# Surgery for MBBS

## A Concise Examination Guide
## Second Edition

115 chapters in 18 Parts, aligned with Bailey & Love, 28th Edition
Clinical features · Investigations · Management · Complications
Exam Alerts and 180 CPSP-style SBAs

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# Preface

This book is written for MBBS students preparing for their professional and final-year surgery examinations. This second edition is aligned with the 28th edition of *Bailey & Love's Short Practice of Surgery*, but presents each condition in a short, uniform format so that a whole topic can be revised in a few minutes.

Each chapter covers the definition, aetiology, clinical features, investigations, management and complications of the disease, with tables for comparisons and differentials. An **Exam Alert** box at the end of each chapter highlights the points most often asked in written papers, vivas and OSCEs, and each Part ends with ten CPSP-style single best answer questions with explanations.

The content reflects the clinical situation in Pakistan, including tuberculosis, amoebic and hydatid disease, thalassaemia, and the use of paan, chhalia and naswar, alongside current international practice.

# What is new in the second edition

All twelve original Parts have been revised and referenced to the 28th edition. Six new Parts reflect the expanded scope of modern surgery: **Paediatric and Neonatal Surgery, Transplantation, Bariatric and Metabolic Surgery, Plastic and Reconstructive Surgery, Cardiothoracic Surgery**, and **Principles of Modern Surgical Practice** (minimal access and robotic surgery, ethics and law, patient safety and audit, and global, disaster and conflict surgery). The book now has 115 chapters and 180 SBAs.

# How to use this book

Read a chapter after your lecture or ward round, then attempt the SBAs at the end of the Part without looking at the answers. Use the Exam Alerts for last-minute revision. This book is a revision aid and does not replace the standard textbooks, clinical teaching or current local guidelines.

**Disclaimer:** Medicine changes constantly. Drug doses, guidelines and protocols should always be checked against current official sources before clinical use.

**Primary references:** Bailey & Love's Short Practice of Surgery, 28th Ed.; Blecha, Surgery, 4th Ed.; ATLS, 10th Ed.

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PART 1

# Basic Principles

## Chapter 1: Wound Healing and Wound Management

**Definition:** A wound is a break in the continuity of skin or tissue. Healing restores continuity by regeneration or by fibrous scar.

### Phases of healing

| Phase | Timing | Key events |
|---|---|---|
| Haemostasis / inflammation | 0–3 days | Platelet plug, fibrin clot; neutrophils then macrophages (key cell) |
| Proliferation | 3 days – 3 weeks | Fibroblasts lay type III collagen, angiogenesis, granulation tissue, epithelialisation, contraction by myofibroblasts |
| Remodelling (maturation) | 3 weeks – 1 year | Type III replaced by type I collagen; tensile strength reaches ~80% of normal, never 100% |

### Types of healing

- **Primary intention:** clean incised wound, edges apposed by sutures; minimal scar
- **Secondary intention:** wound left open (infected, tissue loss); heals by granulation and contraction; larger scar
- **Tertiary (delayed primary) closure:** contaminated wound left open 3–5 days, then closed

### Factors delaying healing

- Local: infection (commonest), poor blood supply, foreign body, haematoma, tension, radiation, movement
- General: old age, malnutrition (protein, vitamin C, zinc), diabetes, anaemia, jaundice, uraemia, steroids, chemotherapy, malignancy

### Classification of wounds (Rank & Wakefield)

Tidy (incised, clean, healthy tissue) vs untidy (crushed, contaminated, devitalised tissue).

### Management of a wound

1. ATLS assessment first; control bleeding by direct pressure
2. Assess nerves, tendons, vessels distal to the wound
3. Wound toilet: irrigation with normal saline, debridement of dead tissue, removal of foreign bodies
4. Tidy wound within 6 hours → primary closure; untidy/late → debride and delayed primary closure
5. Tetanus prophylaxis and antibiotics where indicated

### Abnormal scars

| Feature | Hypertrophic scar | Keloid |
|---|---|---|
| Extent | Confined to wound margins | Extends beyond wound margins |

| Feature | Hypertrophic scar | Keloid |
|---|---|---|
| Onset | Within weeks | Months, may follow trivial injury |
| Natural history | Often regresses | Rarely regresses |
| Sites | Flexures, across joints | Sternum, shoulder, ear lobe |
| Recurrence after excision | Low | High (up to 50%+) |
| Treatment | Pressure garments, silicone gel | Intralesional triamcinolone, intralesional excision + steroid/ radiotherapy |

**Complications of wounds:** infection, dehiscence, incisional hernia, abnormal scar, contracture, Marjolin's ulcer (squamous cell carcinoma in a chronic scar).

> **Exam Alert:** Macrophage is the key cell of healing. Wound dehiscence classically occurs on day 5–8 and is heralded by a serosanguinous ('pink') discharge.

# Chapter 2: Surgical Site Infection and Abscess

## Surgical Site Infection (SSI)

**Definition:** Infection at the operation site within 30 days of surgery (90 days if an implant is placed).

### Classification of operative wounds and infection risk

| Class | Example | SSI risk |
|---|---|---|
| Clean | Hernia repair, thyroidectomy | <2% |
| Clean-contaminated | Cholecystectomy, elective bowel resection | 5–10% |
| Contaminated | Acute appendicitis, open fracture, spillage from gut | 10–20% |
| Dirty | Perforated viscus with pus, faecal peritonitis | >25% |

**Risk factors:** diabetes, obesity, smoking, malnutrition, steroids, long operation, poor technique, haematoma, shaving with razor, hypothermia.

**Clinical features:** pain, redness, swelling, warmth and discharge at the wound around day 4–7; fever.

**Investigations:** wound swab culture and sensitivity, CBC, blood sugar; USG/CT for deep collections.

**Management:** remove a few sutures, drain pus, regular dressings; antibiotics if cellulitis or systemic signs; image-guided drainage for deep abscess.

**Prevention:** pre-op shower, hair clipping (not shaving), chlorhexidine-alcohol skin prep, prophylactic antibiotic within 60 minutes before incision, normothermia, glucose control, good haemostasis.

## Abscess

**Definition:** A localised collection of pus surrounded by a pyogenic membrane of granulation tissue. Commonest organism: *Staphylococcus aureus*.

**Clinical features:** painful, hot, red, tender swelling; fluctuation (may be absent in deep abscess); throbbing pain causing sleeplessness; fever.

**Investigations:** CBC (leucocytosis), blood sugar (exclude diabetes), USG to confirm pus and depth; pus for culture.

**Management:** *Ubi pus, ibi evacua* — where there is pus, drain it.

1. Incision and drainage under anaesthesia
2. Break loculi, irrigate, leave open (pack or drain)
3. Antibiotics only if cellulitis, diabetes, immunocompromise or systemic sepsis
4. Daily dressings; heals by secondary intention

**Complications:** spreading cellulitis, septicaemia, sinus formation, recurrence (foreign body, diabetes, underlying disease).

> **Exam Alert:** Antibiotics do not cure an established abscess; drainage is essential. Recurrent abscesses → check blood sugar.

# Chapter 3: Cellulitis and Necrotising Fasciitis

## Cellulitis

**Definition:** Diffuse, spreading, non-suppurative infection of skin and subcutaneous tissue. Commonest organism: *Streptococcus pyogenes* (also *Staph. aureus*).

**Risk factors:** breach in skin (cuts, fungal toe-web infection), diabetes, lymphoedema, venous insufficiency, obesity.

**Clinical features:** red, hot, tender, swollen skin with ill-defined margins; no fluctuation; fever, malaise; lymphangitis (red streaks) and tender regional lymph nodes.

**Investigations:** CBC, blood sugar, blood culture if septic; USG to exclude abscess; Doppler if DVT suspected.

**Management:** limb elevation and rest; IV/oral antibiotics (e.g. flucloxacillin or co-amoxiclav); mark margins to monitor spread; treat portal of entry; control diabetes.

**Complications:** abscess formation, necrotising fasciitis, septicaemia, recurrent cellulitis → secondary lymphoedema.

**Differential:** DVT, erysipelas (sharply demarcated, raised edge), gout, contact dermatitis.

## Necrotising Fasciitis

**Definition:** Rapidly spreading, life-threatening infection of fascia and subcutaneous tissue with thrombosis of vessels and necrosis. A true surgical emergency (mortality 20–40%).

### Types

- **Type I (polymicrobial):** aerobes + anaerobes; commonest; diabetics, after surgery. **Fournier's gangrene** = necrotising fasciitis of perineum and scrotum
- **Type II (monomicrobial):** Group A *Streptococcus* ± *Staph. aureus*; healthy young people after minor injury

### Clinical features

- **Pain out of proportion to signs** (earliest and key feature)
- Rapidly spreading erythema, oedema beyond the redness, dusky/purple skin, bullae
- Crepitus (gas), skin anaesthesia (nerve destruction), "dishwater" discharge
- Systemic toxicity: fever, tachycardia, hypotension, septic shock

**Investigations:** CBC, CRP, sodium, creatinine, glucose (**LRINEC score**); X-ray/CT for gas in tissues. Do not delay surgery for imaging; diagnosis is confirmed at operation (grey fascia, "finger test" positive, no bleeding).

### Management

1. Resuscitation (sepsis protocol), ICU care
2. High-dose IV broad-spectrum antibiotics: e.g. meropenem + clindamycin (toxin suppression) ± vancomycin
3. **Urgent radical debridement** of all necrotic tissue; repeat look every 24–48 hours
4. Later: skin grafting, reconstruction; diverting colostomy may be needed in Fournier's

**Complications:** septic shock, multi-organ failure, limb loss, death.

> **Exam Alert:** Pain out of proportion to clinical findings = suspect necrotising fasciitis. Treatment is surgical, not antibiotics alone.

## Chapter 4: Gas Gangrene (Clostridial Myonecrosis)

**Definition:** Rapidly spreading necrotising infection of muscle caused by *Clostridium perfringens* (*welchii*), an anaerobic, gram-positive, spore-forming bacillus.

**Aetiology:** deep, contaminated wounds with dead muscle and low oxygen — road traffic and war injuries, crush injuries, high above-knee amputation in ischaemic limbs, bowel and biliary surgery, injections in buttock. Alpha toxin (lecithinase) destroys cell membranes.

### Clinical features

- Incubation 1–4 days (can be hours)
- Sudden severe pain in the wound, rapidly spreading swelling
- Skin: pale → bronze → purple-black, bullae
- Thin, brown, foul ("mousy") smelling discharge
- **Crepitus** on palpation (gas in tissues)
- Patient toxic, anxious, tachycardia out of proportion to fever, hypotension; jaundice from haemolysis

### Investigations

- Clinical diagnosis; treatment must not wait
- Gram stain of exudate: large gram-positive bacilli, few neutrophils
- X-ray: feathery gas shadows along muscle planes
- CBC (haemolysis), electrolytes, creatinine, CK

### Management

1. Resuscitation, IV fluids, blood, oxygen, ICU
2. High-dose IV benzylpenicillin + clindamycin + metronidazole
3. **Radical surgical debridement** of all dead muscle; open fasciotomy; amputation if limb unsalvageable
4. Hyperbaric oxygen as an adjunct where available
5. Re-look surgery every 24 hours

**Prevention:** thorough debridement of contaminated wounds, leave doubtful wounds open, prophylactic penicillin in high-risk amputations.

**Complications:** septic shock, renal failure, haemolysis, DIC, limb loss, death.

**Differential:** necrotising fasciitis, anaerobic streptococcal myositis, surgical emphysema (gas from chest injury, no toxicity).

> **Exam Alert:** Crepitus + toxaemia + wound pain within days of a dirty wound = gas gangrene. Surgery is life-saving; antitoxin is no longer used.

## Chapter 5: Tetanus

**Definition:** An acute illness caused by the exotoxin (tetanospasmin) of *Clostridium tetani*, producing muscle rigidity and spasms. Still a significant problem in Pakistan, including neonatal tetanus.

**Pathogenesis:** spores enter through puncture wounds, burns, compound fractures, unclean delivery or umbilical cord care → toxin travels along nerves to the spinal cord → blocks release of inhibitory transmitters (GABA, glycine) → unopposed motor activity and autonomic instability.

### Clinical features

- Incubation 3–21 days; shorter incubation = worse prognosis
- **Trismus (lockjaw)** — commonest first sign
- **Risus sardonicus** (sardonic smile), neck stiffness, dysphagia
- **Opisthotonus**, board-like abdominal rigidity
- Painful generalised spasms triggered by noise, light, touch; patient fully conscious
- Autonomic dysfunction: tachycardia, labile BP, sweating, arrhythmia
- Local tetanus (rigidity near wound) and cephalic tetanus (head wounds, cranial nerve palsy) are variants

**Investigations:** diagnosis is clinical; wound culture is often negative. Check CBC, electrolytes, CK, ABGs; exclude strychnine poisoning, dystonic drug reactions, meningitis, dental abscess (trismus).

### Management

1. Admit to quiet, dark room / ICU
2. **Human tetanus immunoglobulin (HTIG)** to neutralise unbound toxin (e.g. 3,000–6,000 IU IM)
3. Wound debridement after HTIG
4. Metronidazole IV (drug of choice)
5. Control spasms: benzodiazepines (diazepam/midazolam), magnesium sulphate; paralysis and ventilation in severe cases
6. Early tracheostomy for airway protection; NG feeding, DVT prophylaxis
7. Active immunisation (tetanus toxoid) — the disease does not confer immunity

### Prophylaxis in wounds

| Immunisation history | Clean minor wound | Tetanus-prone wound |
|---|---|---|
| Fully immunised, booster <10 yrs | Nothing | Nothing (booster if >5 yrs in high-risk wounds) |
| Fully immunised, booster >10 yrs | Toxoid booster | Toxoid booster |
| Incomplete or unknown | Toxoid course | Toxoid course + HTIG (250–500 IU) |

**Complications:** airway obstruction, aspiration pneumonia, fractures of vertebrae, rhabdomyolysis, autonomic crisis, death (mortality 10–60%).

> **Exam Alert:** Trismus is the commonest presenting sign. Patients remain conscious during spasms. Tetanus survivors must still be vaccinated.

# Chapter 6: Shock

**Definition:** Inadequate tissue perfusion and oxygenation leading to cellular hypoxia, anaerobic metabolism and lactic acidosis. Hypotension is a late sign.

### Types of shock

| Type | Cause | Examples | Skin |
|---|---|---|---|
| Hypovolaemic | Loss of circulating volume | Haemorrhage, burns, vomiting, diarrhoea | Cold, clammy |
| Cardiogenic | Pump failure | MI, arrhythmia, valve rupture | Cold, raised JVP |
| Obstructive | Mechanical obstruction to flow | Tension pneumothorax, cardiac tamponade, massive PE | Cold, raised JVP |
| Distributive — septic | Vasodilatation from infection | Peritonitis, cholangitis | Warm early, cold late |
| Distributive — anaphylactic | Histamine-mediated vasodilatation | Drug or latex allergy | Warm, urticaria, bronchospasm |
| Distributive — neurogenic | Loss of sympathetic tone | Spinal cord injury above T6 | Warm, **bradycardia** |

### Classes of haemorrhagic shock (ATLS, 70 kg adult)

| Parameter | Class I | Class II | Class III | Class IV |
|---|---|---|---|---|
| Blood loss | <15% (<750 ml) | 15–30% (750–1500 ml) | 30–40% (1500–2000 ml) | >40% (>2000 ml) |
| Pulse | Normal | 100–120 | 120–140 | >140 |
| Systolic BP | Normal | Normal | Decreased | Markedly decreased |
| Urine output | >30 ml/h | 20–30 ml/h | 5–15 ml/h | Negligible |
| Mental state | Slightly anxious | Anxious | Confused | Lethargic |
| Fluid | Crystalloid | Crystalloid | Blood | Blood (massive transfusion) |

**Clinical features:** tachycardia (earliest sign), tachypnoea, cold peripheries, delayed capillary refill (>2 s), narrow pulse pressure, oliguria (<0.5 ml/kg/h), confusion, hypotension (late).

**Investigations:** CBC, cross-match, ABGs and **serum lactate**, electrolytes, RFTs, LFTs, coagulation profile, blood cultures (sepsis), ECG and troponin (cardiogenic), FAST/USG, CXR.

**Monitoring:** pulse, BP, respiratory rate, $SpO_2$, urine output by catheter (≥0.5 ml/kg/h), CVP, lactate clearance.

### Management principles

1. ABCDE, high-flow oxygen, two large-bore cannulae
2. Treat the cause: stop bleeding (pressure, surgery, angio-embolisation), drain sepsis, decompress tension pneumothorax
3. **Hypovolaemic:** warmed crystalloid 1 L bolus, early blood and products (1:1:1 ratio in major haemorrhage), tranexamic acid within 3 hours of injury; permissive hypotension until bleeding controlled
4. **Septic:** Sepsis Six within 1 hour — oxygen, blood cultures, IV antibiotics, 30 ml/kg fluid, lactate, urine output; noradrenaline if MAP <65 mmHg after fluids; source control
5. **Anaphylactic:** IM adrenaline 0.5 mg (1:1000), fluids, antihistamine, steroid
6. **Cardiogenic:** inotropes (dobutamine), treat MI; avoid fluid overload

**Complications:** acute kidney injury, ARDS, DIC, stress ulceration, multi-organ dysfunction syndrome, death.

> **Exam Alert:** Tachycardia is the earliest sign; hypotension appears only after ~30% blood loss. Neurogenic shock has bradycardia and warm skin.

