose.

- Mediastinal emphysema.
- Injury to adjacent structures like oesophagus, recurrent laryngeal nerve, thyroid gland.
- Tracheal stenosis.
- Laryngeal stenosis due to perichondritis of cricoid cartilage.
- Tracheitis/tracheo-bronchitis.
- Displacement/blockage of the tube or erosion of the tube into major vessels.
- Tracheo-oesophageal, tracheoarterial fistula.

Nursing care
- Consent should be taken.
- Materials like tracheostomy tubes, (8.5 size), sterile gown, drapes, gloves, cap, mask, tracheostomy sterile set, gauze, local anaesthetic agent, suction apparatus and tubes, connecting tubes to ventilator, sterile syringes should be kept ready.
- During procedure the patient is monitored for vital signs.
- Proper nursing care of the tracheostomy tube is done like, humidifying, cleaning, suction, care of the wound, checking of cuff pressure.
- Tracheal dilator and additional tracheostomy tube should be kept ready at bedside in case of blockage of existing tube/balloon not getting inflated to replace with a new one.
- Absolute asepsis like scrubbing hands, using sterile equipments are essential.
- Sterile suction tubes should be used.
- Care of inner tube is essential in case of metal tracheostomy tube.
- Regular dressing of the wound is needed. Antibiotics are required to prevent pulmonary sepsis.

CIRCUMCISION

Procedure
In children it is done under G/A. In adults it is done under local anaesthesia.

After cleaning and draping, LA (1% lignocaine (plain) injected circumferentially near the root of the penis) is given (ring block). Dorsal skin is cut up to the corona and later circum-

Fig. 7.14: Circumcision technique.
ferentially and ventrally. The skin is cut with inner layer. Care is taken to see that optimum (less) skin is cut ventrally to prevent the occurrence of chordee. Frenular artery is transfixed and ligated ventrally using chromic catgut (2—0 or 3—0). Small bleeders are also ligated. Skin is apposed to the cut edge of corona using interrupted chromic catgut sutures. Post-operatively, antibiotics and analgesics are given. Plastic cap: Hollister Bell cap technique: This cap is fitted over the glans penis and prepuce is rolled over it. A tight ligature is tied over it near base of the prepuce. In 7 days, skin and prepuce sloughs off and is shed with the cap. Bleeding will not occur due to thrombosis of prepuceal vessels. Technique can be used for religious circumcision/balanoposthitis without phimosis. It is contraindicated in phimosis and paraphimosis.

Complications
- Reactionary haemorrhage due to slipping of ligature from frenular artery dorsal vein.
- Infection.
- Stricture urethra near the external meatus in children.
- Chordee due to removal of excess skin on the ventral aspect.
- Rarely priapism can occur.

**INDICATIONS**
- Religious.
- Phimosis.
- Paraphimosis after doing initial dorsal slit.
- Balanitis and balanoposthitis (common in diabetics).
- Early carcinoma of prepuce or glans penis — both diagnostic as well as therapeutic purpose.
- Certain sexually transmitted diseases, e.g. herpes infection.

**PHIMOSIS**

It is inability to retract the prepuce over the glans.

**PARAPHIMOSIS**

- Inability to cover (place back) the glans with retracted prepucial skin.

**CAUSES**
1. Congenital in which case the child will have pinhole meatus and ballooning of prepuce occurs when child urinates.
2. Balanitis (inflammation of glans) and balanoposthitis (inflammation of glans, prepuce and sac). Common in diabetics. Patients with phimosis are more prone for recurrent infection, smegma collection and more prone for carcinoma penis.

**TREATMENT:** Circumcision.
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After passing urinary catheter if prepuceal skin is not placed back over the glans paraphimosis can occur.
- It causes ring like constriction proximal to the corona and prepuceal skin. As a result the glans will be swollen, oedematous with severe pain and tenderness.
- Often glans will undergo necrosis or becomes gangrenous.

Treatment
- Manual reduction of prepuceal skin is to be tried.
- If not possible, initial dorsal slit is made to relieve the oedema and compression. Antibiotics and analgesics are given. Circumcision is done after 3 weeks.

DORSAL SLIT OF PREPUCE

Indications
- Paraphimosis.
- To do biopsy from a growth underneath the prepuce either in the glans or in prepuce itself. After cleaning and draping, xylocaine plain (1%) is injected into the root of the penis circumferentially. Using two mosquito forceps oedematous prepuceal skin is held. Dorsally skin in midline is cut. Fibrous ring/constriction ring proximally is identified and is cut. Once released properly skin will move freely properly. 'V' shaped cut edge is sutured with continuous plain/chromic catgut. Dressing is placed over the wound. Patient needs formal circumcision at a later period (after 3 weeks) once oedema subsides.

EXCISION OF THE SWELLING

- Swellings like sebaceous cyst, lipoma, pyogenic granuloma, Papilloma are excised usually under local anaesthesia. Dermoid cyst which is extending into the deeper plane should be excised under general anaesthesia.
- After cleaning and draping, xylocaine 1% injection is infiltrated around the swelling and underneath the swelling by lifting the swelling.

Incision
- In sebaceous cyst elliptical incision is placed encroaching the punctum.
- In swellings like lipoma/ganglion lineal incision is placed.
- In swelling like papilloma/pyogenic granuloma elliptical incision covering the entire lesion is placed.

Procedure
- Skin flaps on either side are raised adequately until edge of the swelling is clearly seen. Using scissor sharp dissection is done to remove the entire swelling. Bleeding points are cauterised/ligated. Skin is closed using non-absorbable monofilament polypropylene/polyethylene 3-zero sutures.
- In a sebaceous cyst, capsule should be removed completely otherwise recurrence can occur. Often avulsion of the capsule also done to complete the procedure.
- In a large swelling like of large lipoma drainage tube may be kept for 48 hours.
- Dressing is placed. Antibiotics and analgesics are given.
- Suture removed in 5-8 days.

LYMPH NODE BIOPSY

Indications
- Lymphoma to find out the grade, type of lymphoma.
In secondaries in lymph node only when FNAC is inconclusive but clinically node is significant. Significant node is one which is based on size (variable in different locations and type of primary but hard node > 1 cm is significant) and texture (hard) probably harboring tumour spread. FNAC is the first choice in secondaries as biopsy of node may block the lymphatics and may allow spread of tumour to next level of nodes.

- Tuberculosis of lymph node.
- Rare lymphatic diseases.

**Site of Node Selection for Biopsy**

- Neck nodes—superficial/deep.
- Axillary node.
- Groin node: These nodes can often be non-specific because of repeated recurrent inflammation. Hard, large sized node can be considered as significant.

**Procedure**

Lymph node biopsy ideally should be done under general anaesthesia. Superficial nodes/nodes upper posterior triangle may be removed under local anaesthesia-xylocaine 1%. After cleaning and draping, incision is placed parallel to neurovascular bundle. Adequate incision is a must otherwise technique will be difficult. After skin incision, fascia is incised. Lymph node is identified based on shape, colour and texture. Node is separated from adjacent structures. Node is held using Lane’s tissue holding forceps. After removal haemostasis is maintained. Node is cut to see the interior texture. It is fleshy in Hodgkin’s lymphoma. It is yellowish caseating in tuberculosis and dark, haemorrhagic in secondaries. Skin is closed with interrupted sutures using monofilament non-absorbable sutures. Sutures removed in 7 days.

Ideally entire one node with its intact capsule should be removed specially in lymphomas. Many times it may be difficult because of fibrosis and adherent lymph nodes.

**Complications and Difficulties**

- Bleeding.
- Injury to major structures like nerves and vessels.
- Infection.

**PLEURAL TAP (THORACOCENTESIS)**

**Indications**

- Pleural effusion both diagnostic as well as therapeutic. The fluid is sent for culture, cytology, microscopy, specific gravity, biochemical analysis like proteins for diagnosis of tuberculosis, malignancy.
- In empyema thoracis, for diagnostic purpose before placing an ICT.
- Intrapleural administration of drugs.

**Position**

In sitting position, leaning forward over a wooden support.

![Fig. 7.17: Pleural tap. Note the position of the patient and placement of the needle.](image-url)
Site
Tip of scapula at 7th intercostal space (posteriorly).

Procedure is done in sitting and leaning forward over a support. Tapping is done from behind. After giving local anaesthesia wide bore needle (Abraham needle) is used to tap the fluid. Needle with stopcock (3-way) is used. 50 ml syringe is connected to the stopcock. Fluid is aspirated to syringe from pleura with stopcock in straight position. Then knob is turned right angle to empty the syringe to reservoir. Procedure is repeated to clear the fluid.

For diagnostic tap, 50 ml of fluid is aspirated to send for biochemical/cytological analysis and culture.

For therapeutic aspiration—750-1000 ml per day is aspirated. If more quantity is aspirated rapidly, pulmonary oedema may develop leading to often ARDS which may be life-threatening.

Complications
- Infection.
- Dry tap or bloody tap.
- Sudden vagal shock.
- Pain and respiratory distress.

INTERCOSTAL TUBE DRAINAGE (ICT DRAINAGE)
It is the method of draining collections in the pleural cavity safely so as to make the lung to expand.

Indications
- Haemothorax.
- Pneumothorax.
- Haemopneumothorax.
- Empyema thoracis.
- Traumatic lung contusion.
- After thoracotomy to drain pleural cavity.

Procedure
- Patient is in 45° partial lying positions with backrest support. Under local anaesthesia (5 ml of 1% xylocaine injection), an ICT is placed in 6th or 8th intercostal space in case of haemothorax and pyothorax and in pneumothorax ICT is placed in 2nd or 3rd space.
  - A small incision is made in midaxillary line (as the muscle bulk is less here and so passage of ICT is easier), parallel to intercostal space (above the rib, i.e. lower part of intercostal space to avoid injury to neurovascular bundle which are located in the groove in the lower part of rib). Tube with side openings is pushed into the pleural cavity.
  - Other end is connected to under water seal (200 ml of sterile water). Air-water column moving with respiration can be observed. Tube is fixed with skin sutures.
  - Usually for pneumothorax ICT is kept for 2-3 days (Till lung expands—Confirmed by check chest X-ray). For haemothorax and pyothorax it is kept for 4-6 days or until it stops draining and lung expansion is confirmed by repeat chest X-ray.

Fig. 7.18: Intercostal tube drainage under water seal.
• To have a proper expansion of lungs patient is asked to blow foot ball bladder (balloon) (Breathing exercise). If there is broncho-pleural fistula, ICT should be placed for longer time until fistula heals.

![Intercostal tube drainage in a patient with haemothorax.](image1)

**Fig. 7.19: Intercostal tube drainage in a patient with haemothorax.**

**Complications and Problems**
1. Infection.
2. Displacement and inadequate functioning.
3. Injury to intercostal vessels and bleeding.
4. Injury to intercostal nerves, lung and mediastinum.
5. Pain at the site of ICT placement.

**BRONCHOSCOPY**

**Indications**
- *Diagnostic:* To take biopsy in carcinoma lung, lung abscess, pulmonary tuberculosis.
- *Therapeutic:* To remove foreign body, to suck out the bronchial secretions.

**Types**
- *Rigid bronchoscopy:* It is used for removal of foreign body, bronchial wash, etc. It reaches up to the third generation bronchioles. It is useful to take biopsy from carcinoma of proximal divisions but not from carcinoma of peripheral lung. Rigid scope has got multiple holes to allow ventilation during procedure. Oesophagoscopy does not have side holes. It is done under general anaesthesia.
- *Flexible bronchoscopy:* It reaches up to 5th generation bronchioles. It can be done under local anaesthesia. It is mainly used for diagnosis and biopsy.

**Complications**
- Bleeding.
- Infection.
- Perforation.
- Bronchospasm.

**PERICARDIAL TAP (PERICARDIOCENTESIS)**

**Indications**
- Pericardial effusion due to any cause—viral, tubercular.
- Haemopericardium.
- Purulent pericardium.

**Procedure**
A 16 or 18-gauge needle is passed into the pericardium just below the xiphoid process directing upwards and backwards towards left side with an angle of 45° to the surface.
This site is used because it is—
• Most dependent aspiration.
• Unlikely to traumatize heart.
• Pleura is not punctured.
• Coronary vessels are not injured.

Presently U/S guided aspiration is commonly done. Procedure should be done under ECG monitor.

Complications
• Injury to heart causing bleeding/ventricular fibrillation.
• Infection.

CARDIAC TAMponade
Accumulation of fluid or blood in the pericardial space causing increase in the intrapericardial pressure is called as cardiac tamponade.

Causes
• Trauma.
• Progressive pericardial effusion due to tuberculosis, viral, bacterial infections.
• Often uraemia can cause significant pericardial effusion.

Clinical Features
• Widened cardiac dullness and hypotension.
• Muffled or decreased heart sounds.
• Increased venous pressure with raised jugular veins.
• Pulsus paradoxus. (pulse becomes weaker on inspiration than expiration).
• In severe cases, heart is unable to expand causing shock and often sudden death.

Investigation
Chest X-ray and U/S confirms the diagnosis. ECG—altered QRS complex.

Treatment
• Pericardial tap as early as possible to allow heart to expand adequately.
• Occasionally open pericardiotomy is required.

PERITONEAL TAP

Indications
• For diagnosis—abdominal tuberculosis, peritoneal secondaries, ascitic fluid study.
• For therapy—in massive Ascites to relieve distress by removing fluid—in malignancy, portal hypertension.

Site
In the spinoumbilical line lateral to rectus abdominis muscle.

Procedure
Patient is asked to empty the urinary bladder. Abdomen is percussed to confirm the dullness in the flank. Site of tapping is marked. Site is below the umbilical level away from the lateral margin of the rectus muscle. Xylocaine 1% injection local anaesthetic is infiltrated. 20 gauge needle is inserted into the peritoneal cavity. Ascitic fluid comes into the syringe. Syringe is connected to the 3 way stopcock to have controlled tapping.

For diagnostic purpose 50 ml of fluid is aspirated. Fluid is sent for culture/cytology/AFB/biochemical analysis.

To relieve distress 1500 ml/day is aspirated. If more quantity is a aspirated sudden hypotension and cardiac arrest can occur. It is always safer to do procedure with an intravenous line with IV fluids flowing.