## Chapter 7: Fluids and Electrolytes

**Body water:** about 60% of body weight in adult males (42 L in a 70 kg man): two-thirds intracellular, one-third extracellular (of which three-quarters interstitial, one-quarter plasma).

### Daily maintenance requirements (adult)

| Item | Requirement |
|---|---|
| Water | 25–30 ml/kg/day (about 2.5 L) |
| Sodium | 1 mmol/kg/day |
| Potassium | 1 mmol/kg/day |
| Glucose | 50–100 g/day (prevents ketosis) |
| Insensible loss | ~800 ml/day; add 10% per °C of fever |

Children (Holliday–Segar 4-2-1 rule): 4 ml/kg/h for first 10 kg, 2 ml/kg/h for next 10 kg, 1 ml/kg/h thereafter.

### Common IV fluids (per litre)

| Fluid | $Na^+$ (mmol) | $K^+$ (mmol) | $Cl^-$ (mmol) | Other | Use |
|---|---|---|---|---|---|
| 0.9% saline | 154 | 0 | 154 | — | Resuscitation, vomiting (hypochloraemia) |
| Ringer's lactate (Hartmann's) | 131 | 5 | 111 | Lactate 29, $Ca^{2}$ | Resuscitation, burns, surgery |
| 5% dextrose | 0 | 0 | 0 | Glucose 50 g | Free water, maintenance |
| Dextrose-saline (4%/0.18%) | 30 | 0 | 30 | Glucose 40 g | Maintenance |

**Gastrointestinal losses:** vomiting (gastric outlet obstruction) causes **hypochloraemic, hypokalaemic metabolic alkalosis with paradoxical aciduria** → correct with 0.9% saline + KCl. Small bowel fistula/diarrhoea causes loss of bicarbonate → metabolic acidosis.

### Key electrolyte disorders

| Disorder | Surgical causes | Features | Treatment |
|---|---|---|---|
| Hyponatraemia (<135) | Excess dextrose, SIADH after surgery, TURP syndrome | Confusion, fits | Fluid restriction; hypertonic saline if severe; correct slowly (<10 mmol/L/24h) to avoid central pontine myelinolysis |
| Hypokalaemia (<3.5) | Vomiting, NG aspiration, fistula, diuretics | Weakness, ileus, U waves on ECG | Oral or IV KCl, max 10–20 mmol/h IV, never bolus |
| Hyperkalaemia (>5.5) | Renal failure, crush injury, massive transfusion, burns | Arrhythmia, tall T waves, cardiac arrest | Calcium gluconate 10% 10 ml, insulin-dextrose, salbutamol, dialysis |
| Hypocalcaemia | After thyroidectomy/parathyroidectomy, pancreatitis | Tingling, Chvostek and Trousseau signs, tetany | IV calcium gluconate |

**Monitoring fluid therapy:** pulse, BP, urine output (≥0.5 ml/kg/h), daily weight, fluid balance chart, serum electrolytes.

**Complications:** fluid overload (pulmonary oedema), dilutional hyponatraemia, hyperchloraemic acidosis (excess saline), cannula phlebitis.

> **Exam Alert:** Pyloric stenosis/gastric outlet obstruction = hypochloraemic hypokalaemic metabolic alkalosis. IV potassium is never given as a bolus.

## Chapter 8: Blood Transfusion

**Principle:** Transfuse the specific component needed, not whole blood, and only when the benefit outweighs the risk.

### Blood components

| Component | Storage | Shelf life | Indication |
|---|---|---|---|
| Packed red cells | 2–6 °C | 35–42 days | Haemorrhage, symptomatic anaemia; Hb <7 g/dl (<8 in cardiac disease) |
| Platelets | 20–24 °C with agitation | 5 days | Count <50,000 with bleeding or before surgery; <10,000 prophylactically |
| Fresh frozen plasma (FFP) | −30 °C | 1–2 years | Coagulopathy (INR >1.5), massive transfusion, warfarin reversal (if PCC unavailable) |
| Cryoprecipitate | −30 °C | 1–2 years | Fibrinogen <1.5 g/L, DIC, haemophilia A, von Willebrand disease |
| Whole blood | 2–6 °C | 35 days | Acute massive haemorrhage where components unavailable |

One unit of packed cells raises Hb by about 1 g/dl in an adult.

**Pre-transfusion steps:** group and screen; cross-match; bedside check of patient identity, blood group and expiry by two staff; baseline vitals.

**Massive transfusion:** replacement of one blood volume in 24 h, or >10 units, or 4 units in 1 hour. Give red cells, FFP and platelets in a **1:1:1 ratio**; add tranexamic acid and calcium.

### Complications of transfusion

| Type | Complication | Key point |
|---|---|---|
| Acute immune | Acute haemolytic reaction | ABO incompatibility (clerical error); fever, loin pain, hypotension, haemoglobinuria → stop transfusion immediately |
| Acute immune | Febrile non-haemolytic reaction | Commonest; antibodies to donor white cells; slow rate, paracetamol |
| Acute immune | Allergic / anaphylaxis | Urticaria → antihistamine; anaphylaxis (IgA deficiency) → adrenaline |
| Acute immune | TRALI | Lung injury within 6 hours; ventilatory support |
| Acute non-immune | TACO (circulatory overload) | Elderly, cardiac patients; diuretics |
| Acute non-immune | Bacterial contamination | Commonest with platelets (stored warm) |

| Type | Complication | Key point |
|---|---|---|
| Massive transfusion | Hypothermia, hypocalcaemia (citrate), hyperkalaemia, coagulopathy, acidosis | Warm blood, give calcium |
| Delayed | Delayed haemolytic reaction | 5–10 days later; jaundice, falling Hb |
| Delayed | Infections | Hepatitis B and C, HIV, malaria, syphilis |
| Delayed | Iron overload | Repeated transfusions (thalassaemia) |
| Delayed | Graft-versus-host disease | Immunocompromised; prevented by irradiated blood |

**Management of a reaction:** stop the transfusion, keep IV line open with saline, check patient identity and bag, send bag and patient's blood to lab, supportive treatment, inform blood bank.

**Alternatives:** autologous pre-donation, cell salvage, tranexamic acid, iron therapy, erythropoietin.

> **Exam Alert:** Commonest cause of acute haemolytic reaction is clerical error (wrong patient). Febrile non-haemolytic reaction is the commonest reaction overall.

## Chapter 9: Surgical Nutrition

**Importance:** Malnutrition is present in up to 40% of surgical patients and increases wound infection, dehiscence, anastomotic leak, immune failure and mortality.

### Metabolic response to injury

- **Ebb phase** (first 24–48 h): reduced metabolic rate, shock
- **Flow phase:** catabolism — raised cortisol, catecholamines, glucagon; protein breakdown, negative nitrogen balance, hyperglycaemia, sodium and water retention
- **Anabolic phase:** recovery and weight regain

### Assessment of nutritional status

- History: weight loss >10% in 6 months is significant; dietary intake
- Examination: BMI <18.5 kg/m², muscle wasting, triceps skinfold, mid-arm circumference, grip strength
- Labs: serum albumin (<3 g/dl; also falls with inflammation), prealbumin, lymphocyte count
- Screening tool: **MUST** (Malnutrition Universal Screening Tool)

**Requirements:** energy 25–30 kcal/kg/day; protein 1–1.5 g/kg/day (more in burns and sepsis).

### Routes of nutritional support

| Route | Method | Indications | Complications |
|---|---|---|---|
| Oral | Supplements, high-protein diet | Functioning gut, able to swallow | — |
| Enteral (tube) | Nasogastric, nasojejunal, PEG, feeding jejunostomy | Functioning gut but unable to eat: head injury, dysphagia, ICU, pancreatitis | Tube displacement, aspiration, diarrhoea, refeeding syndrome |
| Parenteral (TPN) | Central line or PICC | Non-functioning gut: prolonged ileus, high-output fistula, short bowel syndrome | Line sepsis, thrombosis, pneumothorax, hyperglycaemia, liver dysfunction, refeeding syndrome |

**"If the gut works, use it."** Enteral feeding is preferred: cheaper, safer, maintains gut mucosa and reduces bacterial translocation.

**Refeeding syndrome:** on starting feeds in a starved patient, insulin drives phosphate, potassium and magnesium into cells → **hypophosphataemia** (hallmark), arrhythmias, heart failure, respiratory failure. Prevent by starting at 10 kcal/kg/day, giving thiamine and replacing electrolytes, then increasing slowly.

**ERAS (Enhanced Recovery After Surgery):** avoid prolonged fasting, carbohydrate loading 2 h before surgery, early oral feeding after operation.

> **Exam Alert:** Enteral is preferred over parenteral whenever the gut works. Hypophosphataemia is the hallmark of refeeding syndrome.

## Chapter 10: Principles of Surgical Oncology

**Definition:** Cancer is uncontrolled cell growth with the ability to invade and metastasise. Surgery remains the main curative treatment for most solid tumours, usually combined with chemotherapy and radiotherapy in a multidisciplinary team (MDT).

### Benign vs malignant tumours

| Feature | Benign | Malignant |
|---|---|---|
| Growth | Slow | Rapid |
| Capsule | Present | Absent, infiltrative |
| Invasion and metastasis | No | Yes |
| Differentiation | Well differentiated | Variable, anaplasia |
| Recurrence after excision | Rare | Common |

**Routes of spread:** direct (local invasion), lymphatic (carcinomas), haematogenous (sarcomas, follicular thyroid, renal cell carcinoma), transcoelomic (stomach and ovary across peritoneum), implantation (port sites, wound).

**Clinical features:** local mass, ulcer with everted edge, bleeding, obstruction of a hollow organ; lymphadenopathy; systemic — weight loss, anorexia, anaemia, fever; paraneoplastic syndromes.

### Investigations

1. **Diagnosis (tissue):** FNAC (cytology), core needle biopsy (histology, preferred), incision/excision biopsy, endoscopic biopsy
2. **Staging:** CT chest/abdomen/pelvis, MRI, PET-CT, bone scan, endoscopic USG
3. **Tumour markers** (monitoring more than diagnosis): CEA (colorectal), AFP (liver, testis), β-hCG (testis), CA 19-9 (pancreas), CA-125 (ovary), PSA (prostate), calcitonin (medullary thyroid)

**TNM staging:** T = size/extent of primary, N = regional nodes, M = distant metastasis. Grading = degree of differentiation (G1–G3).

### Treatment modalities

- **Surgery:** curative (wide excision with clear margins + regional lymphadenectomy, en-bloc resection), palliative (bypass, stoma, debulking), prophylactic (e.g. mastectomy in BRCA carriers), diagnostic and staging, reconstructive
- **Chemotherapy:** neoadjuvant (before surgery to shrink tumour), adjuvant (after surgery to treat micrometastases), palliative
- **Radiotherapy:** curative, adjuvant, palliative (bone pain, spinal cord compression, bleeding)
- **Hormonal, targeted and immunotherapy:** tamoxifen, trastuzumab, checkpoint inhibitors

**Screening programmes:** breast (mammography), cervix (Pap smear/HPV), colorectal (faecal occult blood, colonoscopy).

**Complications of cancer and treatment:** malignant effusions, hypercalcaemia, spinal cord compression, superior vena cava obstruction, tumour lysis syndrome, neutropenic sepsis.

> **Exam Alert:** Core biopsy is preferred to FNAC because it gives histology and receptor status. Sarcomas spread by blood; carcinomas by lymphatics.

## Self-Assessment: Part 1 SBAs

**1.** On day 6 after laparotomy, a 60-year-old man notices a large amount of pink serous fluid soaking his dressing. What is the most likely diagnosis?

A. Anastomotic leak · B. Impending wound dehiscence · C. Seroma · D. Superficial wound infection · E. Wound haematoma

**Answer: B.** Serosanguinous discharge on day 5–8 is the classic warning sign of burst abdomen.

**2.** A 25-year-old woman has a firm, itchy scar on her sternum that has grown beyond the margins of a minor wound over 8 months. What is the best initial treatment?

A. Excision and primary closure · B. Intralesional triamcinolone · C. Oral antibiotics · D. Radiotherapy alone · E. Reassurance

**Answer: B.** This is a keloid; simple excision alone has a high recurrence rate.

**3.** A 45-year-old diabetic man has a 5-day history of a painful, red, fluctuant swelling on his buttock with fever. What is the definitive treatment?

A. Hot fomentation · B. Incision and drainage · C. IV antibiotics alone · D. Needle aspiration only · E. Oral antibiotics and review

**Answer: B.** An established abscess needs drainage; antibiotics are adjuncts.

**4.** A 55-year-old diabetic man has scrotal pain far greater than the visible redness, with crepitus and BP of 85/50 mmHg. After resuscitation and IV antibiotics, what is the next step?

A. CT pelvis · B. Hyperbaric oxygen · C. Observation for 24 hours · D. Urgent radical surgical debridement · E. Ultrasound scrotum

**Answer: D.** Fournier's gangrene; imaging must not delay surgery.

**5.** A 30-year-old farmer with a nail-prick injury 10 days ago presents with difficulty opening his mouth and stiffness of the neck. He is fully conscious. Which drug is used to neutralise the circulating toxin?

A. Diazepam · B. Human tetanus immunoglobulin · C. Magnesium sulphate · D. Metronidazole · E. Tetanus toxoid

**Answer: B.** HTIG neutralises unbound toxin; toxoid gives active immunity.

**6.** A 28-year-old man after a road traffic accident has pulse 130/min, BP 85/60 mmHg and is confused. What is his estimated blood loss?

A. <15% · B. 15–30% · C. 30–40% · D. 40–50% · E. >50%

**Answer: C.** Class III haemorrhage: tachycardia 120–140, hypotension and confusion.

**7.** A 20-year-old man with a cervical spine injury has BP 80/50 mmHg, pulse 52/min and warm peripheries. What type of shock is this?

A. Anaphylactic · B. Cardiogenic · C. Hypovolaemic · D. Neurogenic · E. Septic

**Answer: D.** Hypotension with bradycardia and warm skin indicates loss of sympathetic tone.

**8.** A 50-year-old man with gastric outlet obstruction from a chronic duodenal ulcer has vomited for 2 weeks. Which biochemical picture is expected?

A. Hyperchloraemic metabolic acidosis · B. Hyperkalaemic metabolic acidosis · C. Hypochloraemic hypokalaemic metabolic alkalosis · D. Hyponatraemic metabolic acidosis · E. Respiratory alkalosis

**Answer: C.** Loss of HCl from vomiting; treat with 0.9% saline and potassium.

**9.** Within 10 minutes of starting a blood transfusion, a patient develops fever, loin pain, hypotension and dark urine. What is the first action?

A. Give IV hydrocortisone · B. Give paracetamol and continue slowly · C. Send blood for repeat cross-match · D. Slow the transfusion rate · E. Stop the transfusion immediately

**Answer: E.** Acute haemolytic (ABO incompatible) reaction; stop transfusion and keep the line open with saline.

**10.** A severely malnourished patient is started on full-calorie nasogastric feeding. On day 3 he develops weakness and arrhythmia. Which abnormality is most characteristic?

A. Hypercalcaemia · B. Hyperkalaemia · C. Hypernatraemia · D. Hypoglycaemia · E. Hypophosphataemia

**Answer: E.** Refeeding syndrome; prevent by starting feeds slowly with thiamine and electrolyte replacement.

*References: Bailey & Love's Short Practice of Surgery, 28th Ed.; Blecha, Surgery, 4th Ed.; ATLS, 10th Ed.*

PART 2

# Perioperative Care

## Chapter 11: Preoperative Assessment and Consent

**Aim:** To identify and optimise risk factors before surgery, plan anaesthesia and obtain informed consent, so that the patient arrives in theatre in the best possible condition.

### History

- Presenting surgical problem and urgency
- Cardiovascular: angina, MI, heart failure, exercise tolerance (ability to climb two flights of stairs ≈ 4 METs, acceptable)
- Respiratory: COPD, asthma, smoking, obstructive sleep apnoea
- Endocrine: diabetes, thyroid disease, steroid use
- Bleeding tendency, previous anaesthesia and family history of anaesthetic problems (malignant hyperthermia, suxamethonium apnoea)
- Drugs and allergies

### ASA physical status classification

| ASA | Description | Example |
|---|---|---|
| I | Normal healthy patient | Fit young adult |
| II | Mild systemic disease | Controlled hypertension, smoker |
| III | Severe systemic disease | Stable angina, poorly controlled diabetes |
| IV | Severe disease, constant threat to life | Recent MI, severe heart failure |
| V | Moribund, not expected to survive without surgery | Ruptured aortic aneurysm |
| VI | Brain-dead organ donor | — |

Suffix **E** = emergency surgery (e.g. ASA IIIE).

### Investigations (tailored to age, ASA and surgery)

| Test | Indication |
|---|---|
| CBC | Major surgery, anaemia, blood loss expected |
| Urea, creatinine, electrolytes | Age >60, diabetes, renal disease, diuretics, ACE inhibitors |
| Blood sugar / HbA1c | Diabetes, obesity |
| Coagulation profile | Liver disease, anticoagulants, bleeding history |
| ECG | Age >65, cardiac disease, diabetes, hypertension |
| Chest X-ray | Cardiorespiratory disease, thoracic surgery, malignancy |

| Test | Indication |
|---|---|
| Echocardiography | Murmur, heart failure |
| Viral screen (HBsAg, anti-HCV, HIV) | Routine in many Pakistani hospitals |
| Pregnancy test | Women of reproductive age |
| Group and save / cross-match | Expected blood loss |

### Drug management before surgery

| Drug | Action |
|---|---|
| Aspirin | Usually continue (stop 7 days before if bleeding risk is high, e.g. neurosurgery) |
| Clopidogrel | Stop 5–7 days before elective surgery (not after recent coronary stent without cardiology advice) |
| Warfarin | Stop 5 days before; bridge with LMWH if high thrombotic risk; INR <1.5 on day of surgery |
| DOACs | Stop 24–48 hours before depending on drug and renal function |
| Oral hypoglycaemics | Omit on morning of surgery; metformin held if contrast or renal risk |
| Insulin | Reduce dose; variable-rate IV insulin infusion for major surgery |
| Steroids | Continue; give perioperative hydrocortisone cover |
| OC pill / HRT | Stop 4 weeks before major surgery (DVT risk) |
| Antihypertensives, beta-blockers | Continue (ACE inhibitors may be withheld on morning of surgery) |

**Fasting (ASA guidelines):** solids 6 hours, breast milk 4 hours, clear fluids 2 hours.

### Informed consent

- Must be given voluntarily by a competent patient who understands the information
- Explain the diagnosis, the procedure, its benefits, common and serious risks, alternatives (including no treatment)
- Taken by the operating surgeon or a doctor capable of performing the procedure
- Written consent for operations; in emergencies with an unconscious patient, treat in best interests
- For minors, a parent or guardian consents

> **Exam Alert:** ASA grade predicts perioperative risk. Clear fluids are allowed up to 2 hours before anaesthesia.

# Chapter 12: Anaesthesia and Local Anaesthetics

**Types of anaesthesia:** general, regional (spinal, epidural, nerve blocks), local infiltration, and sedation.

## General Anaesthesia

**Components (triad):** hypnosis (unconsciousness), analgesia, muscle relaxation.

**Phases:** induction (IV propofol or thiopentone, or inhalational sevoflurane in children) → airway (face mask, laryngeal mask airway, endotracheal tube) → maintenance (volatile agents such as isoflurane/sevoflurane or propofol infusion, opioids, muscle relaxants) → reversal and recovery (neostigmine + glycopyrrolate, or sugammadex for rocuronium).

**Rapid sequence induction:** used in emergency or full-stomach patients (intestinal obstruction, pregnancy); preoxygenation, induction agent plus suxamethonium or high-dose rocuronium, cricoid pressure, cuffed endotracheal tube.

**Complications of GA:** sore throat, dental damage, aspiration pneumonitis (Mendelson's syndrome), hypoxia, laryngospasm, postoperative nausea and vomiting, awareness, anaphylaxis, **malignant hyperthermia** (triggered by volatile agents and suxamethonium; rising temperature, rigidity, rising end-tidal $CO_2$ → treat with IV dantrolene), suxamethonium apnoea (pseudocholinesterase deficiency).

### Spinal and Epidural Anaesthesia

| Feature | Spinal | Epidural |
|---|---|---|
| Site of injection | Subarachnoid space (CSF), below L1–L2 | Epidural space, any level |
| Dose | Small | Large |
| Onset | Rapid (minutes) | Slower (15–20 min) |
| Block | Dense | Less dense, can be extended by catheter |
| Uses | Lower limb, hernia, perineal, caesarean | Labour analgesia, postoperative pain relief |

**Complications:** hypotension (sympathetic block, commonest), post-dural puncture headache (worse on sitting; treat with fluids, caffeine, epidural blood patch), urinary retention, high/total spinal block, epidural haematoma or abscess.

**Contraindications:** patient refusal, coagulopathy or anticoagulation, local infection, raised intracranial pressure, uncorrected hypovolaemia.

### Local Anaesthetics

**Mechanism:** block sodium channels in nerve membranes, preventing conduction. Small, unmyelinated pain fibres are blocked first.

| Agent | Onset | Duration | Maximum safe dose |
|---|---|---|---|
| Lidocaine (lignocaine) | Rapid | 1–2 hours | 3 mg/kg plain; 7 mg/kg with adrenaline |
| Bupivacaine | Slow | 4–8 hours | 2 mg/kg (cardiotoxic) |

A 1% solution contains 10 mg/ml. A 70 kg adult can safely receive about 20 ml of 1% plain lidocaine.

**Adrenaline:** causes vasoconstriction, prolongs action and reduces bleeding; avoid in end-arteries (fingers, toes, penis, ear, nose tip) traditionally, because of the risk of ischaemia.

**Local anaesthetic systemic toxicity (LAST):** perioral tingling, metallic taste, tinnitus, light-headedness → convulsions → arrhythmia and cardiac arrest. Treatment: stop injection, ABC, oxygen, benzodiazepines for fits, **IV 20% lipid emulsion**, prolonged CPR if arrest.

> **Exam Alert:** Hypotension is the commonest complication of spinal anaesthesia. Dantrolene treats malignant hyperthermia. Lipid emulsion treats local anaesthetic toxicity.

## Chapter 13: Postoperative Complications

**Classification:** complications are general (any operation) or specific (to that operation), and immediate (<24 h), early (1–30 days) or late (>30 days).

### General complications by time

| Timing | Complications |
|---|---|
| Immediate (<24 h) | Primary haemorrhage, reactionary haemorrhage, airway obstruction, hypoxia, hypotension, nausea and vomiting, urinary retention |
| Early (1–30 days) | Atelectasis, pneumonia, wound infection, secondary haemorrhage, paralytic ileus, anastomotic leak, UTI, DVT/PE, acute confusion, pressure sores |
| Late (>30 days) | Incisional hernia, adhesive obstruction, hypertrophic scar/keloid, recurrence of disease |

## Postoperative Pyrexia

The timing of fever points to the likely cause (the **5 Ws**):

| Day | Cause ("W") | Example |
|---|---|---|
| Day 1–2 | **W**ind | Atelectasis; also normal inflammatory response to surgery |
| Day 3–5 | **W**ater | Urinary tract infection (catheter) |
| Day 5–7 | **W**ound | Wound infection; anastomotic leak, intra-abdominal abscess |
| Day 7–10 | **W**alking | DVT and pulmonary embolism |
| Any time | **W**onder drugs | Drug fever, transfusion reaction, line infection |

**Work-up:** examine chest, wound, calves, IV lines, catheter; CBC, CRP, blood and urine cultures, CXR, USG/CT abdomen for collection.

## Haemorrhage

- **Primary:** during surgery; controlled at operation
- **Reactionary:** within 24 hours, as BP rises and a ligature slips or vessel opens; return to theatre
- **Secondary:** 7–14 days, due to infection eroding a vessel; antibiotics, packing or re-exploration

## Respiratory Complications

- **Atelectasis:** commonest; day 1–2, low-grade fever, reduced breath sounds at bases; prevent and treat with chest physiotherapy, incentive spirometry, analgesia, early mobilisation
- **Pneumonia:** fever, productive cough, consolidation; sputum culture, antibiotics
- **Aspiration:** right lower lobe most often; prevent by fasting, NG decompression, RSI
- **ARDS:** sepsis, massive transfusion, pancreatitis; ventilatory support

## Urinary Retention

Common after hernia, anorectal surgery and spinal anaesthesia, especially in older men with prostatic enlargement. Manage with analgesia, mobilisation, warm sitz bath; catheterise if unresolved.

## Paralytic Ileus

Temporary cessation of gut motility, normal for 24–72 hours after laparotomy. Prolonged ileus: abdominal distension, absent bowel sounds, vomiting, no flatus. Causes: electrolyte imbalance (hypokalaemia), opioids, sepsis, anastomotic leak. Management: nil by mouth, NG tube, IV fluids, correct potassium, treat cause; exclude mechanical obstruction.

### Anastomotic Leak

Usually day 5–7: fever, tachycardia, abdominal pain, peritonitis, discharge of gut contents from drain or wound. CT with contrast confirms. Small contained leak → antibiotics + radiological drainage; major leak → laparotomy, washout, stoma.

### Burst Abdomen (Wound Dehiscence)

Day 5–8; preceded by serosanguinous discharge. Risk factors: poor technique, infection, malnutrition, obesity, jaundice, steroids, raised intra-abdominal pressure (cough, distension). Management: cover with sterile wet swabs, reassure, analgesia, return to theatre for closure (tension sutures/mass closure).

### Acute Confusion (Delirium)

Elderly patients; causes include hypoxia, sepsis, electrolyte imbalance, drugs, alcohol withdrawal, urinary retention. Treat the cause.

> **Exam Alert:** Fever on day 1–2 = atelectasis; day 5–7 = wound infection or leak. Reactionary haemorrhage is within 24 hours; secondary haemorrhage at 7–14 days from infection.

## Chapter 14: Deep Vein Thrombosis and Pulmonary Embolism

### Deep Vein Thrombosis (DVT)

**Definition:** Formation of thrombus in the deep veins, usually of the calf, extending proximally to the popliteal, femoral and iliac veins.

**Aetiology — Virchow's triad:** stasis of blood flow, endothelial (vessel wall) injury, hypercoagulability.

**Risk factors:** major surgery (especially pelvic, hip and knee), immobility, age >60, malignancy, obesity, pregnancy and puerperium, oral contraceptives/HRT, previous DVT, thrombophilia (factor V Leiden, protein C/S deficiency), long-haul travel, trauma.

#### Clinical features

- Often silent (asymptomatic in about half)
- Calf pain, swelling, tenderness, warmth, dilated superficial veins
- Low-grade fever (day 7–10 after surgery)
- **Phlegmasia alba dolens** (white, swollen leg) and **phlegmasia cerulea dolens** (blue, painful leg with risk of venous gangrene) in massive iliofemoral DVT
- Homans' sign is unreliable and no longer recommended

#### Investigations

- **Wells score** to assess pre-test probability
- **D-dimer:** high sensitivity, low specificity; a normal value excludes DVT in low-risk patients (always raised after surgery)
- **Duplex (compression) ultrasound:** investigation of choice
- Venography: gold standard historically, now rarely used

#### Prevention (thromboprophylaxis)

- Mechanical: early mobilisation, graduated compression stockings, intermittent pneumatic compression devices, leg exercises

- Pharmacological: LMWH (e.g. enoxaparin 40 mg SC daily), unfractionated heparin, fondaparinux, DOACs after joint replacement
- Continue for up to 28 days after major abdominal or pelvic cancer surgery

**Treatment**

1. Anticoagulation: LMWH, then warfarin (INR 2–3) or a DOAC (rivaroxaban, apixaban)
2. Duration: 3 months for provoked DVT; 6 months or longer for unprovoked or cancer-related
3. Leg elevation, compression stockings
4. IVC filter if anticoagulation is contraindicated or PE recurs despite treatment
5. Thrombolysis or thrombectomy for phlegmasia cerulea dolens

**Complications:** pulmonary embolism, recurrence, **post-thrombotic syndrome** (chronic swelling, pain, venous ulcers).

### Pulmonary Embolism (PE)

**Definition:** Obstruction of pulmonary arteries by thrombus, most commonly from the deep veins of the leg and pelvis.

**Clinical features:** sudden dyspnoea (commonest), pleuritic chest pain, haemoptysis, tachycardia, tachypnoea, hypoxia; massive PE causes collapse, hypotension, raised JVP and cardiac arrest. Classically day 7–10 after surgery, often on straining at stool or first mobilising.

**Investigations**

- ABGs: hypoxia, hypocapnia
- ECG: sinus tachycardia (commonest); S1Q3T3 pattern and right heart strain in large PE
- CXR: usually normal; excludes other causes
- **CT pulmonary angiography (CTPA):** investigation of choice
- V/Q scan: when contrast is contraindicated (renal failure, pregnancy)
- Echocardiography: right ventricular strain in massive PE

**Management**

1. Oxygen, IV access, resuscitation
2. Anticoagulation with LMWH, then oral anticoagulant as for DVT
3. **Massive PE with hypotension:** thrombolysis (alteplase); surgical or catheter embolectomy if thrombolysis is contraindicated
4. IVC filter in selected patients

> **Exam Alert:** Duplex ultrasound for DVT; CTPA for PE. Commonest ECG finding in PE is sinus tachycardia, not S1Q3T3.

## Chapter 15: Postoperative Pain Management

**Importance:** Uncontrolled pain causes tachycardia, hypertension, poor coughing (atelectasis, pneumonia), immobility (DVT), urinary retention, delayed recovery and chronic pain.

**Assessment:** regular pain scoring — Visual Analogue Scale (0–10), Numerical Rating Scale, faces scale in children; record with vital signs ("the fifth vital sign").

**WHO analgesic ladder (adapted for acute pain, used in reverse as pain settles)**

| Step | Pain | Drugs |
|---|---|---|
| 1 | Mild | Paracetamol ± NSAID |
| 2 | Moderate | Step 1 + weak opioid (tramadol, codeine) |
| 3 | Severe | Step 1 + strong opioid (morphine, nalbuphine, fentanyl) |

**Multimodal analgesia:** combining drugs that act at different sites gives better relief with fewer side effects ("opioid-sparing").

### Analgesic drugs

| Drug | Notes | Main side effects / cautions |
|---|---|---|
| Paracetamol | 1 g 6-hourly, max 4 g/day (IV or oral) | Hepatotoxic in overdose; reduce dose in low weight, liver disease |
| NSAIDs (diclofenac, ketorolac, ibuprofen) | Effective for bony and soft tissue pain | Peptic ulcer, renal impairment, bleeding, asthma; avoid in elderly with renal risk |
| Tramadol | Weak opioid + serotonin/ noradrenaline effect | Nausea, dizziness, seizures, serotonin syndrome |
| Morphine | Gold-standard strong opioid; IV, IM, SC, oral, PCA | Respiratory depression, sedation, nausea, constipation, pruritus, urinary retention |

**Opioid overdose:** pinpoint pupils, respiratory depression, drowsiness → treat with **IV naloxone** (short acting; may need repeat doses or infusion).

### Techniques

- **Patient-controlled analgesia (PCA):** patient presses a button for small IV morphine boluses with a lockout period; safe because a sedated patient stops pressing
- **Epidural analgesia:** excellent for major abdominal and thoracic surgery; watch for hypotension and urinary retention
- **Regional nerve blocks:** TAP block (abdominal wall), femoral nerve block, intercostal block
- **Local wound infiltration** with bupivacaine at the end of surgery
- Adjuncts: ketamine, gabapentin, dexamethasone

**Non-drug measures:** reassurance, positioning, splinting the wound while coughing, early mobilisation.

> **Exam Alert:** Naloxone reverses opioid respiratory depression. NSAIDs are avoided in renal impairment, peptic ulcer and bleeding risk.

## Chapter 16: Day-Case Surgery

**Definition:** A patient admitted, operated on and discharged home on the same day, without an overnight stay. Up to 70–80% of elective procedures can be done this way.

**Advantages:** lower cost, shorter waiting lists, less hospital-acquired infection, reduced DVT risk (early mobilisation), less disruption to patient and family.

### Selection criteria

| Category | Criteria |
|---|---|
| Medical | ASA I–II (stable ASA III acceptable); BMI generally <40; well-controlled diabetes, hypertension, asthma |

| Category | Criteria |
|---|---|
| Social | Responsible adult to escort home and stay for 24 hours; access to a telephone; travel time to hospital ideally <1 hour |
| Surgical | Short procedure (<1–2 h), minimal blood loss, pain controllable with oral analgesia, early return to oral intake, low risk of complications |

**Common day-case procedures:** inguinal and umbilical hernia repair, laparoscopic cholecystectomy, haemorrhoidectomy, fissure and fistula surgery, laser proctology, pilonidal sinus, excision of lumps (lipoma, sebaceous cyst), varicose vein treatment, circumcision, breast lump excision, cystoscopy, endoscopy, cataract surgery.

**Unsuitable patients:** uncontrolled systemic disease, morbid obesity with sleep apnoea, history of malignant hyperthermia, no adult escort, major or prolonged surgery, high expected pain or bleeding.

**Anaesthesia:** short-acting agents (propofol, sevoflurane, remifentanil), laryngeal mask airway, local or regional techniques, prophylactic antiemetics, local infiltration for analgesia.

**Discharge criteria**

- Stable vital signs, fully alert and oriented
- Pain controlled with oral analgesia
- Minimal nausea and vomiting; tolerating oral fluids
- Able to walk (as appropriate to the procedure)
- Wound dry, no active bleeding
- Passed urine (essential after hernia, anorectal surgery and spinal anaesthesia)
- Written instructions, analgesia, contact number and follow-up given; escorted home by an adult

**Patient advice:** no driving, operating machinery, signing legal documents or alcohol for 24 hours after general anaesthesia.