Complications and Difficulties
• Infection and peritonitis.
• Bleeding—haemoperitoneum.
• Bowel injury.
• Negative tapping—In loculated ascites due to (commonly) abdominal tuberculosis, fluid may not get and so ultrasound guidance is needed to get fluid.
• In females tense Ascites should be differentiated from large ovarian cyst before tapping.
**VASECTOMY**

**Indications**
- For family planning purpose. Consent both partners is needed. Look for any hernia/hydrocele—if present vasectomy should be done along with specific surgeries for these conditions.
- Previously while doing prostatectomy vasectomy is done to prevent retrograde infection of testes.
- In specific diseases like tuberculosis of vas, vasectomy may be done for biopsy purpose.
- There are no specific contraindications for vasectomy but if patient is having hernia or hydrocele, it is better to do vasectomy along with surgery for hernia or hydrocele.

**Types**
- Classical method—Scalpel technique
- No scalpel technique (Shunqiang Li- China)

*Classical method—* After cleaning and draping, 2-5 ml of xylocaine plain 1% is injected into root of the scrotum lateral aspect. Skin, dartos are incised (2-3 cm vertical incision). Once spermatic fascia is incised cord structures are identified. Vas deferens is felt as thickened whitish cord like structure. It is dissected using mosquito artery forceps. It is held using Babcock’s forceps as loop outside the wound. Vas is clamped in two different places with a gap in between using two artery forceps. A piece of the vas (5 mm) is excised. Cut ends are ligated using non-absorbable sutures like silk. Skin is closed with sutures. Procedure is repeated on the other side. Dressing is placed. Sutures removed after 7 days.

*No scalpel technique—* Two special instruments are used here. An extracutaneous ring clamp and Chongquing’s sharpened curved mosquito clamp. After cleaning and draping, xylocaine 2 % of 2-3 ml is injected under the skin of midline raphe proximal aspect. Vas deferens of one side is felt and pushed under the raphe. It is carefully held with extracutaneous ring clamp. Skin is incised using sharp tip of the curved mosquito clamp. Whitish cord like vas which is held with ring clamp is dissected-clamped a small piece of 5 mm is cut. Cut ends are ligated using silk. Opposite vas is also similarly brought into the same wound by manipulation and clamped and ligated after cutting. Skin is not closed. It gets apposed automatically and heals on its own. Often two separate approaches can be used for each side. Postoperatively antibiotics and analgesics are given.

*Advice:* Contraception should be used to have protected intercourse for a minimum 6 weeks/15 ejaculations.

**Complications of Vasectomy**
- Infection, pyocele.
- Bleeding, haematoma, haematocele.
- Sperm granuloma.
- Recanalisation and failure.

**VASO-VASOSTOMY (RECANALISATION PROCEDURE)**

**Indications**
Patient who has underwent vasectomy earlier if needs fertility (one more child) again.

**Technique**
Under general/spinal anaesthesia incision over the front of the scrotum is made. Cord is dissected. Cut ends of the vas are identified. Both ends are carefully mobilized. Cut ends are trimmed to see the clear lumen. Fine 3 zero polypropylene suture material is passed through the lumen to act as a stent. Cut ends are sutured using polypropylene continuous sutures. Stent is brought out through vas and through scrotal skin away from main wound. Skin is closed with sutures. Procedure is commonly done on both sides. stent is kept for 3 weeks and removed. Success rate of vaso-vasostomy is 30%.

**Complications**
- Infection.
- Failure.
**STOMA CARE**

**Definition of Stoma**
Stoma is an artificial opening or ‘mouth like’ to the exterior, the abdominal wall so as to drain the content from the tubular structures inside, like bowel or ureter. It is done for diversion of urine or faecal matter in case of malignancy, trauma, and sepsis or after surgery.

**Types**

- **Ileostomy:** Terminal 5 cm ileum is projected out, on to the skin of abdominal wall to drain semi-liquid, faecal matter.

- **Colostomy:** Colon at different levels, as required can be brought out to the skin as colostomy, to divert faecal matter.

- **Cutaneous ureterostomy:** Cut ends of one or both ureters are apposed to the skin of abdominal wall.

- **Ileal urinary conduit:** Segment of isolated ileum can be used to drain urine from the ureter as urinary ileal conduit. Ureters are anastomosed to a closed ileal conduit. Ileal stoma is brought out as stoma. Different types of continent ileostomies are in use to prevent leak, soaking and discomfort.

- **Vesicostomy:** It is done in children. Here anterior bladder wall is brought out and bladder mucosa is sutured to the skin of abdominal wall.

  - Stoma created may be round (commonly) or square in shape.

![Fig. 7.21: Different types of stoma.](image)

**Preparation and Counselling of the Patient for Stoma**
- Stoma of any type causes to certain extent of psychological and physical trauma to the patient, as it is nonphysiological, distressing and socially not acceptable.
- Patient should be explained about the procedure and should be convinced and consoled about the stoma.
- Detailed meaning, explanation and after care of the stoma should be discussed.
- Indication for the stoma and consent for the same should be taken.
- Reassurance about the stoma, its care, and its position should be diagrammatically explained to the patient and his close relative.
- In case of obstructive disease, stoma is done as an inevitable procedure to relieve the obstruction often it may be temporary.
- Proper bowel preparation by bowel wash, gut irrigation is required before surgery.
- The surgeon selects the site of the stoma. Nurse should be there with surgeon. Stoma is usually sited midway between anterior superior iliac spine and umbilicus.
- It should be away from the belt line.
- It should be away from the scar, creases, and bony points.
- Patient should be assessed for proper size, adequacy for stoma in lying down, sitting, and standing positions.
- Proper stoma appliances should be decided after thorough check up and discussion with patient and patient’s relative.
- Stoma site should be marked properly before surgery.
- Ileostomy is usually sited on the right iliac fossa, colostomy on left iliac fossa.
- Allergy for the particular appliances should be checked for.
- The patient should consult stoma therapist.

**Postoperative Care for the Stoma**
- Stitches are removed in 6-10 days.
- Dressing should be done first over the stoma and after placement of appliance, laparotomy wound is dressed otherwise stoma appliance will not sit properly.
- Patient should be observed for any complications.
• Once wound has healed patient can take bath by removing the appliances. After bath skin is dried up and stoma appliances can be fit again.
• Patient should be taught about the stoma care and its appliances.
• Care and prevention of skin excoriation due to leak is also looked into.
• Psychotherapy is given for the patient.
• Skin should be absolutely dry prior to placing the stoma appliances.

Complications of Stoma
• Skin excoriation.
• Mucosal prolapse
• Stenosis and block.
• Infection either bacterial or candidial.
• Diarrhoea due to irritation.
• Leak due to improper fitting of the appliances, scar, irregularity of stoma, prolapse.
• Bleeding from the stoma edge.
• Herniation of the abdominal contents adjacent to stoma.

Skin Excoriation
It is a major problem in stoma patients. It is basically due to leak adjacent to appliances.

Causes for excoriation:
• Leak due to improper appliances.
• Wet skin before placing the appliance.
• Inadequate stoma hole.
• Improper and inadequate adhesive sheet usage.
• Allergy
• Infection like of bacteria and Candida.
• Altered weight of the patient.
• Stoma bag is overfilled or kinked or air in the stoma bag.

Treatment of excoriation
• Control of infection by antibiotics or control of moniliasis.
• Allergy has to be confirmed, and if it is the cause the agent is found out and treated as required.
• Zinc oxide cream application.
• Change of the type of appliance.
• Refashioning of the stoma.

Stoma Appliances
Stoma appliances are devices, which are used to collect and dispose the effluent materials which come out of the stoma.

Ideal Stoma Appliance
It is:
• Leak proof.
• Should not damage the stoma and surrounding skin.
• Should prevent odor.
• Should be available.
• Easier to use.

Types of Appliances
It can be—
• Closed type is discarded when full and is used in patients with well formed stool.
• Drainable type is used in patients with loose liquid stool. It can be emptied and retained and re used. Immediately after colostomy, drainable appliance is used. Later it can be changed over to closed type.

It can also be—
• One-piece stoma appliance with a bag and adhesive attached system, which adheres to skin around the stoma.
• Two-piece stoma appliance has got a flange with adhesive system and a bag over it, which can be removed and replaced with a new one without disturbing the flange underneath.

Bag can be—
• Transparent, in which fluid can be visualized. It is used in initial period of the stoma.
• Opaque, in which fluid cannot be visualized. It is used eventually later.

General Care and Advice to Patients with Stoma
• Patient can have normal diet. Diet, which regulates the bowel action, is better. Plenty of water is advisable.
• Patient can go for normal work, exercise like sports, swimming, tennis. Stoma appliances suitable for these works are available.
Antidepressants, anticholinergics might cause constipation. So these drugs should be taken carefully.

Using irritant solutions near stoma should be avoided. It may lead to dangerous complications.

Patient can have normal sexual activity.

Patient should have additional stoma bags in hand so as to use if required urgently.

Patient should be aware of different appliances available and should be well versed with its use. He can take the help of the stoma societies.

**ILEOSTOMY**

It is indicated when large bowel is entirely diseased or removed with an unprepared bowel where anastomosis cannot be undertaken like Crohn’s disease, malignancy, large bowel fistulas, gangrene or perforation of colon.

Ileostomy is sited at right iliac fossa in the middle of the spinoumbilical line. Ileum carries unformed liquid stool and so leak, skin changes and requirement of more bags is common.

**ILEAL URINARY CONDUIT**

Isolated ileal loop is used as stoma. Ureters are implanted to this ileal loop. Through this ileal stoma in right iliac fossa in the middle of spino-umbilical line, urine is drained as diversion. Often continent ileal conduits are used.

It is indicated when permanent urinary diversion is required like carcinoma urinary bladder, pelvic malignancies where both ureters are involved.

Initially after procedure, a Foley’s catheter is passed into the stoma for seven days and later a nonreturn valved stoma appliance is used.

**Specific Complications**

- Stomal obstruction and urine block.
- Phosphate deposition and encrustation causing stomal infection and block.
- Urinary tract infection often can be severe leading to septicaemia.

**Fig. 7.23:** Ileal urinary conduit as urinary diversion.

**CAECOSTOMY**

- Caecostomy is placing a tube in to the caecum for temporary drainage of the contents.
- It is done in acute conditions of the colon (as colon is not prepared) like perforation, obstruction, and gangrene.
- It is usually of valvular type and drainage is dependent. Wash with an irrigating fluid can be given. Once tube is removed closure is spontaneous. As the tube is not wide, blockage and inefficient drainage is the problem.
• It is technically easier and better accepted by the patient.
• Permanent caecostomy is not done.
• Other management is like in other stoma care.

**COLOSTOMY**

It is an artificial opening made in the colon to the exterior (skin) to divert faeces and flatus.

**Types**

- **Temporary**: Is done in conditions wherein diversion is required to facilitate healing distally in the rectum or distal colon. And this is closed once the purpose is over.
  - Site of temporary colostomy is usually right hypochondrium and left iliac fossa.
  - It can be loop colostomy or Devine’s double-barrel colostomy (wherein there is a gap between the two openings of colostomy which prevents spillage into the distal loop).

- **Permanent** colostomy is always end colostomy placed in left iliac fossa—6 cm above and medial to the anterior superior iliac spine.

Figs 7.25A to D: Types of Colostomy (A) Temporary colostomy site, (B) Loop colostomy—appearance, (C) Devine’s double barrel colostomy, (D) Permanent end colostomy.
Indications

<table>
<thead>
<tr>
<th>Temporary</th>
<th>Permanent</th>
</tr>
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<tbody>
<tr>
<td>Congenital megacolon</td>
<td>AP-Resection</td>
</tr>
<tr>
<td>Anorectal malformations</td>
<td>Carcinoma anal canal</td>
</tr>
<tr>
<td>Sigmoid volvulus</td>
<td>Hartmann’s operation</td>
</tr>
<tr>
<td>Perforation of left-sided colon</td>
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<tr>
<td>Left sided colonic growth</td>
<td></td>
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<tr>
<td>High anal fistula</td>
<td></td>
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<tr>
<td>Trauma to left sided growth</td>
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</tbody>
</table>

- **In defunctioning colostomy**, loop is brought out and proximal and distal ends are separated completely so as to give complete rest to the distal part.
- **Terminal colostomy** is an end colostomy and is always a permanent one. End of the remained colon is sutured to the skin usually in left iliac fossa.

Colostomy Care

- Similar to stoma care.
- Initially stoma bag should be transparent as content is liquid stool but later it can be opaque.
- Regular consultation with stoma therapist.
- Care of the skin.
- Training for managing colostomy, its care to prevent leak, odor, and discomfort.

Closure of Colostomy

- When temporary colostomy is done, it is closed usually after 3 months. Closure of colostomy is done after proper bowel preparation, under general anaesthesia.
- Proper postoperative care is important. Enema should not be given postoperatively. Patient should perform anal sphincter exercises to prevent sphincter atrophy and to maintain sphincter tone.

THYROIDECTOMY

Types

1. **Hemithyroidectomy**: Along with removal of one lobe, entire isthmus is removed. It is done in benign diseases of only one lobe.
2. **Subtotal thyroidectomy** commonly done in toxic thyroid either primary or secondary and also often for nontoxic multinodular goitre. Here about 8 grams, or a tissue, size of pulp of finger is retained on lower pole, on both sides and rest of the thyroid gland is removed.
3. **Partial thyroidectomy** is removal of the gland in front of trachea after mobilization. It was earlier done in nontoxic multinodular goitre. Now subtotal thyroidectomy is preferred.
4. **Near total thyroidectomy**: Here both lobes except the lower pole which is very close to recurrent laryngeal nerve and parathyroid is removed. It is done in case of papillary carcinoma of thyroid.

5. **Total thyroidectomy**: Entire gland is removed. It is done in case of follicular carcinoma of thyroid, medullary carcinoma of thyroid.

**Procedure**

*Position*: Under general anaesthesia patient is put in supine position with neck extended by placing a sand bag under shoulder—with table tilt of 15° head up to reduce venous congestion.

*Incision*: Horizontal crease incision is done, two finger breadth above the sternal notch, from one sternomastoid to the other. Skin and platysma are incised—upper flap raised upto thyroid cartilage, lower flap up to sternoclavicular joint. Deep fascia is opened vertically in the midline. Strap muscles are retracted or cut in between two Kocher’s forceps. Pretracheal fascia is opened to mobilise the thyroid. First, short stout middle thyroid vein is ligated, and then superior thyroid pedicle is ligated close to the gland so as to avoid injury to external laryngeal nerve. Inferior thyroid artery is ligated away from the gland so as to avoid injury to recurrent laryngeal nerve. Mobilised gland is removed. Bed is sutured with catgut so as to prevent bleeding. Drain is placed. The wound is close in layers.

*Thyroid steal*: Patient is taken to operation theatre for few days before doing surgery so as to reduce the anxiety of the patient.