**Unplanned admission (1–3%):** commonest causes are uncontrolled pain, persistent nausea and vomiting, bleeding, urinary retention, and surgical complexity.

> **Exam Alert:** A responsible adult escort for 24 hours is an essential social criterion. Pain and PONV are the commonest reasons for unplanned overnight admission.

## Self-Assessment: Part 2 SBAs

**1.** A 62-year-old man with stable angina and diet-controlled diabetes is listed for elective inguinal hernia repair. What is his ASA grade?

A. ASA I · B. ASA II · C. ASA III · D. ASA IV · E. ASA V

**Answer: C.** Stable angina is severe systemic disease that limits activity but is not a constant threat to life.

**2.** A 58-year-old woman on warfarin for atrial fibrillation is scheduled for elective laparoscopic cholecystectomy. When should warfarin be stopped?

A. 12 hours before · B. 24 hours before · C. 5 days before · D. 14 days before · E. It should not be stopped

**Answer: C.** Stop 5 days before so INR is <1.5 on the day of surgery; bridge with LMWH if thrombotic risk is high.

**3.** During general anaesthesia with sevoflurane and suxamethonium, a 20-year-old develops rising temperature, masseter rigidity and rising end-tidal $CO_2$. What is the specific treatment?

A. Atropine · B. Dantrolene · C. Naloxone · D. Neostigmine · E. Paracetamol

**Answer: B.** Malignant hyperthermia; stop volatile agents and give IV dantrolene.

**4.** A 60 kg man needs excision of a lipoma under local anaesthesia. What is the maximum volume of 1% plain lidocaine that can be used safely?

A. 6 ml · B. 10 ml · C. 18 ml · D. 42 ml · E. 60 ml

**Answer: C.** 3 mg/kg × 60 kg = 180 mg; 1% = 10 mg/ml, so 18 ml.

**5.** On the second day after laparotomy, a 55-year-old smoker has a temperature of 37.9 °C, reduced breath sounds at both lung bases and a clean wound. What is the most likely cause of fever?

A. Anastomotic leak · B. Atelectasis · C. Deep vein thrombosis · D. Urinary tract infection · E. Wound infection

**Answer: B.** Fever on day 1–2 is most often from atelectasis; treat with physiotherapy and analgesia.

**6.** Six hours after thyroidectomy, a patient develops a rapidly expanding neck swelling with stridor. Which type of haemorrhage is this?

A. Intermediate · B. Primary · C. Reactionary · D. Secondary · E. Tertiary

**Answer: C.** Reactionary haemorrhage occurs within 24 hours; open the wound at the bedside if airway is threatened, then return to theatre.

**7.** On day 9 after total hip replacement, a 70-year-old woman develops a swollen, tender left calf. What is the investigation of choice?

A. CT pulmonary angiography · B. D-dimer · C. Duplex ultrasound · D. Plain X-ray · E. Venography

**Answer: C.** Compression duplex ultrasound; D-dimer is always raised after surgery.

**8.** On day 8 after colectomy, a man becomes suddenly breathless with pleuritic chest pain, pulse 120/min and $SpO_2$ 88%; BP is normal. His chest X-ray is clear. What is the most appropriate confirmatory investigation?

A. Bronchoscopy · B. CT pulmonary angiography · C. Echocardiography · D. Exercise ECG · E. Sputum culture

**Answer: B.** Suspected pulmonary embolism is confirmed by CTPA.

**9.** A 65-year-old woman receiving morphine by PCA after laparotomy is drowsy, with pinpoint pupils and a respiratory rate of 7/min. What is the immediate drug treatment?

A. Atropine · B. Doxapram · C. Flumazenil · D. Naloxone · E. Neostigmine

**Answer: D.** IV naloxone reverses opioid respiratory depression; give oxygen and stop the PCA.

**10.** A fit 40-year-old man lives alone with no one able to stay with him after surgery. He is listed for day-case inguinal hernia repair under general anaesthesia. What is the most appropriate action?

A. Discharge home by taxi after surgery · B. Discharge alone after 6 hours of observation · C. Plan overnight admission · D. Postpone surgery indefinitely · E. Proceed as a day case

**Answer: C.** A responsible adult for 24 hours after GA is an essential day-case criterion; without one, admit overnight.

*References: Bailey & Love's Short Practice of Surgery, 28th Ed.; Blecha, Surgery, 4th Ed.*

PART 3

# Trauma

## Chapter 17: Initial Assessment of the Injured Patient (ATLS)

**Principle:** Treat the greatest threat to life first. Trauma deaths occur in three peaks: immediate (minutes; brain or great-vessel injury), early (the "golden hour"; airway, bleeding, tension pneumothorax — the deaths ATLS prevents) and late (days to weeks; sepsis and multi-organ failure).

**Sequence of care:** preparation → triage → primary survey with simultaneous resuscitation → adjuncts → secondary survey → definitive care or transfer.

**Primary survey — (c)ABCDE**

| Step | Assess | Immediate action |
|---|---|---|
| **c** Catastrophic haemorrhage | Exsanguinating external bleeding | Direct pressure, tourniquet |
| **A** Airway with cervical spine protection | Talking? Stridor, gurgling, facial/neck injury | Jaw thrust, suction, oropharyngeal airway, definitive airway (intubation, surgical cricothyroidotomy); manual in-line stabilisation and collar |
| **B** Breathing | RR, $SpO_2$, chest movement, trachea, percussion, breath sounds | High-flow oxygen 15 L/min; needle/finger decompression of tension pneumothorax; chest drain; seal open pneumothorax |
| **C** Circulation with haemorrhage control | Pulse, BP, capillary refill, skin, conscious level; sites of bleeding (chest, abdomen, pelvis, long bones, "floor") | Two large-bore cannulae, bloods and cross-match, warmed fluids and early blood, tranexamic acid, pelvic binder, splint fractures |
| **D** Disability | GCS or AVPU, pupils, blood glucose | Prevent secondary brain injury (oxygen, BP) |
| **E** Exposure / Environment | Undress fully, log-roll for back | Prevent hypothermia (warm blankets, warm fluids) |

**Adjuncts to the primary survey:** ECG, pulse oximetry, ABGs, urinary catheter (not if urethral injury suspected: blood at meatus, perineal haematoma, high-riding prostate), NG tube (orogastric if base of skull fracture), **chest and pelvic X-rays**, **eFAST** ultrasound.

**Secondary survey:** only after the primary survey is complete and the patient is stable. Head-to-toe examination, all orifices, and an **AMPLE** history:

- **A**llergies
- **M**edications
- **P**ast illness / Pregnancy
- **L**ast meal
- **E**vents and Environment of injury (mechanism)

**Tertiary survey:** a repeat full examination within 24 hours to catch missed injuries.

**Triage:** sorting casualties by need when resources are limited — colour codes red (immediate), yellow (urgent), green (minor/walking wounded), black (dead or expectant).

**Damage control surgery:** in the unstable, coagulopathic, hypothermic, acidotic patient ("lethal triad"), do a short operation to stop bleeding and contamination, resuscitate in ICU, then return for definitive repair at 24–48 hours.

> **Exam Alert:** Airway always comes first, with cervical spine protection. Any trauma patient who is cold and tachycardic is in haemorrhagic shock until proved otherwise.

## Chapter 18: Head Injury

**Importance:** Head injury is the leading cause of trauma death in young people, most often from road traffic accidents (motorcyclists without helmets in Pakistan), falls and assaults.

### Primary vs secondary brain injury

- **Primary:** damage at the moment of impact (contusion, laceration, diffuse axonal injury); cannot be reversed
- **Secondary:** later damage from hypoxia, hypotension, raised ICP, hypercarbia, hypoglycaemia, seizures, infection; preventable — the main goal of management

**Monro–Kellie doctrine:** the skull is a fixed box containing brain, blood and CSF; an expanding haematoma first displaces CSF and venous blood, then ICP rises steeply. Cerebral perfusion pressure (CPP) = MAP − ICP (keep >60 mmHg).

### Glasgow Coma Scale (GCS 3–15)

| Eye opening (E) | Verbal (V) | Motor (M) |
|---|---|---|
| 4 Spontaneous | 5 Oriented | 6 Obeys commands |
| 3 To voice | 4 Confused | 5 Localises pain |
| 2 To pain | 3 Inappropriate words | 4 Withdraws from pain |
| 1 None | 2 Incomprehensible sounds | 3 Abnormal flexion (decorticate) |
| — | 1 None | 2 Extension (decerebrate) |
| — | — | 1 None |

Severity: mild 13–15, moderate 9–12, severe ≤8 ("**GCS 8, intubate**").

### Types of intracranial haematoma

| Feature | Extradural (epidural) | Acute subdural | Chronic subdural |
|---|---|---|---|
| Vessel | Middle meningeal artery (temporal bone fracture) | Bridging veins | Bridging veins |
| Patient | Young adult | Severe injury, any age | Elderly, alcoholics, on anticoagulants |
| History | **Lucid interval**, then rapid deterioration | Unconscious from injury | Trivial injury weeks earlier; headache, confusion, fluctuating consciousness |
| CT appearance | Biconvex (lentiform) hyperdense | Crescentic (concave) hyperdense | Crescentic hypodense |
| Treatment | Urgent craniotomy | Craniotomy; poor prognosis | Burr-hole drainage |
| Prognosis | Excellent if operated early | Poor | Good |

**Signs of raised ICP and herniation:** headache, vomiting, falling GCS, **ipsilateral fixed dilated pupil** (third nerve compression), contralateral hemiparesis, **Cushing's response** (hypertension + bradycardia + irregular breathing; late, pre-terminal).

**Base of skull fracture:** periorbital bruising ("raccoon/panda eyes"), Battle's sign (mastoid bruising), CSF rhinorrhoea or otorrhoea, haemotympanum. Avoid nasogastric tube; risk of meningitis.

**Investigations: non-contrast CT head** (investigation of choice); cervical spine imaging (CT); blood glucose, CBC, coagulation, ABGs. CT indications include GCS <13 at first assessment or <15 at 2 hours, suspected skull or base of skull fracture, seizure, focal deficit, >1 vomiting episode, and loss of consciousness with age ≥65, coagulopathy or dangerous mechanism.

### Management

1. ABCDE with cervical spine protection; intubate if GCS ≤8 or airway at risk
2. Prevent secondary injury: $SpO_2$ >94%, $PaCO_2$ 4.5–5 kPa, SBP >100–110 mmHg, normoglycaemia, treat seizures
3. Head up 30°, neck neutral (avoid venous obstruction)
4. Raised ICP: mannitol 0.5–1 g/kg or hypertonic saline as a bridge to surgery
5. Neurosurgical referral; evacuation of haematoma; decompressive craniectomy in selected cases
6. Mild head injury: observe with neuro-observations and give head-injury advice on discharge

**Complications:** post-traumatic epilepsy, CSF leak and meningitis, hydrocephalus, post-concussion syndrome, cognitive and personality change, persistent vegetative state.

> **Exam Alert:** Lucid interval = extradural haematoma. Steroids are not used in head injury. Hypotension in head injury is from bleeding elsewhere until proved otherwise.

## Chapter 19: Chest Trauma

**Importance:** Chest injuries cause about 25% of trauma deaths, yet 85–90% can be managed without thoracotomy — by airway care, oxygen, analgesia and a chest drain.

### Immediately life-threatening injuries (found in the primary survey)

| Injury | Key features | Immediate treatment |
|---|---|---|
| Airway obstruction / tracheobronchial injury | Stridor, surgical emphysema, persistent air leak | Definitive airway |
| **Tension pneumothorax** | Respiratory distress, hypotension, tracheal deviation **away**, hyper-resonance, absent breath sounds, distended neck veins | **Clinical diagnosis — no X-ray first.** Needle decompression (4th/5th intercostal space mid-axillary line in adults) or finger thoracostomy, then chest drain |
| Open pneumothorax (sucking chest wound) | Wound >2/3 tracheal diameter; air sucks through wound | Three-sided occlusive dressing, then chest drain away from wound, surgical closure |
| Massive haemothorax | >1500 ml blood in pleural cavity; shock, dull percussion, absent breath sounds | Restore volume, chest drain; thoracotomy if >1500 ml initially or >200 ml/h for 2–4 hours |
| Flail chest with pulmonary contusion | ≥2 adjacent ribs each broken in ≥2 places; paradoxical movement, hypoxia | Oxygen, analgesia (epidural/nerve blocks), careful fluids, ventilation if respiratory failure; rib fixation in selected cases |
| **Cardiac tamponade** | **Beck's triad**: hypotension, raised JVP, muffled heart sounds; pulsus paradoxus; penetrating precordial wound | FAST/echo; pericardiocentesis as temporary measure; thoracotomy/sternotomy |

**Potentially life-threatening injuries (secondary survey):** simple pneumothorax, haemothorax, pulmonary contusion, blunt cardiac injury, traumatic aortic disruption (widened mediastinum on CXR after deceleration injury; confirm by CT angiography), diaphragmatic rupture (usually left; bowel in chest), oesophageal rupture.

**Rib fractures:** commonest chest injury. Pain limits breathing → atelectasis and pneumonia, especially in elderly. Fractures of ribs 1–2 suggest major force (look for great-vessel injury); ribs 9–12 suggest liver or spleen injury. Treat with good analgesia and physiotherapy.

**Investigations:** chest X-ray (erect if possible), eFAST, ABGs, ECG, CT chest in the stable patient.

**Chest drain (tube thoracostomy)**

- Site: **"triangle of safety"** — lateral border of pectoralis major, anterior border of latissimus dorsi, a line at the level of the nipple (5th intercostal space), apex below the axilla
- Insert just above the upper border of the rib (avoid intercostal bundle under the rib)
- Blunt dissection, finger sweep, then tube connected to an underwater seal; check by swinging of fluid and CXR
- Complications: bleeding, injury to lung, liver, spleen or intercostal vessels; tube misplacement, infection (empyema), re-expansion pulmonary oedema

**Surgical emphysema:** air in subcutaneous tissues giving crepitus; suggests pneumothorax or airway/oesophageal injury.

> **Exam Alert:** Tension pneumothorax is a clinical diagnosis; never wait for an X-ray. Beck's triad = cardiac tamponade. Most chest injuries need only a chest drain.

## Chapter 20: Abdominal Trauma

**Types:** blunt (road traffic accidents, falls, assault) and penetrating (stab and gunshot wounds). In blunt trauma the **spleen** is the commonest organ injured, followed by the liver; in stab wounds the liver, and in gunshot wounds the small bowel.

**Clinical features:** abdominal pain, tenderness, guarding, distension, shock; seat-belt sign (bruising across the abdomen — suspect bowel or lumbar spine injury); Kehr's sign (left shoulder tip pain from splenic blood irritating the diaphragm); blood at urethral meatus or in urine. Clinical examination is unreliable in head injury, intoxication and spinal injury.

**Investigations**

| Test | Use | Comment |
|---|---|---|
| **eFAST** | Free fluid in Morison's pouch, splenorenal angle, pelvis, pericardium; pneumothorax | Rapid, bedside, repeatable; operator dependent; poor for hollow viscus and retroperitoneum |
| **CT with IV contrast** | Investigation of choice in the **haemodynamically stable** patient | Grades solid organ injury, shows retroperitoneum and contrast blush |
| Diagnostic peritoneal lavage (DPL) | Where FAST/CT not available | Positive: >10 ml frank blood, RBC >100,000/mm³, food, bile or bacteria |
| Erect CXR | Free gas under diaphragm (hollow viscus perforation) | — |
| Bloods | CBC, cross-match, amylase, LFTs, ABG/lactate | Serial Hb |
| Urine R/E, CT urography | Haematuria, renal injury | — |

| Test | Use | Comment |
|---|---|---|
| Diagnostic laparoscopy | Stable penetrating wounds, suspected diaphragm injury | — |

### Indications for urgent laparotomy

- Haemodynamic instability with positive FAST or DPL
- Peritonitis
- Gunshot wound traversing the peritoneal cavity
- Evisceration, impalement, or penetrating wound with shock
- Free intraperitoneal gas, diaphragmatic rupture, or blood from NG tube or rectum after penetrating injury

### Management principles

1. ATLS primary survey and resuscitation; permissive hypotension until bleeding controlled
2. **Unstable** → laparotomy (damage control if lethal triad)
3. **Stable** → CT, then decide

### Specific organ injuries

- **Spleen:** stable patients managed **non-operatively** (bed rest, serial Hb and examination, angio-embolisation for contrast blush), especially in children; splenectomy or splenorrhaphy if unstable. After splenectomy: vaccines against pneumococcus, *Haemophilus influenzae* b and meningococcus, plus prophylactic penicillin, to prevent **overwhelming post-splenectomy infection (OPSI)**
- **Liver:** most managed non-operatively; at laparotomy, perihepatic packing, **Pringle manoeuvre** (clamping hepatoduodenal ligament) to control bleeding
- **Hollow viscus:** primary repair or resection with anastomosis; stoma in contaminated or unstable patients
- **Pancreas and duodenum:** often missed on early CT; raised amylase, retroperitoneal air
- **Kidney:** most managed conservatively; haematuria common
- **Pelvic fracture:** major source of hidden bleeding — pelvic binder, angio-embolisation, external fixation, pre-peritoneal packing

**Complications:** missed injury, intra-abdominal abscess, abdominal compartment syndrome, delayed splenic rupture, bile leak, fistula, OPSI.