**Complications of Thyroidectomy**

1. **Haemorrhage**: May be due to slipping of ligatures either superior thyroid artery or other pedicles. It will cause tachycardia, hypotension, breathlessness, and compression over the trachea may cause severe stridor, respiratory obstruction. As a first aid, immediate release of sutures including that of deep fascia has to be done and pressure over the trachea is released. Then patient is shifted to operation theatre, and under general anaesthesia exploration is done and bleeders are ligated. Blood transfusion may be required.

2. **Respiratory obstruction**: It may be due to haematoma (if it is so, the haematoma has to be evacuated), or due to laryngeal oedema. For laryngeal oedema, immediate emergency endotracheal intubation is done along with steroid injections. Often emergency tracheostomy may be required as a life saving procedure.

3. **Recurrent laryngeal nerve palsy**: It can be transient or permanent. Transient is 3% common. They usually recover in 3 weeks to 3 months. Often they require steroid supplement and speech therapy. Permanent paralysis is rare.

4. **Hypoparathyroidism is rare 0.5% common. Mostly it is temporary due to vascular spasm of parathyroid glands, occurs in 2-5th postoperative day. Present with weakness, +ve Chvostek’s sign, carpopedal spasm, convulsions. Serum calcium estimation has to done and then 10 ml of 10% Calcium gluconate is given IV eighth hourly, and later supplemented by oral calcium 500 mg 8th hourly. After 3-6 weeks, patient is admitted, drug is stopped and serum calcium level is repeated.

5. **Thyrotoxic crisis (Thyroid storm)**: occurs in a thyrotoxic patient inadequately prepared for thyroidectomy and rarely a thyrotoxic patient presents in a crisis following an unrelated operation or stress. They present in 12-24 hours with severe dehydration due to circulatory collapse, hypotension, hyperpyrexia, and often cardiac failure.

   Treatment is injection hydrocortisone, oral antithyroid drugs, tepid sponging of whole body, beta blocker injection, oral iodides, large amount of IV fluids for rehydration, digoxin, cardiac monitor, often ventilator support, and observation. It has got high mortality rate.
with critical period of 72 hours. Fluid and electrolyte management, cardiac management are important aspects to be monitored and treated.

6. Injury to external laryngeal nerve causes weakness of cricothyroid muscle leading to alteration in pitch of voice.

7. Hypothyroidism. Revealed clinically after 6 months.

8. Wound infection, stitch granuloma formation.


**CRYOSURGERY**

- It is the destruction of tissues by *controlled cooling*.
- System contains an automatic defrosting device with a cryoprobe.

*Gases used are*

2. CO₂—minus 60°.
4. Freon—minus 190°.
- Commonly used is nitrous oxide as it is easily available, cheaper and achieves optimum temperature required for different procedures.

**Mode of Action**

1. It produces intracellular crystallization, dehydration and denaturation of proteins and cell death.
2. It causes the obliteration of microcirculation and so cell death.

**Indications**

- To remove warts and lesions in the skin.
- Cryotherapy for piles.
- For chronic cervicitis.

**Advantages**

- Relatively bloodless and painless.
- Adequate control of extent and depth in freezing.
- Equally effective.

**Disadvantages**

- Infection.
- Discharge from the site.

**LASERS IN SURGERY**

(*Light Amplification Stimulated Emission of Radiation*)

Molecules are placed in a compact area and power is passed through this so as to activate the molecules. Molecules get activated at different periods and move in different directions, which they hit to each other releasing energy. This energy is allowed to act through optical system to the area wherever required.

- Depending on the molecules used it is named.
- Argon Laser.
- Yttrium-Aluminium Garnet Laser (YAG Laser).
- CO₂ Laser.
- Neon Laser.
- Holmium laser.
- Erbium laser.

**Uses of Laser**

- In *cranial surgery* in children.
- In *ENT* to treat vocal cord lesions, Laryngeal lesions.
- In *ophthalmology* it is very useful in retinal surgery like for detachment,
  - Iridotomy,
  - Dacrocystitis,
  - Capsulotomy,
  - To liquefy human lens,
  - In glaucomas, etc.
- In *General surgery*:
  - In bleeding duodenal ulcer.
  - For palliative decoring of tumors in carcinoma oesophagus.
  - In carcinoma rectum.
  - In haemorrhoidal treatment (1st and 2nd degree).
  - In bladder tumour resection.
  - In cervical cancer.
  - To achieve bloodless field.
  - In varicose veins – Endo Venous Laser Ablation (EVLA)
• Often in making incisions in abdomen and other places.

**Advantages of Laser**

• Blood less field.
• Faster.
• Small lesions can be removed easily and completely.

**Precautions**

• All reflecting instruments should be avoided otherwise laser will reflect and can injure normal tissues or the working team in the OT itself.
• All should wear protective spectacles to protect their eyes.

**Disadvantage**

Availability and cost factors.

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**STAPLERS IN SURGERY**

Staplers are used for apposition of tissues. Used in skin, bowel, lungs, etc.

**Types**

1. **Cutaneous staplers** give clean apposition. It is faster and technically easier. Problem is removal requires specific instrument and costlier than sutures.
2. **Linear staplers** are used to close the bowel either completely or partially.
3. **Circular staplers** also called as EEA Stapler—End to End Anastomosis. It is commonly used for colorectal anastomosis in Anterior resection for carcinoma rectum, oesophagogastric anastomosis after oesophagogastric resection in case of carcinoma at O-G Junction.

Parts are staple gun, and cartridge with two rows of staple pins for apposition. Loaded cartridge is detachable. Cut ends of bowel are placed over **gun and cartridge**. Once gun is shot, cartridge moves to the gun and creates anastomosis.

4. **GIA stapler** (Gastrointestinal anastomosis stapler) for side to side anastomosis like small bowel or ileo-colic anastomosis.

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**DIATHERMY (ELECTROCAUTERY)**

It is the method to control bleeding or to cut the tissues during surgery.

**Types**

*Based on type of current.*

1. Unipolar cautery.
2. Bipolar cautery. It is safer because its effect is seen only in between electrode points. Adjacent tissues will never get damaged.
Based on type of action:
1. **Coagulation cautery** which causes haemostasis by tissue coagulation. Here temperature is 100 degrees.
2. **Cutting cautery**: Here temperature is 1000 degrees which disintegrate the tissues. It is not haemostatic.
3. **Blended current** is combination of both coagulation and cutting.

**Uses**
- For coagulation of bleeders during surgery to achieve haemostasis.
- To cut muscles, fascia, etc.
- It is essential for laparoscopic surgical procedures. Bipolar is commonly used.
- It is used to remove small cutaneous lesions, to control bleeding duodenal ulcer.

**Disadvantages**
- Infection.
- Cauterization of normal tissues.
- Explosive problems.
- Diathermy burn to the patient where diathermy plate is kept.
- Burn injury or electrical shock to surgeon and assisting personnel.

**Precautions**
- Proper earthing.
- Avoid loose contact of electrodes.
- It should be kept off when not in use during procedure.

**LAPAROSCOPIC SURGERY**

**History**
- First laparoscopic cholecystectomy is done by Muhe of Germany in 1985 and by Mouret in Lyon in 1987.
- McKeran and Saye performed first laparoscopic cholecystectomy in USA in 1988.
- First laparoscopic appendicectomy was done by Semm as prophylaxis.
- First laparoscopic appendicectomy for acute appendicitis was done by Schreiber 1987.

- Semm changed 75% open gynaecological surgeries into laparoscopic surgeries.
- Prof. TE Udwadia, Mumbai did first laparoscopic cholecystectomy in India.

**Advantages of Laparoscopic Surgery**
- Relatively less painful compared to open surgery. Trauma of assess is very less.
- Shorter hospital stay and early return to work.
- Faster postoperative recovery.
- Better visualization of the anatomy ie. better approach for dissection and visualization of other parts of abdomen for any other pathology
- Instrumental assess to different abdominal locations is better many times compared to open method.
- Minimal scar in the abdomen.

**Instruments Used**
- Zero degree laparoscope is commonly used. Side viewing scopes are also used to have better visualization.
- Cold light source either Halogen lamp or Xenon lamp is used. Halogen lamp is used commonly and is cheaper. Xenon lamp gives high visualization.
- Camera: 3 chip camera is commonly used with high resolution.
- Video-monitor to display images.
- CO₂ insufflator.
- Long fine dissectors like in open surgical techniques.
- Hooks and spatulas are used along with cautery for dissection.
- Clip applicators.
- Needle holder.
- Endostapler.
- Veress needle.
- Suction-irrigation apparatus.
- Trocars of different sizes—10 mm, 5 mm.
- Reducers to negotiate smaller instruments through larger ports.

**Preparation**
Always general anaesthesia. Other preparations are same as for open method.
Technique

- Pressure bandages are applied to both legs to improve the venous return and to decrease the stasis.
- Head end of the table is lowered to have easier insertion of veress needle and scope.
- Ryle’s tube and Foley’s catheter are must before insertion of the trocars.
- Pneumoperitoneum is created using veress needle through umbilical incision. Assess can be achieved by open method through an umbilical incision.

**CO₂ is used to create pneumoperitoneum commonly.**
- It is readily available.
- It is cheaper.
- It suppresses the combustion.
- It is easily absorbed by tissues.
- It has a high diffusion coefficient.
- It is quickly released via respiration.

Other gases used are: Air, Nitrous oxide, Helium, Argon.

Pneumoperitoneum is created up to 15 mm Hg which distends the abdominal cavity adequately to have proper visualization of the abdominal contents.

- Laparoscope is inserted through the umbilical port (10 mm). Abdomen is evaluated for pathology. Liver, gallbladder, pelvic organs are visualized.
- Additional ports (3-4) through trocars depending on the procedure to be done are placed. It may be either 5 mm port or 10 mm port. These ports are placed in such a way to have a proper triangulation of instruments for dissection.
- To use clip applicator 10 mm port is required.

Physiologic Changes due to Pneumoperitoneum

- CO₂ causes hypercarbia, acidosis and hypoxia.
- Pneumoperitoneum due to pressure on the IVC decreases the venous return and so the cardiac output.

- It increases the arterial pressure also.
- It compromises the respiratory function by compressing over the diaphragm impairing the pulmonary compliance.

Complications

- CO₂ Narcosis and Hypoxia.
- Sepsis – Subphrenic abscess, Pelvic abscess, septicemia.
- IVC compression.
- Bleeding.
- Leak from the site, e.g. bile leak.
- Organ injury during insertion of ports, e.g major vessels, bowel, mesentery, liver.
- Subcutaneous emphysema and pneumomediastinum formation.
- Gas emboli though are rare but fatal.
- Postoperative shoulder pain due to diaphragmatic irritation.
- Cardiac dysfunction due to decreased venous return.
- Injury to the abdominal wall vessels and nerves.
- Cautery burn to abdominal structures.
- Abdominal wall hernias.
- Wound infection.
- Mortality — 0.5 %.

Relative Contraindications

- Cardiac compromised patient.
- Peritonitis patients.
- Previous abdominal surgeries.
- Bleeding disorders.
- Morbid obesity.
- Pregnancy in third trimester.
- Portal hypertension.

Basic Laparoscopic Surgeries

- Laparoscopic cholecystectomy.
- Laparoscopic appendicectomy.

**LAPAROSCOPIC CHOLECYSTECTOMY**

Fig. 7.28: Ports for laparoscopic cholecystectomy

**Indications**
- Gallstones—symptomatic.
- Cholecystitis.
- Biliary colic.

**Relative Contraindications**
- End-stage cirrhosis, ascites or portal hypertension.
- *Cholangitis*: Cholecystectomy should be done after control of cholangitis.
- *CBD stones*: Here initially ERCP and stone extraction is done from CBD then laparoscopic cholecystectomy is done.

**Technique**
After pneumoperitoneum, patient is placed in head up and slight left tilt position so as to make bowels to fall below and towards the left side. One 10 mm trocar is placed at umbilicus and through this umbilical port, laparoscope is passed. One 10 mm port in the epigastric region and two 5 mm ports in the right subcostal line are placed for grasping the gallbladder and for dissection. Initially, through the working channel gall bladder is held and Calot’s triangle is dissected. Cystic duct and cystic artery are clipped.

An intraoperative cholangiogram, done with C-Arm, will help. Through the epigastric port, clips or ligatures are applied to the cystic duct and cystic artery, close to the gall bladder. Care should be taken to avoid bleeding and not to injure or clip the CBD or hepatic ducts. Gall bladder is separated from its bed using cautery and spatula and removed through the epigastric port. Abdomen may be drained. Patient is discharged after 48-72 hours.

**Complications**
- CBD injury.
- Bile leak.
- Haemorrhage.
- Postoperative jaundice.
- Subphrenic and other intraabdominal abscess.
- Septicaemia.
- *When problem arises one should be ready to convert into open cholecystectomy. Conversion rate to open cholecystectomy is 2-10%. It is indicated when there is uncontrolled bleeding, dense adhesions, suspect CBD injury, when anatomy is indistinct.*
- When required one should not be hesitant to do conversion.

**LAPAROSCOPIC APPENDICECTOMY**

**Indications**
Acute appendicitis. Here main advantage is confirmation of the diagnosis. Other parts of the abdomen are also visualized.

**Relative Contraindications**
Appendicular mass and abscess.

**Technique**
Laparoscope is passed through the umbilical port. Two additional ports are placed one in lower midline (5 mm), another at right lumbar region. Mesoappendix is clipped or cauterized using bipolar cautery. Appendix base is clipped or ligated using Roeder knot and ligature.

**Complications**
- Appendicular stump leak.
- Pelvic abscess.
- Bleeding.
- Injury to caecum, ileum.
ADVANCED LAPAROSCOPIC SURGERIES

- Presently most of the abdominal surgeries can be done through laparoscopy.
- It requires advanced technology, skill. Surgeon should be expert in doing intracorporeal and extracorporeal knotting.

Procedures done are:
- Laparoscopic hernia repair.
- Laparoscopic splenectomy.
- Laparoscopic fundoplication.
- Laparoscopic vagotomy and gastrojejunostomy.
- Laparoscopic Nissen’s fundoplication.
- Laparoscopic colectomy.
- Laparoscopic hysterectomy. It is becoming very popular.
- Laparoscopic urologic surgeries.
- Laparoscopic paediatric surgeries.

DIAGNOSTIC LAPAROSCOPY

Indications
- Acute pelvic conditions.
- Tubal pregnancy.
- Ovarian diseases.
- Infertility.
- Staging of the malignancy.
- Biopsy from the tumours.
- Chronic pain abdomen where U/S, endoscopies, barium studies are negative then diagnostic laparoscopy is useful.

Advantages
- Laparotomy is avoided.
- Once diagnosis is made, therapeutic procedure can be carried out also in the same sitting.

RETOPERITONEOSCOPY

It is becoming popular in urology to assess kidney, ureter, adrenals for various urologic procedures.

Through a small loin approach, retroperitoneum is expanded by inflating balloon in the space. Once space is created different ports are placed to do dissections.

Procedures
Procedures done through retroperitoneoscopy are:
- Nephrectomy.
- Pyeloplasty.
- Adrenalectomy.
- Pyelolithotomy.
- Uretero-lithotomy.
- Retroperitoneal lymph node dissection (RPLND).

Complications
- Injury to vessels.
- Paralytic ileus.
- Bowel (colon) injury.

Advantage
Complications of pneumoperitoneum is not present and so respiratory reserve is well maintained.
Different Abdominal Incisions

1. Upper midline.
2. Upper right paramedian.
3. Upper left paramedian.
4. Kocher’s incision (right subcostal).
5. Left subcostal.

7. Upper horizontal.
8. Thoracoabdominal.
10. Incision for lumbar sympathectomy.
11. Lower midline.
12. Lower right or left paramedian.
13. Incisions for appendicectomy—Macburney’s, Rutherford Morrison’s, Lanz, Laparoscopic.
15. Lower horizontal.
17. Mercedes Benz extension incision.
18. Groin incision.

Factors Affecting the Incisions

- Type of surgery—emergency or elective.
- Sepsis.
- General condition of the patient.
- Age of the patient.
- Nutrition.
- Type of closure.
- Suture materials used.
- Postoperative management.
- Chronic diseases like cough, vomiting.

Upper incisions are always better. Horizontal incisions are better.

- Abdominal incisions should be of adequate length to expose and perform the surgery effectively. Skin, subcutaneous tissue, two layers of superficial fascia, anterior rectus sheath, posterior rectus sheath and peritoneum should be opened in the line of incision. While opening the peritoneum, care must be taken not to injure the bowel content and so it should be lifted properly using artery forceps and felt for any content and then opened. Rectus muscle in vertical paramedian incisions is separated from its medial aspect to reach the posterior rectus sheath.
- Lateral side of rectus muscle if approached is called as Battle’s incision which should not be practiced as it denervates the rectus muscle.
Complications of Abdominal Incisions
- Wound infection.
- Haematoma in the wound.
- Burst abdomen – serosanguinous discharge with feeling of given way is typical.
- Fistula through main wound
- Incisional hernia

GASTROSTOMY
It is done if feeding is required more than one month.

**Indications**
- Severe malnutrition
- Major surgeries
- Severe sepsis
- Trauma
- Head and neck surgeries

Fig. 7.31: Tension sutures placed to prevent burst abdomen.

**Types**
- Based on duration of use:
  - Temporary
  - Permanent
- Based on lining:
  - Mucus lined (permanent).
  - Serosal lined (Temporary).
- Based on technique:
  1. **Stamm’s Temporary Gastrostomy** done after opening the abdomen, anterior wall of the stomach is opened. Feeding tube (Malecot’s catheter) is placed in position. Two layers of purse string sutures are put around the tube. Wound is closed.
  3. Percutaneous endoscopic gastrostomy.
  4. Janeway’s mucus lined permanent gastrostomy by creating tunnel in stomach wall.

Figs 7.32A and B: Types of gastrostomy: (A) Temporary gastrostomy (B) Permanent gastrostomy.

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  3. Percutaneous endoscopic gastrostomy.
  4. Janeway’s mucus lined permanent gastrostomy by creating tunnel in stomach wall.
Problems in gastrostomy
- Leak
- Infection
- Aspiration and pneumonia

Contraindications
- Previous gastric surgeries.
- Intestinal obstruction.
- Gastric outlet obstruction.

JEJUNOSTOMY
Jejunostomy for enteral nutrition becoming more popular because of—
- its comfort,
- easy to do,
- can be kept for long time,
- lesser complication than gastrostomy.
- Indications are same as gastrostomy.

GASTRECTOMY
Types
1. Billroth I is done for benign condition. Here along with partial gastrectomy, gastroduodenostomy is done.
2. Billroth II is done for carcinoma stomach. After partial gastrectomy, gastrojejunostomy is done and duodenal stump is closed.
3. Lower radical gastrectomy is done in early carcinoma pylorus. Here along with the growth and proximal 5 cm of stomach, omentum, lymph nodes, spleen with tail of pancreas is removed and Billroth II anastomosis is done.
4. In growth of upper part or O-G junction, upper radical gastrectomy is done along with oesophago-gastric anastomosis.
5. In some cases like linitis plastica, total gastrectomy along with oesophago jejunal anastomosis is done.

Types
- Witzel jejunostomy: Site of placing jejunostomy is 30 cm from duodenojejunal junction.
- Needle jejunostomy using catheter of small gauge.

Indications
- Chronic benign gastric ulcer.
- Benign tumors of stomach (Leiomyoma).
- Carcinoma stomach.
- Stomal ulcer.
- Bleeding ulcer.
Procedure
Abdomen is opened through upper midline incision. Tumour is felt and explored. Liver, omentum, tumor fixity, rectovesical pouch, nodes in mesocolon are looked for. Omentum is mobilised and detached from colon. Kocherisation is done by mobilising second part of the duodenum. Right gastric artery is ligated. Left gastroepiploic artery is also ligated. Care should be taken not to injure middle colic artery. Stomach is divided using linear cutter stapler at duodenal stump. Alternatively it can be divided using crushing clamp at gastric side and occlusion clamp at duodenal side and duodenal stump is closed using 2 zero vicryl sewing machine sutures. Stomach is lifted upwards and descending branch of left gastric artery is ligated securely. Large occlusion clamp is applied and stomach is divided after applying crushing clamp on the tumor side. New lesser curve is created often with a valve using vicryl single layer sutures. Billroth II or any of its modification type of gastrojejunalostomy anastomosis is done. Often a jejuno jejunalostomy is added to prevent possible duodenal leak. Corrugated or tube drain is kept on right subhepatic pouch for 5 days.

Complications
- Bleeding.
- Bile leak.
- Duodenal blow out.
- Gastric fistula.
- Dumping syndrome.
- Anaemia.

CHOLECYSTECTOMY (OPEN)
Indications are similar to laparoscopic cholecystectomy.
Preparation is similar like for obstructive jaundice or any other laparotomy. Incision is right subcostal Kocher’s incision. Nasogastric tube should be passed. After opening the abdomen, contents are explored. One mop is kept over the stomach and retracted medially; another over the colon and retracted below. One more under surface of the liver margin and retracted above using Deaver’s retractor. Gallbladder is held using gallbladder holding or sponge holding forceps and retracted outwards towards the wound. Hartmann’s pouch is held with Babcock’s forceps (Hartmann’s is pathological infundibulum of the gallbladder). Calot’s triangle dissected carefully using peanut, scissor and long artery forceps. Cystic duct is identified and dissected carefully. Cystic artery is also identified above that and dissected. Anomalies and variations of cystic duct like low insertion, insertion into right hepatic duct etc are common and should be remembered. Cystic duct is doubly ligated using silk or vicryl single layer sutures. Gallbladder is mobilized from liver bed using cautery and suction. Small bleeders in gallbladder bed of the liver are cauterized. Ligated cystic duct is cannulated along with a syringe. Air bubble should not be there in the cannula/needle or syringe (if present it will be mistaken for a radiolucent stone in C ARM or X-ray). Water soluble iodine dye is injected into the CBD through this cannula. Any stone if present in CBD appears as radiolucent area. It indicates that choledochotomy should be done. Other indications are – palpable stone in CBD; dilated Figs 7.35A to C: Gastrectomies for carcinoma stomach at different locations (A) Lower radical gastrectomy (B) Upper radical gastrectomy (C) Total radical gastrectomy
CBD more than 10 mm; recent jaundice; US shows CBD stone or when in doubt.

*In difficult gallbladder – fundus first method* is used. Fundus is separated from liver bed and dissected towards the Calot’s triangle. Carefully cystic duct is dissected and ligated. In difficult situations, mass ligature of cystic duct and cystic artery is also done. *Subtotal cholecystectomy* is done when it is not possible to dissect the gallbladder near Hartmann’s pouch.

Drain is placed in subhepatic pouch (tube/corrugated). Wound closed in layers.

**Complications**
- Injury to common bile duct, common hepatic artery, duodenum.
- Biliary fistula.
- Abscess formation–subphrenic/local/pelvic.
- Waltermann Waltmann syndrome–collection of fluid in the subhepatic pouch/gallbladder bed which is compressing on IVC causing cardiac symptoms.
- Obstructive jaundice.
- Sepsis, septicaemia and its problems.
Definitions of Common Terminologies in Surgery

Abscess—localized collection of pus in a cavity lined by granulation tissue covered by pyogenic membrane.

Achalasia cardia—a neuromuscular disorder where there is dilatation of oesophagus without stenosis.

Acute rejection—occurs during the first 3 months of transplantation characterised by mononuclear cell infiltration of the graft.

Agraphia—loss of power of writing without paralysis of muscles of writing.

Amoeboma—extensive reaction leading to granuloma formation in response to amoebic mucosal invasion.

Anchovy sauce—chocolate-coloured pus in amoebic liver abscess.

Aneurysm—dilatation of localized segments of arterial system.

Angular stomatitis—moist, infected reddish brown fissure at the angle of the mouth.

Anhidrosis—lack of sweating.

Ankylosing spondylitis—chronic inflammatory condition involving mainly sacroiliac joints and spine, where the intervertebral disc is replaced by vascular connective tissue that undergoes ossification.

Annular pancreas—developmental anomaly where there is a ring of pancreatic tissue surrounding the 2nd or 3rd part of duodenum due to failure of complete rotation of ventral pancreatic duct.

Anorexia—lack or loss of appetite for food.

Aphagia—complete oesophageal obstruction, which is usually due to bolus impaction and represents a medical emergency.

Appendicitis—inflammation of appendix, may be acute or chronic.

Appetite—physical desire for food.

Ascites—collection of excess serous fluid in peritoneal cavity.

Atelectasis of lung—collapse of one or more segments of lung following blockage of some part of bronchial tree commonly with inspissated mucus plug.

Atheroma—subendothelial plaques seen in arteries near bifurcation or at the origin of major branches in atherosclerosis.

Atherosclerosis—degenerative disease of the arteries, mainly large and medium sized, characterised by accumulation of lipids and fibrous tissue in intima along with smooth muscle proliferation.

Auriculotemporal syndrome—flushing, sweating and pain over the parotid area due to injury to the auriculotemporal nerve with subsequent regeneration.

Bacteraemia—presence of bacteria in blood with no clinical manifestation.
Barrett’s oesophagus—metaplasia of mucosal lining of oesophagus in response to chronic gastroesophageal reflux.

Balanoposthitis—infection of the glans penis and prepuce sac.

Branchial cyst—cystic swelling seen in the upper part of the neck, develops from the persistent embryonic cervical sinus.

Brodie’s abscess—chronic abscess in the metaphyseal region of the bone surrounded by dense sclerotic bone.

Burn—coagulative destruction of surface layers of the body.

Bursae—endothelial-lined, containing little fluid present between tissues that slide past each other and help to decrease the frictional force.

Cachexia—a profound, marked state of constitutional disorder, general ill health and mal-nutrition (cancerous, cardiac, fluorosis, hypophysial).

Callosity—localised, superficial, circumscribed, thickened part of skin seen over region of friction.

Cancer-en-cuirasse—skin over the chest is infiltrated with multiple cancerous nodules resembling like a coat of armour.

Caput medusae—veins seen radiating from the umbilicus in the anterior abdominal wall, indicates obstruction in porto-systemic circulation.

Carbuncle—infective gangrene of the subcutaneous tissue caused by infection from a hair follicle.

Caroli’s disease—congenital dilatation of the intrahepatic biliary ducts.

Cellulitis—nonsuppurative, superficial spreading inflammation of skin and subcutaneous tissue.

Chemodectoma—tumour arising from chemoreceptor cells on medial side of the carotid bulb.

Chemosis—oedema of conjunctiva.

Cholecystitis—inflammation of gallbladder, may be acute or chronic.

Chronic rejection—occurs very slowly, over months after the grafted organ has started functioning normally, mediated by antibodies and T cells.

Chylocele—presence of chyle in the sac of Tunica vaginalis.

Chylothorax—accumulation of chyle in the pleural space.

Chylous ascites—accumulation of chyle in abdominal cavity often seen in lymphomas, adenocarcinoma that causes lymphatic obstruction.

Chyluria—passage of chyle in urine, probably due to development of fistulous connection between lymphatics and urinary tract.

Claudication distance—distance the person can walk before the onset of claudication pain.

Claw foot—there is increased concavity of the arch of foot.

Cleft lip—occurs due to failure of fusion of median nasal process and maxillary process.
Cleft palate—occurs due to incomplete fusion of premaxilla and palatine processes.

Clubbing—bulbous enlargement of soft parts of terminal phalanges, with both transverse and longitudinal curving of the nail.

Colostomy—artificial opening made into the large bowel in order to divert its content into exterior, may be permanent or temporary.

Commensals—non-pathogenic organisms that invade body surfaces like skin, mucus epithelial lining of nose, pharynx, larynx, GIT, anterior urethra, vagina, and conjunctival sac.

Condyloma acuminata—warts or papilloma caused by HPV.

Condyloma lata—raised, flat, white, hypertrophied epithelium seen in secondary stage of syphilis at muco-cutaneous junction.

Constipation—persistent, difficult, infrequent or seemingly incomplete defaecation. Stool frequency is not the sole criteria for diagnosis of constipation.

Corn—circumscribed, horny thickening, with central core being pushed into the skin, formed over areas under extreme pressure, often painful.

Cretinism—hypothyroidism in infants.

Cyanosis—bluish discolouration of the nail due to increased amount of reduced Hb in capillary blood.

Cystic hygroma—swelling in the neck, due to sequestration of jugular lymph sac from lymphatic system.

Dactylitis—infection of phalanges and metacarpals.

Dental cyst—painless, cystic swelling with eggshell crackling occurring in relation to normal erupted pulpless, dead tooth.

Dentigerous cyst—circumscribed painless smooth swelling occurring at the site of unerupted tooth.

Diarrhoea—passage of abnormally liquid or unformed stools at an increased frequency; acute if <2 weeks, persistant if 2-4 weeks, chronic if >4 weeks.