> **Exam Alert:** Unstable patient + positive FAST = laparotomy, not CT. The spleen is the commonest organ injured in blunt abdominal trauma.

## Chapter 21: Burns

**Causes:** thermal (flame — commonest in adults; scald — commonest in children), electrical, chemical (acids, alkalis; alkalis penetrate deeper), radiation, friction, cold injury. In Pakistan, gas cylinder explosions and kitchen fires are common.

**Pathophysiology:** capillary leak causes massive loss of plasma into tissues, peaking in the first 8–12 hours and lasting about 48 hours → burn (hypovolaemic) shock. Burns >25% TBSA produce a systemic inflammatory response with oedema in unburnt tissues too.

### Depth of burn

| Depth | Layers involved | Appearance | Sensation | Healing |
|---|---|---|---|---|
| Superficial (epidermal) | Epidermis | Red, dry, no blisters (sunburn) | Painful | 5–7 days, no scar |

| Depth | Layers involved | Appearance | Sensation | Healing |
|---|---|---|---|---|
| Superficial partial thickness | Epidermis + upper dermis | Pink, moist, **blisters**, blanches with brisk refill | Very painful | 10–14 days, minimal scar |
| Deep partial thickness | Deep dermis | Mottled red/white, sluggish or no refill | Reduced | 3–8 weeks; scarring; often needs grafting |
| Full thickness | Whole dermis ± deeper | White, waxy or leathery, charred, **painless**, no blanching | Absent | Will not heal except from edges; needs excision and grafting |

### Extent — total body surface area (TBSA)

- **Wallace's rule of nines (adult):** head and neck 9%, each upper limb 9%, front of trunk 18%, back of trunk 18%, each lower limb 18%, perineum 1%
- **Patient's palm with fingers** = about 1% TBSA (useful for small or patchy burns)
- **Lund and Browder chart:** most accurate, especially in children (head larger, legs smaller)
- Simple erythema is not counted

**Criteria for admission / burns unit referral:** >15% TBSA in adults (>10% in children and elderly), full-thickness >5%, burns of face, hands, feet, perineum, genitalia or major joints, circumferential burns, inhalation injury, electrical and chemical burns, extremes of age, associated trauma, suspected non-accidental injury.

**Inhalation injury — suspect if:** burns in an enclosed space, facial burns, singed nasal hair or eyebrows, soot in mouth or sputum, hoarse voice, stridor, carboxyhaemoglobin raised. **Early intubation** before oedema closes the airway. Carbon monoxide poisoning: 100% oxygen ($SpO_2$ reading is falsely normal).

**First aid:** stop the burning; remove clothes and jewellery; **cool running tap water for 20 minutes** (within 3 hours); avoid ice; cover with cling film; keep the patient warm.

### Fluid resuscitation — Parkland formula

**4 ml × body weight (kg) × % TBSA** of Ringer's lactate in the first 24 hours from the **time of burn** (not time of arrival): half in the first 8 hours, half in the next 16 hours. Children also receive maintenance fluid with dextrose.

Example: 70 kg man, 30% burn → 4 × 70 × 30 = 8,400 ml; 4,200 ml in first 8 h, 4,200 ml in next 16 h.

Given for burns >15% in adults and >10% in children. Titrate to **urine output**: 0.5 ml/kg/h in adults, 1 ml/kg/h in children.

### Further management

1. ABCDE, oxygen, two large-bore cannulae, catheter, NG tube in large burns
2. Analgesia: IV morphine
3. Tetanus prophylaxis; antibiotics only for proven infection
4. Wound care: cleaning, de-roofing large blisters, dressings (silver sulfadiazine, silver dressings)
5. **Escharotomy** for circumferential full-thickness burns of limbs (ischaemia) or chest (restricted breathing)
6. Early excision and skin grafting (split-thickness) of deep burns
7. High-protein, high-calorie early enteral feeding
8. Physiotherapy, splinting, pressure garments, psychological support

**Complications:** burn shock, acute kidney injury (myoglobinuria in electrical burns), sepsis (*Pseudomonas*, *Staph. aureus*), **Curling's ulcer** (stress ulcer of the duodenum), ARDS, compartment syndrome, contractures, hypertrophic scarring, **Marjolin's ulcer** (squamous cell carcinoma in a chronic burn scar).

**Electrical burns:** small entry and exit wounds hide extensive deep muscle damage; risks of arrhythmia (ECG monitoring), rhabdomyolysis, compartment syndrome and renal failure.

> **Exam Alert:** Parkland formula time starts from the time of burn. Full-thickness burns are painless. Urine output is the best guide to fluid resuscitation.

## Self-Assessment: Part 3 SBAs

**1.** A 25-year-old motorcyclist is brought in after a crash. He has gurgling respiration, an open femur fracture that is oozing, and a GCS of 10. What is the first priority?

A. Apply a traction splint · B. Arrange CT head · C. Clear and secure the airway with cervical spine protection · D. Insert two large-bore cannulae · E. Take an AMPLE history

**Answer: C.** Airway with cervical spine control comes first; the oozing (not catastrophic) bleeding follows.

**2.** A 22-year-old man is hit on the side of his head with a cricket ball. He is briefly unconscious, then talks normally for 2 hours before becoming drowsy, with a dilated right pupil. What is the most likely diagnosis?

A. Acute subdural haematoma · B. Chronic subdural haematoma · C. Diffuse axonal injury · D. Extradural haematoma · E. Subarachnoid haemorrhage

**Answer: D.** Lucid interval after temporal injury = middle meningeal artery bleed.

**3.** After a road traffic accident, a patient opens his eyes to pain, makes incomprehensible sounds and withdraws his hand from a painful stimulus. What is his GCS?

A. 6 · B. 7 · C. 8 · D. 9 · E. 10

**Answer: C.** E2 + V2 + M4 = 8; he needs a definitive airway.

**4.** A 75-year-old man on warfarin becomes increasingly confused and drowsy over 3 weeks after a minor fall at home. CT shows a crescentic hypodense collection over the left hemisphere. What is the treatment?

A. Burr-hole drainage · B. Conservative observation · C. Craniotomy and clipping · D. IV mannitol only · E. Lumbar puncture

**Answer: A.** Chronic subdural haematoma; reverse anticoagulation and drain through burr holes.

**5.** A 30-year-old man with a stab wound to the right chest is breathless, BP 80/50 mmHg, trachea deviated to the left, right chest hyper-resonant with absent breath sounds, and distended neck veins. What is the immediate step?

A. Chest X-ray · B. CT chest · C. Emergency thoracotomy · D. Needle or finger decompression of the right chest · E. Pericardiocentesis

**Answer: D.** Tension pneumothorax is a clinical diagnosis; decompress immediately, then insert a chest drain.

**6.** A man with a stab wound just left of the sternum has BP 75/50 mmHg, a raised JVP and muffled heart sounds. Breath sounds are equal. What is the most likely diagnosis?

A. Cardiac tamponade · B. Massive haemothorax · C. Simple pneumothorax · D. Tension pneumothorax · E. Traumatic aortic rupture

**Answer: A.** Beck's triad with equal breath sounds and a precordial wound.

**7.** After a fall, a 28-year-old woman has left upper abdominal pain, left shoulder tip pain, pulse 130/min and BP 80/50 mmHg not responding to 2 litres of fluid. FAST shows free fluid in the splenorenal angle. What is the next step?

A. Angio-embolisation · B. CT abdomen with contrast · C. Diagnostic peritoneal lavage · D. Emergency laparotomy · E. Serial Hb and observation

**Answer: D.** An unstable patient with positive FAST needs laparotomy; CT is only for stable patients.

**8.** A 10-year-old boy had a splenectomy after trauma. Which measure most reduces his risk of overwhelming post-splenectomy infection?

A. Annual influenza vaccine alone · B. Avoiding contact sports · C. Oral iron · D. Pneumococcal, Hib and meningococcal vaccines with prophylactic penicillin · E. Routine monthly blood counts

**Answer: D.** OPSI is mostly due to encapsulated organisms.

**9.** A 60 kg woman sustains a 25% TBSA burn and arrives at hospital 2 hours later. Using the Parkland formula, at what rate should Ringer's lactate be given for the next 6 hours?

A. 250 ml/h · B. 375 ml/h · C. 500 ml/h · D. 750 ml/h · E. 1000 ml/h

**Answer: C.** 4 × 60 × 25 = 6000 ml; half (3000 ml) in the first 8 hours from the burn; 2 hours lost, so 3000 ml over 6 hours = 500 ml/h.

**10.** A man rescued from a house fire has facial burns, singed nasal hair, soot in his mouth and a hoarse voice. $SpO_2$ is 98% on air. What is the most appropriate next step?

A. Discharge after observation · B. Early endotracheal intubation · C. Escharotomy of chest · D. Nebulised salbutamol · E. Oral fluids and review in 24 hours

**Answer: B.** Inhalation injury; airway oedema progresses rapidly. $SpO_2$ may be falsely normal from carbon monoxide.

*References: Bailey & Love's Short Practice of Surgery, 28th Ed.; Blecha, Surgery, 4th Ed.; ATLS, 10th Ed.*

PART 4

# Skin and Soft Tissue

## Chapter 22: Ulcers

**Definition:** An ulcer is a break in the continuity of an epithelial surface (skin or mucous membrane) due to molecular death of surface cells.

**Parts of an ulcer (examine each):** site, size, shape, **edge**, floor (what you see), base (what you feel), discharge, surrounding skin, regional lymph nodes.

### Types of edge — a classic exam topic

| Edge | Description | Typical ulcer |
|---|---|---|
| Sloping | Gently shelving | Healing ulcer, venous ulcer |
| Punched out | Vertical, sharp | Syphilitic gumma, trophic (neuropathic) ulcer |
| Undermined | Edge overhangs the floor | Tuberculous ulcer |
| Rolled (beaded) | Raised, pearly, rolled | Basal cell carcinoma (rodent ulcer) |
| Everted | Raised and turned outwards | Squamous cell carcinoma |

### Common leg and foot ulcers

| Feature | Venous | Arterial (ischaemic) | Neuropathic (diabetic) |
|---|---|---|---|
| Site | Gaiter area, above **medial malleolus** | Toes, heel, pressure points, dorsum of foot | Sole, under metatarsal heads, heel |
| Pain | Mild, aching, relieved by elevation | **Severe**, worse on elevation, rest pain | Painless |
| Edge / floor | Sloping, shallow, granulating, exudative | Punched out, deep, pale floor | Punched out, callus around |
| Surrounding skin | Lipodermatosclerosis, haemosiderin pigmentation, eczema, varicose veins | Cold, shiny, hairless, absent pulses | Warm, dry, absent sensation, pulses may be present |
| Investigation | Duplex scan; **ABPI** before compression | ABPI <0.5 (severe); duplex, angiography | Blood sugar, HbA1c, monofilament test, X-ray (osteomyelitis) |
| Treatment | **Graded compression bandaging** (if ABPI >0.8), elevation; treat venous reflux | Revascularisation (angioplasty/ bypass); amputation if gangrene | Offloading, debridement, glucose control, antibiotics, footwear |

**Other ulcers to recognise:** tuberculous (undermined edge, caseous floor, neck nodes), syphilitic (punched out, "wash-leather" slough), pressure ulcer (bed sore over sacrum, heels; graded 1–4), Marjolin's ulcer (SCC in a chronic scar or ulcer).

**Investigations for any chronic ulcer:** CBC, blood sugar, ESR, swab culture, X-ray of underlying bone, ABPI/Doppler, and **biopsy of the edge** in any non-healing ulcer to exclude malignancy.

### General principles of treatment

1. Treat the cause (diabetes, ischaemia, venous hypertension, infection)
2. Debride slough and dead tissue
3. Control infection; regular dressings to keep the ulcer moist and clean
4. Improve nutrition, stop smoking
5. Once clean and granulating: split-skin grafting or flap cover

> **Exam Alert:** Always check ABPI before applying compression to a leg ulcer. Biopsy the edge, not the centre, of a suspicious ulcer.

# Chapter 23: Sebaceous (Epidermoid) Cyst and Dermoid Cyst

## Sebaceous (Epidermoid) Cyst

**Definition:** A retention cyst arising from an obstructed hair follicle, lined by stratified squamous epithelium and filled with keratin (cheesy, foul-smelling material). The term "epidermoid cyst" is more accurate; true sebaceous gland cysts are rare.

**Sites:** scalp, face, neck, back, scrotum — wherever hair follicles exist. **Never on palms and soles** (no hair follicles).

### Clinical features

- Slow-growing, painless, smooth, spherical swelling
- Attached to skin (cannot be moved separately from skin); free from deeper tissues
- **Punctum** (blackhead) over the summit in about half — pathognomonic
- Fluctuant, non-transilluminant

**Complications:** infection and abscess (commonest), ulceration (**Cock's peculiar tumour** — a fungating, ulcerated scalp sebaceous cyst resembling SCC), sebaceous horn, calcification, rarely malignant change.

**Investigations:** clinical diagnosis; USG if doubt.

### Management

- **Complete excision** with an elliptical skin incision around the punctum, removing the entire cyst wall (otherwise recurrence)
- Infected cyst: incision and drainage first, antibiotics; excise the wall after 4–6 weeks when inflammation settles

## Dermoid Cyst

**Definition:** A cyst lined by squamous epithelium containing skin appendages (hair, sweat and sebaceous glands).

| Type | Origin | Sites | Features |
|---|---|---|---|
| **Sequestration dermoid** (congenital) | Skin sequestered along lines of embryonic fusion | **External angular dermoid** (lateral end of eyebrow, commonest), midline of nose, neck, sublingual | Present in childhood; deep to skin, not attached to it; may indent or erode underlying bone; possible intracranial extension |

| Type | Origin | Sites | Features |
|---|---|---|---|
| **Implantation dermoid** (acquired) | Epidermis driven into deeper tissue by a puncture wound | Fingers, palms (tailors, farmers) | History of injury; firm, tender, scar nearby |
| Teratomatous dermoid | Germ cells | Ovary, testis, mediastinum | Contains hair, teeth, bone |
| Tubulodermoid | Remnant of embryonic duct | Thyroglossal, postanal | — |

### Sebaceous vs sequestration dermoid

| Feature | Sebaceous cyst | Sequestration dermoid |
|---|---|---|
| Age | Adults | Children |
| Attachment | Fixed to skin | Free from skin, may be fixed to bone |
| Punctum | Often present | Absent |
| Site | Hair-bearing areas | Lines of fusion |

**Management of dermoid:** excision; **X-ray or CT first** for midline and skull dermoids to exclude intracranial extension.

> **Exam Alert:** Punctum = sebaceous cyst. External angular dermoid is the commonest sequestration dermoid. Image midline dermoids before excision.

## Chapter 24: Lipoma

**Definition:** A benign tumour of mature fat cells enclosed in a thin fibrous capsule. It is the commonest benign soft tissue tumour — the "universal tumour" because it can occur wherever there is fat.

### Sites and types

- **Subcutaneous** (commonest): back, shoulders, neck, upper limbs, thighs
- Subfascial, intermuscular, intramuscular
- Subsynovial, subperiosteal
- Retroperitoneal (may become large; higher risk of liposarcoma)
- Submucosal (gut — may cause intussusception), subserosal
- Extradural, intra-articular

**Variants: multiple lipomatosis** (familial), **Dercum's disease** (adiposis dolorosa — multiple painful lipomas, middle-aged obese women), Madelung's disease (symmetrical fat around neck, alcoholics), fibrolipoma, angiolipoma (painful, vascular), hibernoma (brown fat).

### Clinical features

- Slow-growing, painless, soft swelling
- **Lobulated** surface; edge **slips under the examining finger** ("slip sign")
- Not attached to skin (skin may dimple when lifted, from fibrous strands)
- **Pseudo-fluctuation** (soft fat at body temperature)
- Non-transilluminant (except rarely large superficial ones), non-compressible

### Investigations

- Usually clinical

- **USG:** confirms fatty lesion, depth, relation to muscle
- **MRI:** large (>5 cm), deep, subfascial, rapidly growing or painful lesions — to exclude **liposarcoma**
- Core biopsy if MRI suspicious

**Red flags for sarcoma (refer):** size >5 cm, deep to fascia, rapid growth, pain, recurrence after excision.

### Management

- Small, asymptomatic: reassurance
- **Excision** for cosmetic reasons, discomfort, increasing size or diagnostic doubt; under local anaesthesia for small subcutaneous lipomas, enucleating the lipoma with its capsule
- Liposuction for large lipomas in selected cases (risk of incomplete removal)

**Complications:** pressure on nerves, intussusception (submucosal intestinal lipoma), calcification, rarely saponification; liposarcoma arises de novo rather than from a lipoma (malignant change of a subcutaneous lipoma is very rare).