Diverticulosis—acquired herniation of mucosa through the circular muscle at the points of penetration of blood vessel.

Dysorexia—impaired or deranged appetite.

Dysphagia lusoria—dysphagia caused by compression of oesophagus by congenital vascular anomalies.

Dysphagia—sensation of ‘sticking’ or obstruction of the passage of food through mouth, pharynx or oesophagus.

Ectopia vesicae—congenital defect or failure in formation of anterior wall of allantois and lower anterior abdominal wall exposing the posterior wall of bladder.

Ectopic testis—one which has deviated from its usual path of descent.
Elephantiasis neuromatosa—severe form of plexiform neurofibromatosis involving the subcutaneous nerves of the limbs.

Emesis (vomiting)—oral expulsion of gastrointestinal contents resulting from contraction of gut and thoraco-abdominal wall musculature.

Empyema necessitatis—pus of empyema burrows throws chest wall and becomes superficial presenting on either anterior or lateral aspect.

Empyema thoracis—collection of purulent fluid between parietal and visceral layers of pleura.

Encephalocele—protrusion of brain.

Endemic goitre—increased goitre prevalence in children in 6-12 years, greater than 10%.

Epididymo-orchitis—inflammation of epididymis and testis.

Epispadias—external urinary meatus opens on the dorsal surface of the penis.

Epulis—tumour arising from mucoperiosteum of gums.

Erysipelas—diffuse cuticular infection associated with inflammation of the superficial lymphatics.

Erythroplakia—when red area is predominant in leucoplakia.

Ewing's tumour—primary malignant tumour of bone arising from the metaphysis, commonly seen in childhood.

Exophthalmos—forward protrusion of eyeball as a result of cellular infiltration of retro-orbital space leading to retraction of eyelid, lower first followed by upper, seen in thyrotoxicosis.

Fissure-in-ano—ulcer in the skin lined part of anal canal.

Fistula—a track that is lined by granulation tissue may be epithelialised, communicating two hollow viscera or a hollow viscus to surface.

Fistula-in-ano—a track that is lined by granulation tissue connecting an external opening on the perianal skin to an area in the depth of the anal canal or rectum.

Flatulent dyspepsia—feeling of fullness after food with belching and heart burn often seen in gallbladder disease.

Galactocele—cystic lesion of the breast, as a result of blockage of one of the main lactiferous duct, containing milk that has inspissated.

Ganglion—localised, painless subcutaneous cystic swelling commonly over the dorsum of the hand.

Gangrene—death of body part with putrefaction and loss of function.

Gastroparesis—delay in emptying of food from stomach.

Globus pharyngeus—sensation of lump lodged in the throat, however, no difficulty is encountered while swallowing.

Goitre—diffuse or nodular enlargement of thyroid usually resulting from a benign process or a process of unknown origin.
Guarding—involuntary muscle rigidity or stiffness indicating underlying parietal peritonitis.

Gynaecomastia—here male breast resembles a female breast.

Haematemesis—vomiting of blood, caused by bleeding in upper GI tract, may be bright red or dark coloured taking the typical coffee ground colour.

Haematocele—haemorrhage into the tunica vaginalis testis.

Haematochezia—bright red blood from rectum that may or may not mix with stools.

Haemorrhoids—varicosities of the veins of the anal canal.

Haemothorax—blood in pleural space.

Haitus hernia—prolapse of part of stomach into the thoracic cavity through oesophageal haitus.

Hallux rigidus—painful, rigid great toe due to osteoarthritis of 1st metatarsophalangeal joint.

Hallux valgus—valgus displacement of great toe.

Hard chancre—occurs in primary syphilis, over external genitalia nipple, lips, which has characteristic indurated base, with regional lymph nodes enlarged and discrete showing no signs of suppuration.

Heart burn—burning sensation behind the lower part of sternum radiating up to the neck.

Heberden’s nodes—small pea-like swelling seen in the terminal interphalangeal joints of fingers due to osteoarthrosis.

Hemianopia—blindness in one half of each visual field.

Hepatomegaly—enlargement of liver.

Hernia—protrusion of whole or part of viscus through the wall that contains it.

Hiccup—brought by spasmodic contraction of diaphragm.

Horseshoe kidney—lower poles of kidneys are joined by fibrous band or renal tissue.

Hour-glass stomach—occurs due to cicatricial contracture around a saddle-shaped lesser curve ulcer.

Hunger pain—pain seen in chronic duodenal ulcer, below xiphisternum about 1½ to 4 hr after meal, relieved by taking food.

Hydrocele—is abnormal collection of serous fluid within the sac of tunica vaginalis testis.

Hydrocephalus—increased amount of CSF under tension in the cerebral ventricles.

Hydrohepatosis— gross dilatation of intrahepatic biliary canaliculi filled with white fluid.

Hydronephrosis—aseptic dilatation of pelvis and calyces of the kidney due to obstruction to the flow of urine.

Hyper-acute rejection—occurs within minutes of transplantation and is due to destruction of the transplanted organ by pre-existing antibodies in the recipient.

Hypersplenism—enlargement of spleen with depletion of one or more blood cells that can be corrected by splenectomy.
**Hypospadias**—external urinary meatus opens on the undersurface of the penis.

**Impotence**—inability to achieve and maintain an erection, sufficient for intercourse.

**Incidentalomas**—adrenal tumours incidentally found either by ultrasonography or by CT scan performed for other disorders of abdomen.

**Infection**—invasion of tissues by pathogenic organism (bacteria/virus/fungi).

**Intermittent claudication**—cramp-like pain that develops on exercise in muscles of calf (commonly), thighs, buttocks due to accumulation of metabolites and, relieved by rest.

**Intestinal obstruction**—interference in the normal forward progression of intestinal contents.

**Intestinal pneumatosis**—gas-filled cysts are formed under the mucosa and submucosa of intestine.

**Intussusception**—invagination of one part of bowel into the next part, often occurs in forward direction.

**Involucrum**—new bone formation from periosteum in osteomyelitis.

**Jaundice**—yellowish discolouration of skin, tissues and body fluids due to increased bile pigments (normal serum bilirubin—1 mg%, direct—0.25 mg%, indirect—0.75 mg%).

**Keloid**—overgrowth of scar tissue extending beyond the original wound site.

**Latent stone**—stone in post-prostatic pouch or diverticula does not produce typical feature of stone but revealed only X-ray or cystoscopy.

**Leiomyoma**—benign tumour of smooth muscle.

**Leucoplakia**—white hyperkeratotic patch in the mouth or penis which may be small, well circumscribed or wide extensive lesion.

**Lid lag**—eyelid cannot keep pace with eyeball when it looks down following the instruction of the examiner.

**Lid retraction**—upper eyelid is higher than the normal.

**Ligaments**—tissues that provide stability to joints, and transmit tensile force across the joints.

**Lipoma**—benign tumour of mature fat cell.

**Lumbar spondylosis**—degenerative condition involving both disc space and intervertebral joints.

**Lung abscess**—localized area of suppuration and cavitation within the lung substance.

**Lymph scrotum**—dilatation and tortuosity of cutaneous lymphatics of scrotum.

**Lymph varix**—dilatation of lymph vessels of spermatic cord.

**Lymphangioma**—localised cluster of dilated lymph sac seen in the skin and subcutaneous tissue, of congenital origin, does not communicate with normal lymph system.

**Lymphoedema**—interstitial oedema of lymphatic origin.

**Lymphomas**—neoplastic alteration in lymphoreticular tissues.
Macrocheilia—hypertrophy of lip.

Macrostoma—abnormally large oral orifice due to imperfect fusion of mandibular and maxillary processes.

Major histocompatibility antigens—important antigens, which are glycoprotein molecules present on all somatic cells, responsible for graft rejection.

Mallet finger—persistent flexion of terminal phalanx due to rupture of extensor tendons.

Mallory-Weiss syndrome—disruption of mucosa and submucosa of the upper end of the stomach after a bout of forceful retching.

March fracture—stress fracture affecting 2nd metatarsophalangeal joint.

Mechanical dysphagia—dysphagia caused due to obstruction by a large bolus.

Meconium ileus—small bowel obstruction seen in infants due to inspissated meconium resulting from inadequate secretion of pancreatic and intestinal enzymes.

Melanoma—malignant tumour of melanocyte of neural crest in origin.

Meningioma—benign tumour arising from arachnoid villi.

Meningitis—inflammatory reaction in the meninges following growth of bacteria in CSF.

Meningoencephalocele—protrusion of meninges and brain.

Meningocele—protrusion of meninges.

Metatarsus adductus—forefoot is adducted with normal hindfoot.

Micrognathism—congenital deformity where mandible is very small.

Microstoma—abnormally small oral orifice due to excessive fusion of mandibular and maxillary processes.

Motor aphasia—loss of power of speech without paralysis of muscles of speech.

Multiple myeloma—malignant tumour of bone marrow.

Nausea—subjective feeling of need to vomit.

Necrosis—microscopic cell death.

Neurilemmoma—benign tumour arising from Schwann cell of neurilemma.

Neuroblastoma—tumour arising from immature nerve cells of the sympathetic nervous system of adrenal and extra adrenal sites.

Neurofibroma—benign tumour containing both neural and fibrous components.

Nystagmus—involuntary oscillation of eyeball.

Odonophagia—painful swallowing.

Odontomes—tumour arising from tooth germs.
Oedema—collection of fluid in the interstitial space and serous cavities, becomes evident only when 5-6 litres of fluid has accumulated. Pitting on pressure is evident when the circumference of limb increases by 10%.

Onychogryphosis—thickened crooked overgrowth of toe nail.

Onychomycosis—fungal infection of nail.

Osteosarcoma—primary malignant tumour of bone arising from the metaphysis, commonly seen in adolescent age.

Osteomyelitis—acute inflammatory process in the bone commonly occurring in the metaphysis.

Pallor—paleness of skin and mucous membrane, due to diminished circulating RBCs or blood supply.

Palmar erythema—bright red warm palms, which blanches on pressure.

Pancreatic pseudocyst—collection of fluid in lesser sac following acute pancreatitis or pancreatic injury.

Pancreatitis—non-infectious inflammatory disease of pancreas caused by activation, interstitial liberation and autodigestion by its own enzymes.

Papilloma—simple pedunculated overgrowth of all layers of skin.

Paralytic ileus—here there is neurogenic failure of peristalsis to propel the intestinal contents.

Paraphimosis—inability to reduce the previously retracted prepuce.

Paratendinitis—inflammation of tendon sheath.

Paratendon—sheath that encloses a tendon.

Peau d’orange—'orange peel' appearance of skin seen in carcinoma breast due to blockage of subdermal lymphatics and cutaneous oedema.

Peritonitis—inflammatory response of peritoneal lining to various factors (micro-organism, foreign body, extravasated secretions (bile, urine, blood, meconium).

Pes planus—the height of the arch of foot becomes low and medial border touches the ground.

Phaeochromocytoma—tumour arising from chromaffin cells of adrenal medulla.

Phagophagia—fear of swallowing.

Phimosis—difficulty to retract the prepuce fully and freely over the glans up to the coronal sulcus.

Phlebitis—thrombosis of superficial vein accompanied by marked pain and inflammatory response of the overlying tissues.

Pleural effusion—fluid collection between parietal and visceral layers of pleura.

Plexiform neurofibromatosis—fibromyxomatous degeneration of nerve sheath that occurs in the terminal branches of cutaneous nerves.

Pneumothorax—air in pleural space.
Porcelain gallbladder—dystrophic calcification in gallbladder following acute or sometimes chronic cholecystitis, causing hard radiopaque gallbladder.

Priapism—persistent painful erection of penis.

Prognathism—congenital deformity where mandible is larger than average, and protrudes.

Prostatism—symptom complex of frequency, urgency, difficulty in micturition.

Pseudodiarrhoea—frequent passage of small quantities of stool, often associated with rectal urgency, associated with IBS and colitis.

Ptosis—drooping of upper eyelid due to paralysis of levator palpebrae superioris muscle.

Pyelocoele—infected hydrocele.

Pyonephrosis—kidney becomes multilobular sac containing pus.

Quinsy—abscess in the peritonsillar region causing severe pain and trismus.

Ranula—retention cyst arising sublingual salivary gland.

Regurgitation—effortless passage of gastric contents into the mouth.

Residual urine—amount of urine collected by passing catheter after voiding urine.

Rest pain—continuous, burning pain seen in lower limbs over the distal foot in advanced stage of ischaemia, aggravated on elevating the limb, caused by ischaemic neuritis and tissue necrosis.

Retention of urine—failure to pass urine in the presence of normal kidneys and its accumulation in bladder.

Retractile testis—testis is pulled from the scrotum into the superficial inguinal pouch due to the strong contraction of cremester muscle, often seen in younger age group.

Retroperitoneal fibrosis—deposition of fibrous tissue in the retroperitoneal space.

Rhabdomyoma—benign tumour of skeletal muscle.

Rigidity—stiffness of abdominal musculature brought by the patient himself due to fear of being hurt.

Sebaceous cyst—swelling arising due to blockage of duct of sebaceous gland which often opens into hair follicle.

Sarcoma—rapidly growing malignant tumour of connective tissue, may arise from any tissue of mesoblastic origin, spread occurs by blood.

Satiety—state of feeling of being completely full of food.

Septicaemia—presence of organisms and their toxic products in blood.

Sequestrum—dead bone in situ.

Shock—profound widespread reduction in effective delivery of oxygen and other nutrients to tissues leading to reversible, and if prolonged, to irreversible injury (Parillo, 1994).

Sinus—blind track, lined by granulation tissue may be epithelialised, leading from the surface down into the tissues.
Sjögren’s syndrome—autoimmune disease causing progressive destruction of salivary and lacrimal gland.

Slough—piece of dead tissue like skin, fascia, or muscle.

Soft chancre—caused by Haemophilus ducreyi; multiple painful ulcers over external genitalia with enlarged painful regional lymph nodes which has tendency towards suppuration.

Spider naevi—is a central arteriole with numerous small vessels radiating from it, commonly seen in liver disorders over the territory of superior vena cava—over face, neck, shoulder, and forearm; ranges in diameter from 3-15 mm.

Splenomegaly—enlargement of spleen, has to enlarge to more than 2 and a half times to become palpable.

Splenunculi—accessory splenic tissue.

Spondylolisthesis—gradual slipping forward of the lumbar spine on the sacrum following degenerative changes in the facet joints and the discs.

Sterilisation—is the process of killing all microorganisms.

Stomatitis—inflammatory, erosive, ulcerative condition of oral mucous membrane.

Surgical emphysema—means air in subcutaneous tissue which was been forced through the chest wall following an injury to lung.

Syringomyelia—congenital defect due to mechanical dilatation of the central canal, secondary to partial obstruction of drainage of CSF from 4th ventricle to the cisterna magna.

Talipes calcaneovalgus—foot is dorsiflexed and everted.

Talipes equinovarus (club foot)—hindfoot is held in varus and is plantar flexed; forefoot adducted and supinated.

Tenderness—sign elicited by physician by exerting pressure over the diseased site where the patient complains of pain.

Tendinosis—slow degenerative changes seen in tendons with advancing age.

Tendon—tissues that attach muscle to bone, thereby help in transmitting load from muscle to bone.

Tenesmus—ineffectual straining at stools with passage of mucus and blood.

Thyroglossal cyst—cystic swelling developing from remnants of thyroglossal duct.

Thyrotoxic crisis—ultra acute form of thyrotoxicosis occurring in thyrotoxic patients inadequately prepared for thyroidectomy.

Thyrotoxicosis—physiological condition resulting from action of excess of T₄ and T₃.

Torticollis—deformity in which the head is bent to one side while the chin points to other side.

Tracheomalacia—tendency of trachea to collapse following thyroidectomy for large goitre.

Trigeminal neuralgia—burning or shooting pain along the distribution of trigeminal nerve.
Trigger finger—difficult extension of the affected finger, which extends suddenly with a click.

Trismus—unable to open the mouth due to muscular spasm around temporo-mandibular joint.

Unascended kidney—failure of kidney to ascend from its embryonic position in pelvis and remains as pelvic organ.

Undescended testis—failure of testis to descend into the scrotum from its embryonic position in lumbar region along the inguinal canal.

Ureterocele—cystic dilatation of intramural portion of the ureter.

Varicocele—dilatation and tortuosity of veins of pampiniform plexus.

Varicose vein—vein that is dilated, tortuous and saccular, associated with valvular incompetence.

Virulence of organism—ability of organism to establish in the host, to multiply, and to cause progressive disease.

Volvulus neonatorum—volvulus seen in neonates due to arrested rotation of gut.

Volvulus—twisting of a portion of bowel about its mesentery.

Wart—elevated lesions with rough keratinised surface, seen over skin and mucus membrane anywhere in the body, caused by HPV virus, often contagious.

Water brash—reflux of sour material up to the mouth occurring spontaneously or on bending.

Weight loss (significant)—unintentional loss of > 10% of body weight in 6 months or 5% in past one month.

White bile—it is the content of the bile duct seen in complete obstruction of common bile duct, which neither bile nor white.

Xerophthalmia—dryness of eyes due to lack of lacrimal secretion.

Xerostomia—dryness of mouth due to lack of salivary secretion.

a. Sensation—

• Paraesthesia—altered sensation felt in the form of pins and needle.
• Hyparaesthesia—the skin is hypersensitive to normal stimuli.
• Hypoesthesia—decreased feeling of sensation.
• Anaesthesia—total loss of sensation in the affected part.

b. Deformities of fingers and digits—

• Syndactyly—fusion of two or more fingers.
• Polydactyly—presence of extra digit which may be rudimentary or fully developed.
• Ectrodactyly—absence of digit.
• Macrodactyly—overgrowth of finger.

c. Smell—

• Parosmia—perversion of sense of smell.
• Anosmia—loss of sense of smell.
d. Head injury—
- Cerebral concussion—head injury leading to temporary physiological paralysis of function without any organic structural damage, where the patient’s recovery is complete and perfect after a brief period of unconsciousness.
- Cerebral contusion—head injury leading to rupture of white fibres of the brain causing petechial haemorrhages, with prolonged variable period of unconsciousness.
- Cerebral laceration—head injury leading to tear of brain surface with effusion of blood into CSF leading to subarachnoid haemorrhage.

e. Bezoars—foreign bodies in stomach
- Trichobezoar—hair in stomach following abnormal habit of chewing hair.
- Phytobezoar—abnormal vegetable matter in stomach.

f. Some characteristic facies—
- Facies Hippocratica—an anxious look, bright eyes, pinched face and cold sweat are the features seen in terminal stage of peritonitis.
- Facies of dehydration—features consists of sunken eyes, drawn cheeks, dry tongue.
- Adenoid facies—high-arched palate, narrow dental arch, protruding incisor teeth seen in patients with enlarged adenoids.
- Carcinoid facies—typical facial flushing seen in patients with carcinoid tumour with metastasis in liver.
- Facies of cretinism—pale, puffy, wrinkled face with dry cold skin and protruding tongue.
- Facies of Cushing’s—round-shaped face like a full moon with pursed lips.

g. Contour of chest—
- Pectus excavatum (Funnel chest)—congenital condition where there is depression of sternum and xiphoid process along with inward curving of costal cartilages and adjacent ribs.
- Pectus carinatum (Pigeon chest)—deformity where sternum is unusually pushed forward and is prominent due to excessive growth of costal cartilages.
- Barrel-shaped chest—antero-posterior diameter is greater than transverse diameter, seen in emphysema.
- Flat chest—transverse diameter is greater than antero-posterior diameter, seen in emphysema.
- Rachitic chest—bead-like prominences at costo-chondral junction.

h. Anomalies in breast—
- Amazia—absence of breast.
- Polymazia—accessory breast, present along the milk line.
- Athelia—absence of nipple.
- Polythelia—accessory nipples may occur along the milk line (from anterior axillary fold to the fold of groin).

i. Ulcer—break in continuity of the covering epithelial surface, skin or mucus membrane.
- Margin—junction between normal epithelium and ulcer.
- Edge—area between margin and floor.
- Floor—exposed surface of the ulcer.
- Base—on which the ulcer rests, better felt than seen.
j. Biopsy—
• Needle biopsy—a core of tissue is removed by introducing a hollow needle into the swelling (Vim Silvermann needle for liver biopsy).
• Drill biopsy—a core of tissue is removed by introducing a sharp cannula attached to a high speed compressor air drill.
• Punch biopsy—using a punch biopsy forceps, a piece of tissue is taken from the margin of the tumour along with surrounding normal tissue.
• Open biopsy—done by surgery; incisional—only a slice of tumour is removed; excisional—whole lesion with surrounding normal tissue is removed for malignant but only the lesion for benign.
• FNAC—tissue from the suspected lesion is aspirated using fine needle (22/23 gauge) and sent for cytology.
• Exfoliative cytology—cells shed from tumour present in hollow viscus is collected and studied under microscopy for any malignancy (e.g.—respiratory tract tumours, bladder tumours).

k. Swelling—
• Impulse on coughing—impulse elicited on coughing over swelling which are in continuity with pleural, abdominal, cranial, spinal cavities.
• Fluctuation—it is a feel over a swelling containing gas or liquid due to pressure transmitted in perpendicular direction.
• Translucency of a swelling—means it contains clear fluid (water, serum, lymph, plasma) and can transmit light through it.
• Reducibility of swelling—swelling reduces and disappears completely.
• Compressibility of swelling—swelling can be compressed but do not disappear completely.

l. Tongue—
• Ankyloglossia—inability to protrude the tongue out.
• Macroglossia—painless, large tongue.
• Black hairy tongue—due to fungal infection.

m. Nails—
• Koilonychia—spoon shaped, brittle nails.
• Terry’s nail—whitening of nailbed, a manifestation of hypoalbuminaemia.

n. Abnormal stools—
• Melena—black, tarry (sticky) stools.
• Steatorrhoea—bulky, pale, sometimes frothy, porridge-like.
• Slimy stool—when there is excess mucus.
• Pipe stem stool—in carcinomatous stricture of rectum.
• Tooth paste stool—in Hirschsprung’s disease.

o. Haemorrhage under skin—
• Petechiae—tiny haemorrhage less than 1 mm diameter.
• Purpura—haemorrhage 2-5 mm in diameter.
• Ecchymosis—haemorrhage >5 mm in diameter.
• Haematoma—haemorrhage large enough to elevate the skin.

p. Vertebral column—
• Scoliosis—abnormal lateral curvature of spine.
• Kyphosis—abnormal antero-posterior curvature of the spine, with forward concavity.
• Lordosis—abnormal antero-posterior curvature of the spine, with forward convexity.
q. Skin eruptions
- **Macule**—not raised above the skin.
- **Papule**—raised tiny nodule.
- **Pustule**—papules containing pus.
- **Nodule**—large papule as a solitary projection from the skin.
- **Vesicle**—small blister.
- **Wheal**—elevated patches on the skin with centre pale than periphery.
- **Café-Au-lait patches**—coffee brown patches, significant when they are more than 5 in number.

r. Pain:
Types—
- **Colic**—It is a paroxysmal, intermittent pain, gripping in nature brought about by obstruction of a muscular conducting tube. 4 types—ureteric, biliary, intestinal, appendicular.
- **Vague aching**—mild continuous pain.
- **Burning pain**—sensation felt as contact with a hot object, typically seen in acid peptic disease.
- **Throbbing pain**—typically felt in severe inflammatory condition as in abscess.
- **Shooting pain**—pain shoots along the course of a nerve as in sciatica.
- **Stabbing pain**—sudden, severe pain of short duration, e.g.—duodenal ulcer perforation
- **Constricting pain**—reveals compressing nature of pain from all direction; e.g.—typical anginal pain.

Special types of pain—
- **Renal pain**—dull or severe ache over the renal angle (between outer border of erector spine muscle and lower border of 12th rib), may spread towards umbilicus; brought about by distension of renal capsule and pelvis.
- **Prostatic pain**—vague discomfort or fullness in perineum or rectal area, often associated with difficulty in passing urine.
- **Urethral pain**—burning pain felt in the penis or vulva occurs at the end of micturition.
- **Ureteric pain**—starts in the loin, radiates along the course of ureter to the groin and inner aspect of the upper part of thigh.

Radiation of pain—pain extends to another site while the original pain persists at the original site.
- e.g.—Ureteric colic radiating to the groin, pain of duodenal ulcer radiating to the back.

REFERRED pain—when pain is felt at distant site from the source, and there is no pain at the diseased site; e.g.—in diseases of hip joint there is referred pain over the knee joint.

Shifting or migration of pain—pain is felt at one site in the beginning and it later shifts to another site with no pain in the original site; e.g.—pain in acute appendicitis is initially felt around umbilicus, which later shifts to right iliac fossa (McBurney’s point).

s. Fever:
Normal body temperature—36.7°C-37.2°C
- **Continuous fever**—temperature remains above the normal throughout the day, not fluctuating more than 1°C in 24 hr.
- **Remittent fever**—temperature remains above normal throughout the day, and fluctuates more than 1°C in 24 hr.
- **Intermittent fever**—temperature remains high only for a few hours a day.
I. Micturition:
Normal act of micturition—5-6 times in 24 hr.

Incontinence—involuntary loss of urine.
- True incontinence—constant dribbling of urine from the bladder.
- False or overflow incontinence—urine overflows from distended bladder which has been totally
decompenated and acts as a fixed reservoir.
- Stress incontinence—few drops of urine flow out while straining due to distortion of the normal
anatomic relationship between bladder and the urethra, as a result of which any rise in intra-
abdominal pressure is unequally distributed to bladder and urethra.
- Automated—periodic contraction without the patient’s knowledge.
- Urgent incontinence—precipitous loss of urine preceded by strong urge to void.

Irritative symptoms—
- Frequency—refers to increased number of times one feels the need to urinate.
- Nocturia—increased frequency in the night (normally not more than 2).
- Dysuria—painful or difficult urination, usually caused due to inflammation.
- Strangury—painful desire to micturate which starts in the bladder and extends to the tip of
urethra, which neither produces urine nor helps in relieving pain—“painful ineffective micturition”.
- Urgency—sudden severe urge to void that may or may not be controllable.

Obstructive symptoms—
- Hesitancy—prolonged interval necessary to voluntarily initiate the urinary stream.
- Intermitancy—involuntary start—stopping of urinary stream.
- Post-void dribbling—terminal release of drops of urine at end of micturition.
- Straining—is use of abdominal musculature to raise intra-abdominal pressure to urinate.
- Sense of residual urine—sensation of incomplete emptying of the bladder that the patient recognises
after voiding.

Haematuria—haemorrhage into the urinary tract gives red or brownish tinge to the urine; macroscopic—if
there is visible reddish discoloration of urine; microscopic—when bleeding is minimal it is
detected only on microscopy.

Anuria—complete absence of urine production.

Oliguria—24 hr urine output is less than 300 ml.

u. Nerve injury—
- Neurapraxia—transient physiological block of nerve following pressure effect of short duration
or stretching, where spontaneous and complete recovery is the rule.
- Axonotmesis—there is disruption of nerve fibres within an intact sheath, recovery is generally
satisfactory unless there is extensive intraneurial fibrosis.
- Neurotmesis—complete or partial division of nerve.
1. Most common anaemia in surgical patients—**Iron deficiency anaemia**

<table>
<thead>
<tr>
<th>Age</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>Duodenal ulcers</td>
</tr>
<tr>
<td></td>
<td>Secondary to carcinoma colon</td>
</tr>
<tr>
<td>Females</td>
<td>Secondary to menorrhagia, pregnancy</td>
</tr>
<tr>
<td></td>
<td>Secondary to carcinoma colon</td>
</tr>
<tr>
<td>Neonates, children</td>
<td>Worm infestation</td>
</tr>
<tr>
<td></td>
<td>Bleeding Meckel’s diverticulum</td>
</tr>
</tbody>
</table>

2. Common surgery causing anaemia:
   a. Billroth-II: Due to defective iron absorption (as the duodenum becomes a blind loop) and 
      $\text{B}_12$ deficiency due to decreased acid and intrinsic factor production.
   b. Terminal ileal resection - $\text{B}_12$ deficiency as the ileum is the site of absorption

3. Most common cause of acute blood loss in surgical patient:
   a. GI bleeding due to acid peptic disease
   b. Accidents—spleen, liver, major vessels injuries
   c. Gynaecological causes in females—ruptured ectopic, rupture uterus

4. Common cause of pneumonia/sepsis in ICU—**Pseudomonas aeruginosa**

5. Commonest hospital risk factor for sepsis—indwelling urinary catheter

6. Causes of generalised tender lymphadenopathy—
   Infections—HIV, infectious mononucleosis, secondary syphilis
   Drugs—phenytoin
   Autoimmune—SLE, rheumatoid arthritis.