> **Exam Alert:** Slip sign + lobulation + pseudo-fluctuation = lipoma. Any lipoma >5 cm or deep to fascia needs MRI to exclude liposarcoma.

## Chapter 25: Basal Cell Carcinoma (Rodent Ulcer)

**Definition:** A locally invasive malignant tumour of the basal cells of the epidermis. It is the **commonest skin cancer**; it almost **never metastasises** but destroys local tissues ("rodent" — gnaws locally).

**Aetiology / risk factors:** chronic sun (UV) exposure, fair skin, elderly, outdoor workers, radiation, arsenic, immunosuppression, xeroderma pigmentosum, **Gorlin's syndrome** (basal cell naevus syndrome).

**Site:** about 90% on the face, above a line from the angle of the mouth to the ear lobe — inner canthus, nose, nasolabial fold, forehead, around the eye.

**Types:** nodular (commonest), nodulo-ulcerative (classic rodent ulcer), superficial (trunk, scaly plaque), pigmented (mimics melanoma), morphoeic/sclerosing (scar-like, ill-defined, aggressive, highest recurrence).

### Clinical features

- Slow-growing, painless nodule over months to years
- **Pearly, translucent rolled (beaded) edge** with **telangiectasia** over it
- Central ulceration with a crust that bleeds and recurs
- No regional lymphadenopathy
- Neglected lesions erode cartilage, bone, eye and even brain

### Investigations

- Clinical diagnosis; dermoscopy
- **Biopsy** (punch or excision) to confirm — histology shows nests of basaloid cells with **peripheral palisading**
- CT/MRI for large or deeply invasive lesions

### Management

| Method | Indication |
|---|---|
| **Surgical excision** with 4 mm margin (treatment of choice) | Most lesions; gives histological margin check |
| **Mohs micrographic surgery** | High-risk sites (around eyes, nose, lips, ears), recurrent, morphoeic, ill-defined lesions — maximum tissue preservation |

| Method | Indication |
|---|---|
| Radiotherapy | Elderly, unfit for surgery, difficult sites |
| Cryotherapy, curettage, topical imiquimod or 5-FU, photodynamic therapy | Small superficial BCCs |
| Vismodegib (hedgehog pathway inhibitor) | Advanced or metastatic disease |

Reconstruction by direct closure, skin graft or local flap.

**Prognosis:** excellent; cure rate >95% with adequate excision. Follow-up for recurrence and new lesions; advise sun protection.

> **Exam Alert:** Pearly rolled edge + telangiectasia on the upper face of an elderly patient = BCC. BCC does not spread to lymph nodes.

## Chapter 26: Squamous Cell Carcinoma of Skin

**Definition:** A malignant tumour of keratinocytes of the epidermis. It is the second commonest skin cancer, grows faster than BCC and **spreads to regional lymph nodes**.

**Risk factors:** chronic UV exposure, fair skin, elderly, immunosuppression (transplant recipients — risk up to 65-fold), arsenic, tar, radiation, HPV, xeroderma pigmentosum, chronic scars and ulcers.

**Premalignant conditions:** actinic (solar) keratosis, **Bowen's disease** (SCC in situ — red scaly plaque), leukoplakia, erythroplakia, chronic burn scars, chronic osteomyelitis sinuses, chronic venous ulcers.

**Marjolin's ulcer:** a slow-growing, painless, aggressive SCC arising in a chronic scar or ulcer (classically an old burn scar). Being in scar tissue without lymphatics, it spreads late to nodes, but once it reaches the edge of the scar it spreads fast.

**Keratoacanthoma** (differential): rapidly growing dome-shaped nodule with a central keratin plug, over 6–8 weeks, that may regress spontaneously; excise to exclude SCC.

**Sites:** sun-exposed skin — lower lip, ear, back of hands, scalp, face; also at scars.

### Clinical features

- Ulcer or nodule that grows over weeks to months
- **Everted, raised, indurated edge**
- Floor: necrotic tissue, friable, bleeds easily; may become **cauliflower-like** (proliferative)
- Fixed to deeper structures when advanced
- **Regional lymph nodes** enlarged — hard, may be fixed (but may be inflammatory from infection)

### Investigations

- **Biopsy of the edge** (incisional) or excision biopsy — histology shows keratin pearls and invasion
- FNAC of enlarged lymph nodes
- USG/CT of regional nodes; CT/MRI for deep invasion; CXR

### Management

- **Wide local excision** with 4–6 mm margins (wider for high-risk lesions) — treatment of choice
- Mohs surgery for high-risk facial sites
- **Lymph node dissection** if nodes are histologically involved (prophylactic dissection not routine)
- Radiotherapy: elderly, unfit, inoperable, or adjuvant after incomplete excision or extensive nodal disease
- Amputation for extensive limb lesions invading bone (e.g. Marjolin's ulcer)
- Reconstruction with skin graft or flaps

**Prognosis:** good when localised; poor with nodal or distant spread. High-risk features: >2 cm, depth >4 mm, poor differentiation, perineural invasion, lip/ear site, immunosuppression, recurrence, Marjolin's ulcer.

### BCC vs SCC — quick comparison

| Feature | BCC | SCC |
|---|---|---|
| Frequency | Commonest | Second commonest |
| Growth | Slow (years) | Faster (months) |
| Edge | Rolled, pearly, beaded | Everted, indurated |
| Site | Upper face | Lower lip, ear, hands, scars |
| Lymph node spread | Almost never | Yes |
| Histology | Peripheral palisading | Keratin pearls |

> **Exam Alert:** Everted edge + lymph node involvement = SCC. Marjolin's ulcer is SCC in a chronic scar.

## Chapter 27: Malignant Melanoma

**Definition:** A malignant tumour of melanocytes. It is less common than BCC and SCC but causes most skin cancer deaths because it **metastasises early** by lymphatics and blood.

**Risk factors:** intermittent intense sun exposure and sunburn (especially in childhood), fair skin, red hair, many (>100) or atypical naevi, **dysplastic naevus syndrome**, giant congenital naevus, family history, previous melanoma, xeroderma pigmentosum, immunosuppression.

### Types

| Type | Frequency | Features |
|---|---|---|
| Superficial spreading | Commonest (~70%) | Flat, irregular, variegated; long radial growth phase; legs in women, back in men |
| Nodular | ~15% | Raised, dark nodule; vertical growth from the start; worst prognosis for its size |
| Lentigo maligna melanoma | ~10% | Elderly, sun-damaged face; arises in Hutchinson's freckle; slow |
| **Acral lentiginous** | Commonest in dark-skinned (Asian, African) people | Soles, palms, **subungual** (Hutchinson's sign — pigment spreading to nail fold) |
| Amelanotic | Rare | Non-pigmented; diagnosis often delayed |

### Clinical features — ABCDE of a suspicious mole

- **A**symmetry
- **B**order irregularity
- **C**olour variation
- **D**iameter >6 mm
- **E**volution (change in size, shape, colour); also itching, bleeding, ulceration, satellite nodules

Also examine regional lymph nodes, liver, lungs and look for in-transit metastases between the primary and the node basin.

### Investigations

- **Excision biopsy** with 2 mm margin (never shave or incision biopsy for a suspected melanoma, as depth must be measured accurately)
- Histology: **Breslow thickness** (depth in mm from granular layer to deepest tumour cell) — the single most important prognostic factor; ulceration; mitotic rate
- **Sentinel lymph node biopsy** for tumours >0.8 mm or ulcerated
- Staging CT/PET-CT, brain MRI, LDH for advanced disease
- BRAF mutation testing for advanced disease

### Wide local excision margins (after excision biopsy)

| Breslow thickness | Margin |
|---|---|
| In situ | 5 mm |
| ≤1 mm | 1 cm |
| 1–2 mm | 1–2 cm |
| >2 mm | 2 cm |

### Management

1. Wide local excision with margins above, down to deep fascia
2. Subungual melanoma: amputation of the digit at the appropriate joint
3. Positive sentinel node or clinical nodes: completion lymph node dissection or surveillance per MDT
4. Adjuvant and advanced disease: immunotherapy (nivolumab, pembrolizumab, ipilimumab) and targeted therapy (BRAF + MEK inhibitors) have transformed outcomes
5. Radiotherapy for brain and bone metastases

**Spread:** lymphatic (regional nodes, in-transit), blood (lungs, liver, brain, bone, and unusual sites such as small bowel causing intussusception).

**Prognosis:** depends mainly on Breslow thickness — 5-year survival >95% for thin melanomas (<1 mm), falling to about 50% for >4 mm.

> **Exam Alert:** Excision biopsy, never incision or shave, for suspected melanoma. Breslow thickness is the most important prognostic factor. Acral lentiginous melanoma is the commonest type in South Asians.

# Chapter 28: Ingrowing Toenail and Paronychia

## Ingrowing Toenail (Onychocryptosis)

**Definition:** The lateral edge of the nail plate grows into the adjacent nail fold, causing inflammation, infection and granulation tissue. Almost always the **big toe**.

**Causes:** cutting nails too short or curved (instead of straight across), tight footwear, sweaty feet, poor hygiene, curved nail plate, trauma; commonest in teenagers and young adults.

**Clinical features:** pain and swelling of the nail fold, redness, pus, overgrowth of **granulation tissue** over the nail edge; recurrent episodes.

### Management

| Stage | Treatment |
|---|---|
| Mild | Warm soaks, hygiene, cut nail straight across, lift nail edge with cotton wisp, wide shoes |

| Stage | Treatment |
|---|---|
| Infected | Above + oral antibiotics; drainage of pus |
| Recurrent / severe | **Wedge excision of the nail edge with phenolisation** of the nail bed (chemical matricectomy) — procedure of choice; or wedge resection of nail bed (Zadik's procedure for total nail bed ablation) |

Procedures are done under **ring (digital) block** with plain lidocaine (traditionally without adrenaline) and a tourniquet.

**Complications:** recurrence (commonest, about 10%), infection, osteomyelitis of terminal phalanx, nail deformity.

## Paronychia

**Definition:** Infection of the nail fold (around the nail). The commonest hand infection.

**Acute paronychia:** usually *Staph. aureus* after minor trauma (nail biting, manicure, hangnail). Red, swollen, tender, throbbing nail fold → pus. Treatment: warm soaks and antibiotics early; **incision and drainage** once pus forms (incise the fold parallel to the nail, or lift the eponychium); remove part of the nail if pus is under it.

**Chronic paronychia:** lasting >6 weeks, in people whose hands are often wet (housewives, cooks, dishwashers); *Candida* commonly involved; cuticle lost, nail ridged. Treatment: keep hands dry, gloves, topical antifungal and steroid; eponychial marsupialisation if resistant.

### Related hand infections

- **Felon (pulp space infection):** tense, throbbing pulp of fingertip; drain early to prevent osteomyelitis of the terminal phalanx
- **Herpetic whitlow:** vesicles on fingertip (health workers); **do not incise**; antiviral (acyclovir)

> **Exam Alert:** Phenolisation of the nail bed reduces recurrence of ingrowing toenail. Never incise a herpetic whitlow.

## Self-Assessment: Part 4 SBAs

**1.** A 55-year-old man has a painless, shallow ulcer above the medial malleolus with a sloping edge, surrounding brown pigmentation and varicose veins. Before applying compression bandaging, which test is essential?

A. Ankle–brachial pressure index · B. Biopsy of the ulcer edge · C. Nerve conduction study · D. Plain X-ray of the leg · E. Venography

**Answer: A.** ABPI must exclude arterial disease (>0.8) before compression.

**2.** A 50-year-old diabetic man has a painless, punched-out ulcer under the head of the first metatarsal, surrounded by callus. Foot pulses are palpable. What is the most likely type of ulcer?

A. Arterial · B. Marjolin's · C. Neuropathic · D. Tuberculous · E. Venous

**Answer: C.** Painless pressure-point ulcer with callus and pulses present.

**3.** A 35-year-old man has a 2 cm smooth, spherical swelling on his back, attached to the skin, with a small black dot on its summit. What is the most likely diagnosis?

A. Dermoid cyst · B. Lipoma · C. Neurofibroma · D. Sebaceous (epidermoid) cyst · E. Sebaceous horn

**Answer: D.** Punctum and skin attachment are characteristic.

**4.** A 4-year-old child has a painless, non-tender swelling at the lateral end of the eyebrow, present since infancy and not attached to skin. What is the most likely diagnosis?

A. External angular dermoid · B. Implantation dermoid · C. Lipoma · D. Sebaceous cyst · E. Haemangioma

**Answer: A.** Commonest sequestration dermoid, along a line of embryonic fusion.

**5.** A 48-year-old man has a 9 cm soft swelling in the thigh that has grown over 6 months and lies deep to the fascia lata. What is the most appropriate next investigation?

A. Excision under local anaesthesia · B. FNAC · C. MRI of the thigh · D. Plain X-ray · E. Reassurance and review in a year

**Answer: C.** Size >5 cm, deep and growing are red flags for liposarcoma.

**6.** A 70-year-old farmer has a slow-growing nodule at the inner canthus for 2 years with a pearly rolled edge, surface telangiectasia and a central crust. Neck nodes are not enlarged. What is the most appropriate treatment?

A. Chemotherapy · B. Cryotherapy · C. Mohs micrographic surgery · D. Radical neck dissection · E. Topical imiquimod

**Answer: C.** BCC at a high-risk site (periocular) is best treated by Mohs surgery for tissue preservation.

**7.** A 60-year-old man has a non-healing ulcer that developed over a burn scar on his leg sustained 30 years ago. What is the most likely diagnosis?

A. Basal cell carcinoma · B. Keratoacanthoma · C. Marjolin's ulcer · D. Tuberculous ulcer · E. Venous ulcer

**Answer: C.** SCC arising in a chronic scar; confirm by edge biopsy.

**8.** A 45-year-old woman has a pigmented lesion on her sole that has enlarged with an irregular border and variable colour. What is the most appropriate initial step?

A. Cryotherapy · B. Excision biopsy with 2 mm margin · C. Incision biopsy · D. Shave biopsy · E. Wide excision with 2 cm margin

**Answer: B.** Suspected acral melanoma; excision biopsy allows accurate Breslow measurement before definitive margins.

**9.** Histology of an excised melanoma reports Breslow thickness of 1.6 mm. What wide local excision margin is recommended?

A. 2 mm · B. 5 mm · C. 1–2 cm · D. 3 cm · E. 5 cm

**Answer: C.** 1–2 mm thickness requires a 1–2 cm margin.

**10.** A 17-year-old boy has had three episodes of a painful, infected ingrowing big toenail with granulation tissue. What is the most appropriate treatment?

A. Long-term oral antibiotics · B. Repeated nail cutting · C. Total nail avulsion alone · D. Wedge excision with phenolisation of the nail bed · E. Amputation of the terminal phalanx

**Answer: D.** Phenolisation destroys the nail matrix at the edge and reduces recurrence.

*References: Bailey & Love's Short Practice of Surgery, 28th Ed.; Blecha, Surgery, 4th Ed.*

PART 5

# Head and Neck

## Chapter 29: Neck Swellings — Approach and Congenital Cysts

**Approach:** Classify a neck swelling by its **site (triangle)** and **age** of the patient. Lymph nodes are the commonest cause of a neck lump at every age.

**Rule of 80 (for neck masses in adults):** 80% of non-thyroid neck masses are neoplastic; 80% of neoplastic masses are malignant; 80% of malignant masses are metastatic; 80% of metastases come from a primary above the clavicle.

**Neck swellings by site**

| Site | Causes |
|---|---|
| Midline | Thyroglossal cyst, thyroid isthmus swelling, submental lymph node, dermoid cyst, plunging ranula, Delphian node |
| Anterior triangle | Lymph nodes, branchial cyst, thyroid lobe, carotid body tumour, submandibular gland, cold abscess, laryngocele, parotid tail |
| Posterior triangle | Lymph nodes (TB, lymphoma, metastatic), cystic hygroma, cervical rib, subclavian aneurysm, pharyngeal pouch, lipoma |

**By age:** children — reactive nodes, congenital (thyroglossal, branchial, cystic hygroma, dermoid); young adults — reactive nodes, TB, lymphoma, thyroid; over 40 — metastatic nodes until proved otherwise.

### Thyroglossal Cyst

**Origin:** remnant of the thyroglossal duct, along the descent of the thyroid from the foramen caecum of the tongue to the neck.

**Clinical features:** commonest congenital neck cyst; children and young adults; **midline** swelling, usually **subhyoid** (also suprahyoid, at foramen caecum); smooth, cystic, transilluminant if thin-walled. **Moves upward with protrusion of the tongue** and with swallowing (attached to hyoid). May become infected or form a **thyroglossal fistula** (often after incomplete excision or drainage).

**Investigations: USG neck** to confirm a normal thyroid gland in the normal position (exclude ectopic thyroid being the only functioning tissue); thyroid function tests; radioisotope scan if doubt; FNAC if solid (papillary carcinoma can arise in the cyst, about 1%).

**Management: Sistrunk's operation** — excision of the cyst with the tract and the **central part of the hyoid bone**, up to the foramen caecum. Simple excision has a high recurrence rate. Treat infection first.