7. Causes of generalised non-tender lymphadenopathy:
   a. Acute and chronic leukaemia
   b. NHL

8. Lymph nodes and malignancy:

<table>
<thead>
<tr>
<th>Site</th>
<th>Commonest malignancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Virchow’s node</td>
<td>Secondaries from adenocarcinoma of stomach, pancreas, colon; testicular neoplasms; cervical cancer.</td>
</tr>
<tr>
<td>3. Hilar lymph nodes</td>
<td>Primary lung cancer.</td>
</tr>
<tr>
<td>4. Non-tender unilatera-</td>
<td>NHL</td>
</tr>
<tr>
<td>epitrochlear lymph nodes</td>
<td></td>
</tr>
</tbody>
</table>
9. Commons in NHL
   a. Extranodal site of primary malignant
   b. Bacteria associated with NHL
   c. Cause of increased incidence of
      Stomach in MALT (mucosa associated
      lymphomas lymphoid tissue)
      Helicobacter pylori in MALT lymphoma
      AIDS

10. Commonest malignancy of lymph nodes—secondaries

11. Commonest NHL in children—Burkitt’s lymphoma

12. Commonest site for Burkitt’s lymphoma—abdominal cavity:
   a. Boys—Peyer’s patches of the small intestine
   b. Girls—Pelvic organs.

13. Common complications of treatment of Hodgkin’s disease:
   a. Second malignancies related to alkylating agents
   b. Infertility
   c. Hypothyroidism due to radiation
   d. Sepsis in splenectomised patients
   e. Congestive cardiomyopathy due to the effect of doxorubicin.


15. Commons in spleen:
   a. Hypersplenism Portal hypertension
   b. Parasitic disease Echinococcus
   c. Primary tumour Benign haemangiomas
   d. Malignancy Metastatic NHL
   e. Multifocal calcification Histoplasmosis.


17. Common clinical finding in protein C deficiency—Recurrent DVT (65%)

18. Renal disease with increased risk of venous thrombosis—nephrotic syndrome (cause: loss of
    Antithrombin III, protein C, protein S in urine)

19. Common sites of origin of embolism:
   a. To the lungs—femoral veins following DVT.
   b. To the arterial systems—clot/vegetations dislodged from left heart.


21. Commons in phlebothrombosis:
   a. Cause—stasis of blood flow.
   b. Location—deep veins of the calf.

22. Commonest cancer associated with superficial migratory thrombophlebitis (Trousseau’s sign)—
    Pancreatic carcinoma.

24. Association of blood group and GI pathology:

<table>
<thead>
<tr>
<th>Pathology</th>
<th>Blood group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duodenal ulcer</td>
<td>O</td>
</tr>
<tr>
<td>Gastric carcinoma</td>
<td>A</td>
</tr>
</tbody>
</table>

25. Cause for post-transfusion hepatitis—Hepatitis C in 90% of cases.

26. Commonest preservative used in blood bank.
   - CPDA 1 (shelf life of CPDA1 blood is 35 days)
   - Citrate Calcium-binding anticoagulant
   - Phosphate Maintains 2,3 dPG level
   - Dextrose Nutrition for RBCs
   - Adenine Substrate for ATP.

27. Blood components with highest concentration of factor VIII—vWF multimers—cryoprecipitate.

28. Effect of acute blood loss on Hb% and haematocrit—no change.


30. Types of surgery associated with greatest cardiac risk:
   a. Emergency surgeries.
   b. Right upper quadrant abdominal surgeries
   c. Thoracic surgeries.

31. Commonest perioperative complication in diabetes mellitus;
   - Infections—wound sepsis, UTI, pneumonia.

32. Biochemical effects of surgical trauma/sepsis:
   a. Increased catabolism of proteins
   b. Increased glucagon secretion
   c. Increased cortisol and catecholamine secretion.

33. Common contraindications of enteral feeding:
   a. Short bowel syndrome.
   b. Intestinal obstruction.
   c. Severe vomiting/diarrhoea
   d. Enterocolitis.
   e. GI fistulas.

34. Nutritional problems in systemic diseases:
   a. Renal failure—inability to handle urea load.
   b. Hepatic failure—hepatic encephalopathy.
   c. Cancer—anorexia, cachexia.
   d. Diabetes mellitus—hyper/hypoglycaemia.

35. Commonest cause of death following surgery—pneumonia.
36. Organisms involved with intravascular catheter sepsis:
   a. *Staphylococcus aureus*.
   b. *Staphylococcus epidermidis*.
   c. *Candida*.

37. Source of postoperative UTI—indwelling urinary catheter.

38. Commonest site in lungs for embolus—right lower lobe.


40. Environmental factor accelerating wound healing—UV light.

41. Vitamin which reverses corticosteroid effects in a wound—retinoic acid.

42. Commonest causes for wound haematoma:
   a. Inadequate wound haemostasis.
   b. Anticoagulants.
   c. NSAIDs.

43. Common cause of wound seroma—creation of large subcutaneous space.

44. Commonest initial sign of wound dehiscence—discharge of serosanguinous fluid from the wound.

45. Common cause of myonecrosis—*Clostridium perfringence*.

46. Commonest type of human bite—knuckle laceration from punching the mouth of another person.

47. Causes of foot ulcers in diabetes mellitus:
   a. Peripheral neuropathy
   b. Ischaemia
   c. Soft tissue infection.

48. Sites of pressure ulcer:
   a. Sacrum (commonest site)
   b. Greater trochanter
   c. Ischial tuberosity
   d. Calcaneus.
   e. Lateral malleolus.

49. Common complication in burns:
   a. Wound infection (*Pseudomonas aeruginosa, Staphylococcus aureus*)
   b. Sepsis.

50. GI abnormality associated with burns—Curling’s ulcer in stomach.

51. Sites of atherosclerosis in descending order:
   a. Abdominal aorta.
   b. Coronary artery.
   c. Popliteal artery.
   d. Descending thoracic aorta
   e. Internal carotid artery.
52. Complication of atherosclerosis:

<table>
<thead>
<tr>
<th>Artery</th>
<th>Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Abdominal aorta</td>
<td>Aneurysm, embolism</td>
</tr>
<tr>
<td>b. Peripheral artery</td>
<td>Gangrene</td>
</tr>
<tr>
<td>c. Coronary artery</td>
<td>Angina, MI</td>
</tr>
<tr>
<td>d. Internal carotid artery</td>
<td>TIA, stroke</td>
</tr>
<tr>
<td>e. Renal artery</td>
<td>Renovascular hypertension</td>
</tr>
</tbody>
</table>

53. Commonest peripheral artery aneurysm—popliteal artery.

54. Commonest cause of cystic aneurysm of the artery—polyarteritis nodosa.

55. Commonest site of pain in occlusive arterial diseases:

<table>
<thead>
<tr>
<th>Artery</th>
<th>Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Aorta</td>
<td>mid abdomen</td>
</tr>
<tr>
<td>b. Common iliac</td>
<td>buttocks</td>
</tr>
<tr>
<td>c. Common femoral</td>
<td>thigh</td>
</tr>
<tr>
<td>d. Superficial femoral</td>
<td>knee</td>
</tr>
<tr>
<td>e. Popliteal</td>
<td>calf</td>
</tr>
<tr>
<td>f. Tibial artery</td>
<td>foot</td>
</tr>
</tbody>
</table>

56. Screening test for volar arch artery—Allen’s test.

57. Vasculitis associated with young male smokers—thromboangitis obliterans.

58. Commonest cause of axillary vein thrombosis—over exercising upper extremity hence called effort vein thrombosis.

59. Commonest cause for varicose veins in legs:
   Primary-congenital absence of sentinel valve in the common femoral vein.
   Secondary-vessel obstruction as in DVT.

60. Commonest cause for superior venacaval obstruction—obstruction of the SVC by small cell carcinoma of the lung.

61. Commonest cause for inferior venacaval obstruction—extension of a pelvic/femoral vein thrombosis into IVC.


63. Commonest cause for renovascular hypertension in females—fibromuscular hyperplasia (renal angiogram shows string of beads appearance)

64. Commonest surgically correctable cause of secondary hypertension in young-Coarctation of aorta.

65. Tumours and secondary hypertension
   1. Renal Renal adenocarcinoma
      Wilms’ tumour.
2. Adrenal
   - Primary aldosteronism
   - Pheochromocytoma.
3. Neurogenic
   - Increase in intracranial pressure, e.g. brain tumours
4. Parathyroid
   - Adenoma causing primary hyperplasia/hyperparathyroidism

66. Organisms producing infective endocarditis:
   a. *Streptococcus viridans* 50-75%
   b. *Staphylococcus aureus* 25%
   c. Enterococci.

67. Organisms in infective endocarditis:
   a. Secondary prosthetic valve—*Staphylococcus epidermidis*
   b. Colon cancer, IBD—*Streptococcus bovis*.

68. Procedures and organisms producing infective endocarditis:
   a. Dental/upper respiratory procedures—*Streptococcus viridans*.
   b. GI/GU procedures *Enterococcus*.

69. Valve abnormalities in carcinoid heart diseases:
   a. Tricuspid regurgitation
   b. Pulmonary valve stenosis.

70. Commonest cardiac tumour—cardiac myxoma.

71. Commons in pericarditis:

<table>
<thead>
<tr>
<th>Infected</th>
<th>Viral, e.g Coxsackie B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacterial</td>
<td>Streptococci</td>
</tr>
<tr>
<td>Metabolic</td>
<td>Uremia</td>
</tr>
<tr>
<td>Collagen Disease</td>
<td>SLE</td>
</tr>
</tbody>
</table>

72. Commonest cause of spontaneous pneumothorax—rupture of an apical subplueral bulla.

73. Location of lung cancer:
   a. Periphery—Adenocarcinoma
   b. Central—Squamous cell carcinoma.

74. Lung cancer and smoking:
   a. Greatest relationship to smoking—Squamous cell carcinoma.
   b. No relationship to smoking—Bronchio-alveolar carcinoma.

75. Sites of metastasis of primary lung cancer:
   a. In chest cavity—Hilar and mediastinal lymph nodes.
   b. Outside the lung—Adrenal gland (50%).

76. Commonest primary lung tumour in children—Bronchial carcinoid.

77. Commonest mediastinal tumour/lesion:
   a. Anterior—Thymoma.
   b. Posterior—Neurogenic tumour.
   c. Middle—Pericardial cyst
78. Common organisms causing Ludwig’s angina:
   a. Aerobic/anaerobic streptococci.
   b. Eikenella corrodens.

79. Commonest oral manifestation of AIDS:
   a. Candidiasis.
   b. Aphthous ulcer
   c. Hairy leukoplakia.

80. Diseases associated with mucosal pigmentation:
   b. Endocrine disorder—Addison’s disease.

81. Common location of leukoplakia:
   a. Ventrolateral tongue.
   b. Floor of the mouth.
   c. Lower lip.

82. Common cancer in oral cavity—Squamous cell carcinoma.

84. Confirmatory tests in the workup of neck mass:
   a. FNAC—when lymph node secondary is suspected.
   b. Excision biopsy—When malignant lymphoma is suspected.

85. Common complication of vomiting—Electrolyte imbalance.

86. Common location for NSAIDs induced erosions/ulcers:
   a. Prepyloric area.
   b. Antrum.

87. Artery responsible for bleeding in gastric/duodenal ulcers:
   a. Gastric ulcer—Left gastric artery.
   b. Duodenal ulcer—Gastroduodenal artery.

88. Surgery leading to dumping syndrome—Billroth II gastrojejunostomy (incidence 5-10%).

89. Commonest cause of marginal ulcer in post gastrectomy—incomplete vagotomy.


91. Nerve fibres responsible for abdominal pain:
   a. Visceral pain—unmyelinated afferent C fibres.
   b. Parietal pain—C fibres and myelinated

92. GI location of haematochezia—below the ligament of Treitz.

93. Megacolon causes:
   b. Acquired—Chagas’ disease.

94. Common causes of gut obstruction:
   a. Foregut—Obstructive peptic ulcer disease, Carcinoma stomach, Carcinoma of head of pancreas.
   b. Hind gut—Annular obstructing cancer in carcinoma colon.
95. Commonest abdominal hernia in decreasing order:
   a. Indirect inguinal hernia.
   b. Direct inguinal hernia.
   c. Femoral hernia.

96. Hernia with highest rate of incarceration—Femoral hernia.

97. Commonest hernia in adults with ascites/pregnancy—umbilical hernia.

98. Hernia with highest mortality—Obturator hernia due to difficult preoperative diagnosis.

99. Commonest site of volvulus:
   a. Elderly patients—sigmoid colon
   b. Young adults—Cecum

100. Common cause of nontoxic megacolon—Ogilvie’s syndrome

101. Sites of squamous cell carcinoma in oral cavity in descending order:
   a. Floor of the mouth.
   b. Lower lip.
   c. Lateral border of tongue
   d. Hard palate.
   e. Tongue base.

102. Commonest location of verrucous carcinoma—mandibular sulcus.


104. Commonest salivary gland tumour—Pleomorphic adenoma.

105. Commonest malignant tumour of salivary gland—mucoepidermoid carcinoma.

106. Malignant salivary gland tumour is common in—submandibular salivary gland.

107. Commonest sites for Kaposi’s sarcoma in oral cavity in AIDS:
   a. Hard palate.
   b. Gingiva.
   c. Buccal mucosa.

108. Commonest feature of oesophageal disease—heart burn.

109. Common causes of dysphagia:
   a. For solids but not for liquids — Obstructive lesions, e.g. web, cancer.
   b. For solids and liquids — Motility disorder.
   c. For liquids but not for solids — Achalasia cardia.
   d. Oropharyngeal dysphagia — Neuromuscular disorder.
   e. Intermittent dysphagia for solids — Lower oesophageal rings.
   f. Progressive dysphagia for solids with heart burn — Peptic stricture secondary to Barrett’s
   g. Intermittent dysphagia with noncardiac chest pain — GORD

110. Commonest benign tumour of oesophagus—leiomyoma.
111. Common cause of Mallory-Weiss syndrome—severe retching in alcoholics.
112. Commonest complication of diverticular disease—diverticulitis.
113. Common cause of fistula in GI tract:
   a. Diverticulitis.
   b. Crohn’s disease.
114. Common GI site for acute ischaemia—small bowel
116. Commonest malignant tumour of small bowel—secondaries from colon, rectum, ovary.
117. Common GI site for polyps—sigmoid colon.
118. Common GI tract polyp—hyperplastic polyp.
120. Commonest tumour of appendix—carcinoid tumour.
121. Common cause of haematobilia—trauma to the liver.
122. Cause of segmental dilation of intrahepatic bile ducts—Caroli’s disease.
123. Common site for intra-abdominal abscess—sub-diaphragmatic space.
125. Parasitic cause of cholangiocarcinoma—Clonorchis sinensis.
126. Common cause of Budd-Chiari syndrome:
   a. Polycythemia rubra vera.
   b. OCP.
   c. Hypercoagulable state.
128. Common in liver:
   a. Tumour like condition—focal nodular hyperplasia.
   b. Benign tumour—cavernous haemangioma.
   c. Malignant tumour—metastasis.
   d. Primary tumour—hepatocellular carcinoma.
129. Common location of cholangiocarcinoma:
   a. Ampulla/common bile duct.
   b. Junction of right and left hepatic duct.
130. Common cause of acute peritonitis—ruptured viscus.
131. Common cause of air in biliary tree—gallstone ileus.
132. Common cystic disease in GIT—choledochal cyst.
133. Commonest cause of acute cholecystitis—impacted stone in cystic duct (90%)
134. Commonest cause of acalculous cholecystitis—ischaemic compromise of cystic artery.
135. Commonest cause of hydrops in gallbladder—chronic obstruction of cystic duct.
136. Commonest benign tumour in gallbladder—papilloma.
137. Commonest cause of gallbladder cancer—gallstones.
139. Common location of aberrant pancreatic tissue in decreasing order:
   a. Wall of stomach, duodenum, jejunum.
   b. Meckel’s diverticulum.
142. Common site for pancreatic tumour—head of pancreas.
143. Commonest islet cell tumour—insulinoma.
144. Common cause of secretory diarrhoea—Vipoma.
145. Common cause of galactorrhea after prolactinoma is primary hypothyroidism.
146. Common location of pyramidal lobe of thyroid—superior extension from the isthmus.
147. Common symptom of lingual thyroid—dysphagia.
149. Cause of endemic goitre—iodine deficiency.
150. Common test to evaluate functional status of goitre—serum TSH.
151. Commonest thyroiditis—Hashimoto’s thyroiditis.
152. Thyroiditis occurring in the postpartum state—subacute painful lymphocytic thyroiditis.
153. Thyroiditis mimicking thyroid cancer—Reidel’s thyroiditis.
156. Commonest cause of benign thyroid tumour—follicular adenoma.
158. Commonest extranodal site of papillary cancer metastasis—lungs, bone.
159. Thyroid cancer presenting as solitary cold nodule—follicular carcinoma.
160. Thyroid cancer with a familial history—medullary carcinoma.
161. Cause of primary malignant lymphoma of thyroid—pre-existing Hashimoto’s thyroiditis.
162. Commonest cause of primary hyperparathyroidism—benign parathyroid adenoma.
159. Anaemia leading to malignancy.
   Plummer-Winson/Paterson-Kelly syndrome—post-cricoid carcinoma.

160. Commonest cause of secondary hyperparathyroidism—chronic renal failure

161. Commonest metabolic bone disease—osteoporosis.

162. Commonest childhood sarcoma—embryonal rhabdomyosarcoma.

163. Malignant tumour that do not metastasise—basal cell carcinoma.

164. Commonest carcinomas that invade blood vessels:
   a. Renal cell carcinoma.
   b. Follicular carcinoma of thyroid
   c. Hepatocellular carcinoma.

165. Sarcoma that invades lymphatics—rhabdomyosarcoma.

166. Tissue resistant to tumour invasion:
   a. Mature cartilage.
   b. Elastic tissue in artery.


168. Osteoblastic bone secondary is commonly produced by carcinoma prostate.

169. Pure osteolytic bone secondary is commonly produced by lung/kidney.

170. Most common malignancies in respect to various sites.

<table>
<thead>
<tr>
<th>Site</th>
<th>Common malignancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Lymph nodes</td>
<td>a. Metastasis, e.g. carcinoma breast, colon</td>
</tr>
<tr>
<td></td>
<td>b. Primary: NHL</td>
</tr>
<tr>
<td>2. Lung</td>
<td>a. Metastasis, e.g. breast.</td>
</tr>
<tr>
<td></td>
<td>b. Primary: adenocarcinoma.</td>
</tr>
<tr>
<td></td>
<td>b. Primary: Glioblastoma multiforme.</td>
</tr>
<tr>
<td>4. Liver</td>
<td>a. Metastasis: Lung carcinoma</td>
</tr>
<tr>
<td></td>
<td>b. Primary: Hepatocellular carcinoma.</td>
</tr>
<tr>
<td>5. Bone</td>
<td>a. Metastasis, e.g. Breast carcinoma</td>
</tr>
<tr>
<td></td>
<td>b. Primary: Adult—Multiple myeloma Adolescent—osteosarcoma</td>
</tr>
<tr>
<td>6. Adrenals</td>
<td>a. Metastasis, e.g lung</td>
</tr>
</tbody>
</table>

171. Commonest primary site for metastasis to Virchow’s node in decreasing order:
   a. Adenocarcinoma of stomach
   b. Adenocarcinoma of pancreas
172. Metastatic sites in descending order:

<table>
<thead>
<tr>
<th>Primary</th>
<th>Metastatic sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Breast</td>
<td>Lung, bone, liver</td>
</tr>
<tr>
<td>b. Colorectum</td>
<td>Liver, adrenals, bone</td>
</tr>
<tr>
<td>c. Renal</td>
<td>Lung</td>
</tr>
<tr>
<td>d. Transitional cell</td>
<td>Adrenals</td>
</tr>
<tr>
<td>carcinoma of bladder</td>
<td></td>
</tr>
<tr>
<td>e. Lung</td>
<td>Liver, bone, brain, adrenal.</td>
</tr>
<tr>
<td>f. Melanoma</td>
<td>Liver, lung, adrenal, brain, bone, skin</td>
</tr>
<tr>
<td>g. Ovary</td>
<td>Liver, lung</td>
</tr>
<tr>
<td>h. Prostate</td>
<td>Bone, lung, liver</td>
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174. Commonest cause of hypercalcaemia in cancer:
   a. Metastasis to bone.
   b. Secretion of a PTH like peptides.

175. Commonest paraneoplastic syndrome is hypercalcaemia secondary to secretion of a PTH like peptide.

176. Commonest cause of Eaten-Lambert syndrome is small cell carcinoma.

177. Cancer associated with pulmonary osteoarthropathy is primary lung cancer

178. Common tumour markers known:

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<th>Malignancy</th>
<th>Tumour marker</th>
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<td>Multiple myeloma</td>
<td>Bence Jones proteins</td>
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<td>Ovarian cancer</td>
<td>CA 125</td>
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<td>Small cell carcinoma</td>
<td>CEA, bombesin</td>
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<td>Prostate cancer</td>
<td>Prostate specific Ag.</td>
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<td>Breast cancer</td>
<td>CEA, CA 15-3.</td>
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<td>Medullary carcinoma of thyroid</td>
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<td>Colorectal cancer</td>
<td>CEA</td>
</tr>
<tr>
<td>Pancreatic cancer</td>
<td>CA19-9, CEA</td>
</tr>
</tbody>
</table>

179. Cancer frequency in decreasing order:
   a. Children            ALL, CNS tumours, Burkitt’s lymphoma, neuroblastoma,
                           Wilm’s tumour, Ewing’s sarcoma.
   b. Men                 Prostate, lung, colon.
   c. Women               Cervix, breast, lung, colon.

180. Cancer mortalities in decreasing order:
   a. Men                 Lung, prostate, colorectal.
   b. Women               Lung, breast, cervix, colorectal.
181. Cancer associated with parasitic disease—
   Squamous cell carcinoma of bladder—Schistosoma hematobium
   Cholangiocarcinoma—Clonorchis sinensis.

182. Common cancer in geographical area:
   a. South-East China — Nasopharyngeal carcinoma
   b. Japan — Adenocarcinoma of stomach
   c. South-East Asia — Hepatocellular carcinoma
   d. Africa — Burkitt’s lymphoma

183. Commonest complication associated with cyclophosphamide—Haemorrhagic cystitis.

184. Breast lump with respect to age:

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<th>Breast lump</th>
<th>Age</th>
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<tr>
<td>Fibrocystic disease</td>
<td>&lt; 50 yr</td>
</tr>
<tr>
<td>Infiltrating ductal carcinoma</td>
<td>&gt; 50 yr</td>
</tr>
<tr>
<td>Fibroadenoma</td>
<td>&lt; 35 yr</td>
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</tbody>
</table>

185. Commonest cause of blood stained nipple discharge
   < 50 yr - Intraductal papilloma.
   > 50 yr - Infiltrating ductal carcinoma.

186. Commonest cause of acute mastitis—Staphylococcus aureus in lactating women.


188. Drug associated with development of fibroadenoma—cyclosporine.

189. Commonest disorder of male breast—Gynaecomastia.

190. Commonest breast disease with microcalcification:
   a. Benign disease—Sclerosing adenosis.


192. Cancer misdiagnosed as acute mastitis—Inflammatory carcinoma.


194. Commonest subtype of breast cancer with high propensity for CNS, ovary, uterus, bone marrow
   metastasis—Invasive lobular carcinoma.

195. Lymph nodes involved in cancer breast in decreasing order of frequency—
   a. Axillary lymph nodes
   b. Internal mammary nodes
   c. Supraclavicular nodes.

196. Important nerve injury:
   a. Claw hand — Ulnar nerve palsy.
   b. Wrist drop — Radial nerve palsy
   c. Waiter’s tip deformity — Brachial plexus lesion at Erb’s point
   d. Klumpke’s paralysis — Injury to lower trunk of brachial plexus.
197. Cause of axillary nerve injury:
   a. Fracture of surgical neck of humerus.
   b. Dislocation of shoulder joint.

198. Commonest site of disc herniation – L₅ - S₁ disc.

199. Commonest site of nerve entrapment.

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<th>Nerve</th>
<th>Site</th>
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<td>Median nerve</td>
<td>Carpal tunnel</td>
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<tr>
<td>Sciatic nerve</td>
<td>Sciatic notch in buttocks</td>
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<tr>
<td>Peroneal nerve</td>
<td>Behind the knees</td>
</tr>
<tr>
<td>Lateral femoral nerve</td>
<td>Inguinal ligament</td>
</tr>
</tbody>
</table>

200. Commonest benign soft tissue tumour—lipoma.

201. Tumours arising from fat:
   a. Yellow fat—Lipoma.

202. Sites of humerus fracture and nerve injury:

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<th>Site</th>
<th>Nerve injured</th>
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<td>Axillary nerve</td>
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<td>b. Mid shaft/distal third</td>
<td>Radial nerve</td>
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<tr>
<td>c. Supracondylar elbow fracture</td>
<td>Median nerve</td>
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<tr>
<td>d. Medial epicondyle</td>
<td>Ulnar nerve</td>
</tr>
</tbody>
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203. Common causes of neuropathic joints:
   a. Diabetes mellitus
   b. Syringo myelia
   c. Tabes dorsalis

204. Important sites of vascular necrosis:
   a. Femoral head
   b. Scaphoid
   c. Body of talus

205. Common primary bone tumour with respect to age.

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<th>Age</th>
<th>Tumor</th>
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<td>a. 1st and 2nd decades</td>
<td>Ewing’s sarcoma</td>
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<td>b. 10-25 yr</td>
<td>Osteogenic sarcoma</td>
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<tr>
<td>c. &gt;30 yr</td>
<td>Chondrosarcoma</td>
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<tr>
<td>d. &gt;50 yr</td>
<td>Multiple myeloma</td>
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</table>

206. Common primary bone tumours in descending order of frequency:
   a. Multiple myeloma
   b. Osteogenic sarcoma
c. Chondrosarcoma.
d. Ewing’s sarcoma
e. Giant cell tumour.

207. Common benign bone tumour—osteochondroma.

208. Commonest site of osteosarcoma—distal femur/proximal tibia.

209. Common causes of pathologic fracture:
   a. Metastasis from breast carcinoma
   b. Osteoporosis

210. Common neurological symptom in patients with cancer:
   a. Headache
   b. Altered mental status—metabolic encephalopathy

211. Commonest neurological complication of systemic cancer—cerebral metastasis.

212. Cancer with most neurological complication—malignant melanoma.

213. Common CNS tumour with respect to location:
   a. Cerebrum—Metastasis
   b. Cerebellum—Astrocytoma.
   c. Spinal cord—Ependymoma.

214. Common cause of costovertebral angle pain:
   a. Acute pyelonephritis
   b. Renal adenocarcinoma

215. Commonest cause of microscopic haematuria in males—BPH.


217. Common cause of renal calcifications on radiograph:
   a. Stones
   b. Nephrocalcinosis
   c. Calcified tumours/cyst
   d. Medullary sponge kidney

218. Commonest cause of scrotal swelling—hydrocele.


220. Commonest cause of male impotence—psychogenic.

221. Commonest systemic fungal disease in AIDS—candidiasis.

222. Commonest CNS fungal infection in AIDS—Cryptococcus meningitis.

223. Commonest electrolyte abnormality in AIDS—hyponatremia, SIADH.

224. HIV related common CNS disease—HIV encephalopathy (60% of AIDS patient).

225. Malignancy associated with immunosuppressive treatment in transplant patients:
   a. Squamous cell carcinoma of skin
   b. Cervical cancer
c. Malignant lymphoma
d. Basal cell carcinoma

226. Test used to localize the cause of $B_{12}$ deficiency—Schilling’s test.

227. Coagulation system tests:
   a. Extrinsic coagulation system—Prothrombin time
   b. Intrinsic coagulation system—Activated thromboplastin time

228. Cause of anaemia in renal disease—Erythropoietin deficiency (Site of production—peritubular capillary endothelial cells in kidneys, liver).

229. Cause of persistent haemolytic anaemia post-splenectomy for congenital spherocytosis—failure to identify and remove accessory spleens (splenenculi).

230. Plasmocytoma commonest locations:
   a. Solitary plasmocytoma—vertebrae
   b. Extra-medullary plasmocytoma—upper respiratory tract

231. Commonest vascular disorders:

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<td>Nutritional</td>
<td>scurvy</td>
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<tr>
<td>Metabolic</td>
<td>excess glucocorticoid</td>
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232. Common clinical cause of adult vitamin K deficiency, postoperative patient on antibiotics who is nil per oral.

233. Commonest cause of coagulation deficiency in liver disease—multiple clotting factor deficiency.

234. Commonest clinical features of micronutrient deficiency:
   a. Zinc—perioral pustular rash
   b. Copper—microcytic anaemia
   c. Chromium—hyperglycaemia
   d. Selenium—myopathy
   e. Manganese—dermatitis

235. Malignant hyperthermia:
   Triggers—
   a. Succinylcholine
   b. Halothane
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