### Branchial Cyst

**Origin:** remnant of the second branchial cleft (cervical sinus of His); some believe it arises from cystic degeneration of lymphoid tissue.

**Clinical features:** young adults (20–30 years); swelling at the **junction of the upper third and lower two-thirds of the anterior border of sternocleidomastoid**, partly deep to it; smooth, ovoid, fluctuant; contains turbid fluid with **cholesterol crystals** on aspiration. May become infected.

**Branchial sinus/fistula:** congenital opening at the lower third of the anterior border of sternocleidomastoid, discharging mucus; the fistula tract passes between internal and external carotid arteries to open into the tonsillar fossa.

**Investigations:** USG; FNAC (cholesterol crystals; exclude cystic metastasis in adults >40, especially from oropharynx).

**Management:** complete surgical excision (avoid hypoglossal, glossopharyngeal, accessory nerves); treat infection first. Fistula: excision with step-ladder incisions.

### Cystic Hygroma (Lymphangioma)

**Origin:** congenital malformation of lymphatic sacs (jugular lymph sac sequestration).

**Clinical features:** present at birth or in early childhood; **lower third of the posterior triangle**; soft, lobulated, multicystic, compressible, and **brilliantly transilluminant**; may extend into axilla or mediastinum. Can cause obstructed labour or airway compromise and may enlarge suddenly from infection or haemorrhage.

**Investigations:** antenatal USG, USG and MRI to assess extent.

**Management:** sclerotherapy (**OK-432 / picibanil**, bleomycin) for macrocystic lesions; surgical excision; urgent airway management if compromised.

> **Exam Alert:** Moves with tongue protrusion = thyroglossal cyst (Sistrunk's operation). Cholesterol crystals = branchial cyst. Brilliantly transilluminant posterior triangle swelling in an infant = cystic hygroma.

## Chapter 30: Cervical Lymphadenopathy

**Definition:** Enlargement of cervical lymph nodes (>1 cm). It is the commonest cause of a lump in the neck.

**Causes**

| Group | Examples |
|---|---|
| Infective — acute | Tonsillitis, dental infection, scalp infection, viral (EBV/infectious mononucleosis) |
| Infective — chronic | **Tuberculosis (commonest cause in Pakistan)**, toxoplasmosis, HIV, cat-scratch disease |
| Neoplastic — primary | Hodgkin and non-Hodgkin lymphoma, leukaemia |
| Neoplastic — secondary | Head and neck SCC (oral cavity, larynx, pharynx), thyroid carcinoma, nasopharyngeal carcinoma; **Virchow's node** (left supraclavicular — Troisier's sign) from stomach, pancreas, testis, lung |
| Others | Sarcoidosis, drug-induced, Kikuchi disease |

**Levels of neck nodes:** I (submental/submandibular), II (upper jugular), III (middle jugular), IV (lower jugular), V (posterior triangle), VI (central compartment), VII (superior mediastinal).

### Clinical clues

- Tender, soft, mobile, with obvious infection → reactive
- **Rubbery**, painless, discrete, multiple; fever, night sweats, weight loss, pruritus, alcohol-induced pain → **lymphoma**
- **Stony hard**, fixed, painless in older smoker → **metastatic carcinoma**
- Matted nodes, cold abscess, sinus → **tuberculosis**

## Tuberculous Cervical Lymphadenitis (Scrofula)

**Cause:** *Mycobacterium tuberculosis* (human), occasionally bovine via tonsils; the commonest form of extrapulmonary TB.

### Stages

1. Lymphadenitis — firm, discrete, mobile nodes
2. Periadenitis — nodes **matted** together
3. Caseation — **cold abscess** (fluctuant, not hot or red)
4. **Collar-stud abscess** — pus breaks through deep fascia into subcutaneous tissue
5. Sinus formation — chronic discharging sinus with undermined edges, bluish skin

**Investigations:** CBC, ESR, Mantoux test or IGRA, chest X-ray, USG neck, **FNAC** (caseating granulomas, Langhans giant cells), AFB smear, **GeneXpert (CBNAAT)**, culture; excision biopsy if FNAC inconclusive; HIV test.

### Management

- **Anti-tuberculous therapy for 6 months:** 2 months HRZE (isoniazid, rifampicin, pyrazinamide, ethambutol), then 4 months HR
- Cold abscess: **aspirate through a non-dependent site** (through healthy skin, obliquely) to avoid sinus formation
- Surgery: excision of persistent nodes, curettage of sinuses, drainage of collar-stud abscess
- Paradoxical enlargement of nodes during treatment can occur and does not mean failure

## Approach to a Neck Node in an Adult >40

1. Full ENT examination including nasopharynx, larynx and oral cavity (endoscopy)
2. **FNAC** (USG-guided) — first-line investigation
3. **Avoid open excision biopsy** of a suspected metastatic SCC node before finding the primary (seeds tumour, compromises later neck dissection)
4. CT/MRI of head and neck, PET-CT for unknown primary; panendoscopy with biopsies
5. **Lymphoma:** excision biopsy of a whole node is needed for architecture and typing

> **Exam Alert:** FNAC is the first investigation of a neck lump. Excision biopsy is needed for lymphoma. Aspirate a cold abscess through a non-dependent site.

# Chapter 31: Cleft Lip and Palate

**Definition:** Congenital failure of fusion of the facial processes. Cleft lip results from failure of fusion of the **maxillary process with the medial nasal process** (6th–7th week); cleft palate from failure of fusion of the **palatal shelves** (8th–12th week).

**Incidence:** about 1 in 600–1000 live births; commonest congenital craniofacial anomaly. Cleft lip ± palate is commoner in boys and on the **left side**; isolated cleft palate is commoner in girls.

**Aetiology:** multifactorial — genetic (family history, syndromes such as Pierre Robin sequence, Van der Woude), maternal smoking, alcohol, anticonvulsants (phenytoin, valproate), steroids, folic acid deficiency, consanguinity (common in Pakistan).

### Classification

- **Cleft lip:** unilateral or bilateral; incomplete or complete (extending into nostril floor)
- **Cleft palate:** primary palate (anterior to incisive foramen), secondary palate (posterior), complete; **submucous cleft** (bifid uvula, notch in posterior hard palate, translucent midline zona pellucida)
- Commonest overall: cleft lip with cleft palate

### Problems caused

| Problem | Reason |
|---|---|
| Feeding difficulty | Cannot create suction; nasal regurgitation |
| Speech (hypernasal) | Velopharyngeal insufficiency |
| Hearing loss, otitis media with effusion | Eustachian tube dysfunction (abnormal tensor veli palatini) |
| Dental anomalies | Missing, extra or malpositioned teeth, maxillary hypoplasia |
| Cosmetic and psychological | Facial deformity |
| Aspiration, airway problems | Especially with Pierre Robin sequence |

**Investigations:** antenatal USG detection (cleft lip from about 18–20 weeks); look for associated anomalies and syndromes; hearing assessment.

**Management — multidisciplinary cleft team:** plastic surgeon, orthodontist, speech therapist, ENT, audiologist, paediatrician, psychologist, specialist nurse.

**Feeding:** specially designed bottles (squeezable), soft teats, upright feeding; breastfeeding may be possible with cleft lip alone; feeding plates (obturators) in some centres.

### Timing of surgery (common protocol)

| Procedure | Age |
|---|---|
| Cleft lip repair (cheiloplasty) — **Millard rotation–advancement** | **3 months** ("rule of 10s": 10 weeks, 10 lb weight, Hb 10 g/dl) |
| Cleft palate repair (palatoplasty) — von Langenbeck, Furlow double-opposing Z-plasty | **6–12 months** (before speech develops) |
| Grommets for glue ear | With palate repair if needed |
| Alveolar bone grafting | 8–11 years (before eruption of canine) |
| Pharyngoplasty for velopharyngeal insufficiency | 3–5 years |
| Orthognathic surgery, rhinoplasty, lip revision | Adolescence, after facial growth |

**Complications of surgery:** bleeding, airway obstruction, wound dehiscence, oronasal fistula, velopharyngeal insufficiency, maxillary growth restriction, poor scar.

> **Exam Alert:** Lip repair at about 3 months; palate repair before 12 months, for normal speech. Cleft palate causes glue ear through Eustachian tube dysfunction.

# Chapter 32: Salivary Gland Disorders and Tumours

**Anatomy in brief:** three paired major glands — parotid (serous; **Stensen's duct** opens opposite the upper second molar; facial nerve divides it into superficial and deep lobes), submandibular (mixed; **Wharton's duct** opens at sublingual papilla), sublingual (mucous); plus hundreds of minor glands in the mouth.

## Sialolithiasis (Salivary Calculi)

- **80% in the submandibular gland** — its saliva is alkaline, viscous, rich in mucin and calcium, and the duct runs uphill
- **Clinical features:** painful swelling of the gland **at mealtimes**, subsiding afterwards; stone may be palpable bimanually in the floor of the mouth; recurrent sialadenitis
- **Investigations:** X-ray floor of mouth (occlusal view; most submandibular stones are radio-opaque), USG, sialography, sialendoscopy, CT
- **Management:** stone in the duct → **intraoral removal** (dochotomy) or sialendoscopy; stone in the gland or recurrent sialadenitis → **submandibular gland excision** (protect marginal mandibular, lingual and hypoglossal nerves)

## Acute Parotitis

- **Viral (mumps):** bilateral painful swelling in children; complications — orchitis, pancreatitis, meningitis
- **Acute bacterial (suppurative) parotitis:** *Staph. aureus*; elderly, dehydrated, postoperative patients with poor oral hygiene; tense, painful swelling, pus from Stensen's duct; treat with hydration, oral hygiene, sialogogues, IV antibiotics, drainage of abscess (no fluctuation because of the tough parotid fascia — use USG)

## Salivary Gland Tumours

**Rule of 80s:** 80% of salivary tumours are in the parotid; 80% of parotid tumours are benign; 80% of benign parotid tumours are pleomorphic adenomas. The smaller the gland, the more likely a tumour is malignant (sublingual and minor glands → mostly malignant).

| Tumour | Features | Treatment |
|---|---|---|
| **Pleomorphic adenoma** (commonest) | Middle-aged women; slow-growing, painless, firm, lobulated, in the parotid behind the angle of the jaw; facial nerve intact; incomplete capsule with **pseudopodia** → recurrence if enucleated; malignant change (carcinoma ex-pleomorphic) in 5–10% if long-standing | **Superficial parotidectomy** preserving facial nerve |
| **Warthin's tumour** (adenolymphoma) | Elderly male **smokers**; often bilateral; soft, cystic; lower pole of parotid; **hot spot on technetium scan** | Superficial parotidectomy or observation |
| Mucoepidermoid carcinoma | Commonest malignant salivary tumour; low or high grade | Parotidectomy ± neck dissection, radiotherapy |
| Adenoid cystic carcinoma | Commonest malignancy of submandibular and minor glands; **perineural spread**, pain, late recurrence (lung metastases) | Radical excision + radiotherapy |

| Tumour | Features | Treatment |
|---|---|---|
| Acinic cell carcinoma, adenocarcinoma, carcinoma ex-pleomorphic adenoma | — | Surgery + radiotherapy |

**Features suggesting malignancy:** rapid growth, pain, **facial nerve palsy**, fixity to skin or deep tissues, hard consistency, cervical lymphadenopathy.

**Investigations: USG + USG-guided FNAC or core biopsy** (first-line); MRI for deep lobe and malignancy. **Open (incision) biopsy of a parotid lump is contraindicated** — spillage, recurrence, facial nerve injury.

### Complications of parotidectomy

- **Facial nerve injury** (temporary weakness common; permanent rare)
- **Frey's syndrome** (gustatory sweating): redness and sweating of cheek skin while eating, due to aberrant regeneration of parasympathetic (auriculotemporal) fibres to sweat glands; confirmed by starch–iodine (Minor's) test; treat with botulinum toxin
- Greater auricular nerve numbness (ear lobe), salivary fistula or sialocele, haematoma, cosmetic hollow

> **Exam Alert:** Pleomorphic adenoma is the commonest salivary tumour; treat by superficial parotidectomy, not enucleation. Facial nerve palsy with a parotid lump means malignancy until proved otherwise.

## Chapter 33: Oral Cancer and Premalignant Lesions

**Importance:** Oral cancer is among the commonest cancers in Pakistan and South Asia (especially in men), because of widespread use of betel quid (paan), areca nut (chhalia, supari), gutka, naswar and tobacco. Over 90% are **squamous cell carcinomas**.

**Risk factors:** tobacco (smoked and smokeless — naswar, gutka), betel quid and areca nut, alcohol (synergistic with tobacco), HPV (oropharynx), sharp jagged teeth and ill-fitting dentures (chronic irritation), poor oral hygiene, syphilis, nutritional deficiency, immunosuppression.

### Premalignant (potentially malignant) lesions

| Lesion | Description | Malignant potential |
|---|---|---|
| **Leukoplakia** | White patch that cannot be scraped off and is not any other disease (commonest) | 2–5%; higher if speckled or on floor of mouth/ventral tongue |
| **Erythroplakia** | Red velvety patch | **Highest** (up to 50% already dysplastic or invasive) |
| **Oral submucous fibrosis** | Areca nut chewing; blanching, fibrous bands, **progressive trismus**, burning with spicy food | 7–13% |
| Lichen planus (erosive) | Lacy white striae | Low |
| Chronic hyperplastic candidiasis, syphilitic glossitis | — | Low–moderate |

**Sites:** in South Asia the **buccal mucosa** and gingivobuccal sulcus are commonest (where quid is held); in the West, the lateral border of the tongue and floor of mouth.

### Clinical features

- Non-healing ulcer (>3 weeks) with **everted, indurated edge**, bleeds on touch
- Proliferative growth, white or red patch

- Pain, often **referred otalgia** (lingual nerve → auriculotemporal nerve)
- Difficulty chewing, swallowing, speaking; trismus (pterygoid involvement); loosening of teeth; foul breath
- **Neck nodes:** levels I–III commonly; hard and fixed in advanced disease

**Investigations**

- **Incisional (wedge) biopsy** from the edge — confirms SCC
- FNAC of neck nodes
- **Orthopantomogram (OPG)** and **CT/MRI** for bone invasion and extent; CT neck for nodes; chest CT/X-ray
- PET-CT in advanced disease; panendoscopy for synchronous primaries (field cancerisation)

**Staging:** TNM (AJCC 8th Ed. includes **depth of invasion** in T staging).

**Management**

1. **Surgery** (mainstay): wide local excision with 1 cm margin; marginal or **segmental mandibulectomy** if bone involved; hemiglossectomy for tongue cancer
2. **Neck dissection:** therapeutic for positive nodes (modified radical neck dissection); **elective selective neck dissection (levels I–III)** for N0 neck when depth of invasion >3–4 mm
3. **Reconstruction:** local flaps, pectoralis major myocutaneous flap, free flaps (radial forearm, anterolateral thigh, free fibula for mandible)
4. **Adjuvant radiotherapy** (± cisplatin chemotherapy) for advanced stage, close/positive margins, extranodal extension, perineural invasion
5. Palliative care for inoperable disease

**Management of premalignant lesions:** stop tobacco and areca nut; biopsy; excision or laser ablation of dysplastic lesions; long-term follow-up. Oral submucous fibrosis: stop chewing, mouth-opening exercises, intralesional steroids, surgical release of bands.

**Prevention:** public awareness against paan, chhalia, gutka, naswar and smoking; regular dental check-ups; biopsy of any oral ulcer not healing in 3 weeks.

> **Exam Alert:** Erythroplakia has the highest malignant potential. Any oral ulcer lasting >3 weeks needs biopsy. Referred ear pain in a smoker with a tongue ulcer suggests carcinoma.

## Self-Assessment: Part 5 SBAs

**1.** An 8-year-old girl has a 2 cm smooth, painless midline swelling just below the hyoid bone that moves upward when she protrudes her tongue. Ultrasound shows a normal thyroid gland. What is the treatment of choice?

A. Aspiration · B. Incision and drainage · C. Simple excision of the cyst · D. Sistrunk's operation · E. Total thyroidectomy

**Answer: D.** Excision of cyst, tract and central hyoid reduces recurrence.

**2.** A 24-year-old man has a smooth, fluctuant swelling at the junction of the upper and middle thirds of the anterior border of the left sternocleidomastoid. Aspiration yields turbid fluid. What will microscopy most likely show?

A. Acid-fast bacilli · B. Cholesterol crystals · C. Colloid · D. Keratin flakes only · E. Reed–Sternberg cells

**Answer: B.** Branchial cyst.

**3.** A newborn has a soft, lobulated, compressible swelling in the lower posterior triangle that is brilliantly transilluminant. What is the most likely diagnosis?

A. Branchial cyst · B. Cystic hygroma · C. Haemangioma · D. Sternomastoid tumour · E. Thyroglossal cyst

**Answer: B.** Lymphatic malformation of the posterior triangle.

**4.** A 22-year-old woman has matted, non-tender nodes in the left posterior triangle with an overlying fluctuant swelling that is not warm. FNAC shows caseating granulomas. What is the most appropriate management of the fluctuant swelling?

A. Aspiration through a non-dependent site with anti-tuberculous therapy · B. Incision and drainage through a dependent incision · C. IV antibiotics alone · D. Radical neck dissection · E. Radiotherapy

**Answer: A.** Cold abscess; non-dependent aspiration prevents a chronic sinus.

**5.** A 58-year-old smoker has a hard, painless, 3 cm left level II neck node for 2 months. What is the most appropriate first investigation?

A. Excision biopsy of the node · B. Incision biopsy of the node · C. Mantoux test · D. Trial of antibiotics for 2 weeks · E. USG-guided FNAC with full ENT examination

**Answer: E.** Suspected metastatic SCC; open biopsy before finding the primary compromises treatment.

**6.** A baby is born with a complete unilateral cleft lip and palate. At what age is cleft palate repair usually performed?

A. Within the first week · B. 6–12 months · C. 3–4 years · D. 8–11 years · E. After puberty

**Answer: B.** Before speech develops; lip repair is done earlier, at about 3 months.

**7.** A 45-year-old man has pain and swelling below his right jaw every time he eats, settling an hour later. Bimanual palpation reveals a hard mass in the floor of the mouth. What is the most likely diagnosis?

A. Parotid calculus · B. Pleomorphic adenoma · C. Ranula · D. Submandibular duct calculus · E. Submandibular lymphadenitis

**Answer: D.** Mealtime swelling from obstruction; 80% of stones are submandibular.

**8.** A 40-year-old woman has a slowly enlarging, painless, firm lump in front of the left ear for 3 years. Facial nerve function is normal. FNAC shows epithelial and myxoid stromal elements. What is the appropriate operation?

A. Enucleation · B. Incision biopsy · C. Radical parotidectomy with facial nerve sacrifice · D. Superficial parotidectomy preserving the facial nerve · E. Submandibular gland excision

**Answer: D.** Pleomorphic adenoma; enucleation leaves pseudopodia and causes recurrence.

**9.** Eight months after parotidectomy, a man notices sweating and flushing of the cheek skin while eating. What is the mechanism?

A. Facial nerve regeneration · B. Greater auricular nerve injury · C. Misdirected regeneration of parasympathetic fibres to sweat glands · D. Salivary fistula · E. Sympathetic chain injury

**Answer: C.** Frey's syndrome via the auriculotemporal nerve.

**10.** A 50-year-old man who has chewed paan and chhalia for 30 years has an ulcer on the left buccal mucosa for 6 weeks with an everted, indurated edge, and progressive restriction of mouth opening. What is the next step?

A. Antifungal lozenges · B. Incisional biopsy from the ulcer edge · C. Mouth-opening exercises only · D. Review after 3 months · E. Topical steroids

**Answer: B.** Suspected SCC on a background of oral submucous fibrosis.

*References: Bailey & Love's Short Practice of Surgery, 28th Ed.; Blecha, Surgery, 4th Ed.*

PART 6

# Breast and Endocrine

## Chapter 34: Approach to a Breast Lump — Triple Assessment

**Principle:** Every breast lump is assessed by **triple assessment** — clinical examination, imaging and tissue diagnosis (cytology or histology). When all three agree, diagnostic accuracy exceeds 99%.

### Commonest lump by age

| Age | Commonest cause |
|---|---|
| 15–25 years | Fibroadenoma |
| 25–45 years | Fibroadenosis (fibrocystic change) |
| 35–55 years | Breast cyst |
| >50 years | **Carcinoma** |

**History:** duration, pain, change with menstrual cycle, nipple discharge (bloody?), skin changes, lactation, trauma; risk factors — age, family history (BRCA), early menarche, late menopause, nulliparity, late first pregnancy, no breastfeeding, HRT, obesity, previous breast cancer or atypical hyperplasia, chest radiation.

### Examination (sitting with arms by side, raised, hands on hips; then lying):

- Inspection: asymmetry, skin tethering, **peau d'orange**, nipple retraction or deviation, ulceration, eczema of nipple (Paget's disease)
- Palpation: quadrant, size, shape, consistency, mobility, fixity to skin (tethering) and pectoralis major (contract the muscle)
- Axillary, supraclavicular nodes; opposite breast; liver, spine, chest

### Imaging

- **Ultrasound:** first-line under 35–40 years (dense breasts); distinguishes solid from cystic; guides biopsy
- **Mammography:** over 35–40 years; signs of cancer — spiculated mass, microcalcifications, architectural distortion
- **MRI:** lobular cancer, implants, BRCA carriers, occult primary, assessing response to neoadjuvant chemotherapy
- Scoring: BI-RADS / U1–U5, M1–M5 (1 normal … 5 malignant)

### Tissue diagnosis

- **Core needle biopsy** (image-guided) — **preferred**; gives histology, grade, invasion and receptor status (ER, PR, HER2)
- FNAC — cytology only, cannot distinguish in situ from invasive; useful for cysts and axillary nodes
- Vacuum-assisted biopsy for microcalcification; excision biopsy if discordant results

**Scoring in the clinic:** each component is graded 1 (normal), 2 (benign), 3 (indeterminate), 4 (suspicious), 5 (malignant). Any score of 3 or more needs further assessment.

> **Exam Alert:** Triple assessment = clinical + imaging + core biopsy. USG under 35 years, mammography over 35–40 years.

# Chapter 35: Benign Breast Disease

**Concept — ANDI:** most benign conditions are **Aberrations of Normal Development and Involution** of the breast rather than true diseases.

## Fibroadenoma

- Benign tumour of stroma and epithelium (an ANDI of lobule development); commonest lump in women aged 15–25
- **Clinical:** painless, smooth, firm, rubbery, well-defined, **highly mobile ("breast mouse")**; may be multiple or bilateral
- **Giant fibroadenoma:** >5 cm; juvenile fibroadenoma in adolescents grows rapidly
- **Phyllodes tumour** (differential): older women (40s), large, rapidly growing, leaf-like on histology; can be benign, borderline or malignant; treat by **wide local excision** with 1 cm margin (recurs if enucleated)
- **Investigations:** USG + core biopsy (triple assessment)
- **Management:** reassurance and observation after confirmed diagnosis (many regress); **excision** if >3 cm, growing, symptomatic, patient's wish, age >35–40, or diagnostic doubt

## Fibroadenosis (Fibrocystic Change, Benign Breast Change)

- Ages 25–45; cyclical hormonal change
- **Clinical: cyclical mastalgia** (worse before menses), lumpiness or nodularity, usually upper outer quadrants, bilateral
- **Investigations:** triple assessment of any dominant lump
- **Management:** reassurance (most important), well-fitting supportive bra, simple analgesics, topical NSAIDs; evening primrose oil (limited evidence); severe cases — danazol or tamoxifen (specialist, side effects)

## Breast Cyst

- Perimenopausal women (35–55); smooth, fluctuant, may be painful; "halo" on mammogram
- **Management:** USG then aspiration; if fluid is not blood-stained and the lump disappears, no further action. **Blood-stained aspirate or residual lump → cytology and biopsy** (intracystic carcinoma)

## Duct Papilloma

- Benign epithelial tumour in a major subareolar duct; ages 35–50
- **Commonest cause of bloody nipple discharge** from a single duct
- **Investigations:** USG, mammography, ductography, cytology of discharge
- **Management: microdochectomy** (excision of the affected duct); **total duct excision (Hadfield's operation)** for multiple-duct discharge

### Duct Ectasia and Periductal Mastitis

- Dilatation of subareolar ducts with periductal inflammation; perimenopausal; **smoking** strongly associated with periductal mastitis
- **Clinical:** cheesy, green or multicoloured nipple discharge from multiple ducts; **slit-like nipple retraction**; subareolar mass; recurrent periareolar abscess; **mammary duct fistula**
- **Management:** stop smoking; antibiotics for infection; total duct excision for persistent discharge or fistula

**Nipple discharge — quick guide**

| Discharge | Likely cause |
|---|---|
| Milky, bilateral | Lactation, prolactinoma, drugs (galactorrhoea) |
| Green, multicoloured, multiple ducts | Duct ectasia |
| Bloody, single duct | Duct papilloma (exclude carcinoma) |
| Bloody with lump | Carcinoma until proved otherwise |
| Purulent | Infection / periductal mastitis |

> **Exam Alert:** Breast mouse = fibroadenoma. Bloody discharge from a single duct = duct papilloma. Slit-like nipple retraction = duct ectasia.

## Chapter 36: Breast Abscess and Mastitis

**Types**

| Feature | Lactational (puerperal) | Non-lactational (periductal) |
|---|---|---|
| Patient | Breastfeeding mother, first weeks after delivery or at weaning | Young to middle-aged women, **smokers** |
| Organism | ***Staph. aureus*** (from baby's mouth via cracked nipple) | Mixed: *Staph.*, anaerobes, enterococci |
| Site | Peripheral, any quadrant | **Periareolar / subareolar** |
| Recurrence | Uncommon | Common; may form **mammary duct fistula** |

**Pathogenesis (lactational):** cracked nipple, milk stasis (poor attachment, engorgement) → infective mastitis → abscess if untreated.

**Clinical features**

- **Mastitis (cellulitis stage):** painful, red, hot, tender, swollen segment of breast; fever, malaise; no pus
- **Abscess:** throbbing pain, a tender, indurated mass; fluctuation is a **late** sign because of fibrous septa; systemic toxicity; axillary nodes

**Investigations: ultrasound** to confirm pus and size; pus for culture and sensitivity; CBC, blood sugar. In non-lactating or older women, **exclude inflammatory carcinoma** (biopsy if no improvement).

**Management**

1. **Continue breastfeeding** or express milk from the affected breast (milk is safe for the baby; emptying the breast aids resolution)
2. Antibiotics: **flucloxacillin** or co-amoxiclav (erythromycin/clarithromycin if penicillin allergy); add metronidazole for non-lactational
3. Analgesia, supportive bra, warm compresses

4. **Abscess: repeated USG-guided needle aspiration** (first-line, better cosmesis); **incision and drainage** if large, multiloculated, skin thinned or necrotic, or aspiration fails — curvilinear incision along Langer's lines, break loculi, leave open
5. Non-lactational recurrent abscess or fistula: stop smoking; **total duct excision** or **fistulectomy** once inflammation settles

**Complications:** recurrence, mammary duct fistula, milk fistula, scarring and deformity, missed carcinoma.

**Differential:** inflammatory breast carcinoma (non-tender, no fever, peau d'orange, no response to antibiotics), tuberculous mastitis (chronic, sinuses; common in Pakistan), granulomatous mastitis.

> **Exam Alert:** Don't stop breastfeeding in lactational mastitis. Staph. aureus is the commonest organism. Biopsy any 'abscess' that fails to resolve, to exclude carcinoma.

## Chapter 37: Carcinoma of the Breast

**Importance:** The commonest cancer in women worldwide. **Pakistan has one of the highest rates in Asia**, with about 1 in 9 women affected and frequent presentation at a late stage and younger age.

**Risk factors:** female sex, increasing age, **BRCA1/BRCA2** mutations and family history, early menarche, late menopause, nulliparity, first pregnancy after 30, not breastfeeding, HRT and long-term oral contraceptives, obesity (post-menopausal), alcohol, previous breast cancer, atypical hyperplasia, chest irradiation.

### Pathology

| Type | Notes |
|---|---|
| **Ductal carcinoma in situ (DCIS)** | Non-invasive; microcalcification on mammogram; treat to prevent invasion |
| Lobular carcinoma in situ (LCIS) | Risk marker for both breasts |
| **Invasive ductal carcinoma (no special type)** | **Commonest (~75–80%)**; hard, irregular |
| Invasive lobular carcinoma | 10–15%; multifocal, bilateral; poorly seen on mammogram (MRI) |
| Special types: medullary, mucinous, tubular, papillary | Better prognosis |
| Inflammatory carcinoma | Diffuse redness, oedema, peau d'orange over >1/3 of breast; dermal lymphatic invasion; poor prognosis |
| **Paget's disease of the nipple** | Eczema-like nipple lesion that destroys the nipple (unlike eczema, which starts on the areola); underlying DCIS or invasive cancer |

**Molecular subtypes:** luminal A (ER+, HER2−, low grade), luminal B, **HER2-enriched**, **triple-negative** (ER−, PR−, HER2−; BRCA1-associated, aggressive, young women).

**Clinical features:** painless, hard, irregular lump, commonest in **upper outer quadrant**; skin tethering or dimpling, **peau d'orange** (lymphatic obstruction), nipple retraction, bloody discharge, ulceration, fixity to chest wall; axillary nodes. Advanced: **cancer en cuirasse**, bone pain, breathlessness, jaundice, headache.

**Spread:** lymphatic (axillary — levels I, II, III; internal mammary), blood (**bone — commonest, vertebrae**), lung, liver, brain.

### Investigations

- **Triple assessment** with core biopsy: histology, grade, **ER, PR, HER2, Ki-67**
- Axillary USG ± FNAC/core of suspicious nodes

- Staging (stage III or symptomatic): CT chest/abdomen/pelvis, bone scan or PET-CT; LFTs, calcium, alkaline phosphatase
- Genetic testing (BRCA) in young or strong family history

**TNM summary:** T1 ≤2 cm, T2 2–5 cm, T3 >5 cm, T4 chest wall or skin involvement (including inflammatory); N1 mobile axillary nodes, N2 fixed/matted, N3 infraclavicular, supraclavicular or internal mammary; M1 distant.

**Management — multidisciplinary**

1. **Surgery to the breast** - **Breast-conserving surgery (wide local excision)** + **radiotherapy** — survival equal to mastectomy for suitable tumours - **Mastectomy** (modified radical: breast + axillary clearance, pectoralis preserved — Patey/Madden): large tumour relative to breast, multicentric, central, patient choice, previous radiotherapy, BRCA carriers; ± reconstruction
2. **Surgery to the axilla** - Clinically/USG node-negative → **sentinel lymph node biopsy** (blue dye + radioisotope) - Proven node-positive → **axillary lymph node dissection**
3. **Radiotherapy:** after breast conservation (always); after mastectomy for large tumours or ≥4 positive nodes
4. **Chemotherapy:** neoadjuvant (to downstage locally advanced, inflammatory, HER2+ or triple-negative) or adjuvant (high risk)
5. **Endocrine therapy (ER+): tamoxifen** (pre-menopausal; risk of endometrial cancer and DVT) or **aromatase inhibitors** — letrozole, anastrozole (post-menopausal; risk of osteoporosis), for 5–10 years
6. **Targeted therapy (HER2+): trastuzumab** (Herceptin) for 1 year (monitor cardiac function), pertuzumab
7. Metastatic disease: endocrine therapy, chemotherapy, CDK4/6 inhibitors, bisphosphonates for bone, palliative radiotherapy

**Prognostic factors:** tumour size, **axillary node status (most important)**, grade, receptor status, lymphovascular invasion; Nottingham Prognostic Index.

**Complications of axillary surgery:** lymphoedema of arm, seroma, shoulder stiffness, numbness (intercostobrachial nerve), **winged scapula (long thoracic nerve)**, latissimus dorsi weakness (thoracodorsal nerve).

**Screening:** mammography every 2–3 years from 50–70 (40 in some guidelines); breast self-awareness campaigns (Pink Ribbon Pakistan).

> **Exam Alert:** Axillary node status is the most important prognostic factor. Tamoxifen for pre-menopausal, aromatase inhibitors for post-menopausal ER+ disease. Peau d'orange is due to dermal lymphatic obstruction.

## Chapter 38: Goitre and Solitary Thyroid Nodule

**Definition:** Goitre is any enlargement of the thyroid gland. A thyroid swelling **moves upward on swallowing** because the gland is enclosed in pretracheal fascia attached to the larynx.

**Classification of goitre**

| Type | Examples |
|---|---|
| Simple (non-toxic) | Diffuse physiological (puberty, pregnancy), **multinodular goitre (MNG)** |
| Toxic | Graves' disease (diffuse), toxic MNG, toxic adenoma |
| Neoplastic | Benign follicular adenoma; carcinoma; lymphoma |
| Inflammatory | Hashimoto's thyroiditis, de Quervain's (subacute, painful), Riedel's (woody hard) |

**Endemic goitre:** iodine deficiency — historically common in the northern mountain areas of Pakistan (Gilgit-Baltistan, Chitral, Swat); prevented by **iodised salt**.

**Pathogenesis of MNG:** iodine deficiency or goitrogens → low T4 → raised TSH → diffuse hyperplasia → alternating hyperplasia and involution → nodules, colloid, haemorrhage, calcification.

### Clinical features

- Neck swelling moving with swallowing (not with tongue protrusion)
- Pressure symptoms: dyspnoea, stridor (tracheal compression), dysphagia, hoarseness (recurrent laryngeal nerve palsy — suggests malignancy)
- **Retrosternal extension:** lower border not palpable, **Pemberton's sign** (facial plethora and venous distension when arms are raised — thoracic inlet obstruction)
- Features of thyroid status (hyper- or hypo-)

### Investigations

- **TFTs (TSH first, then free T4/T3)**
- **Ultrasound neck** — nodules, characteristics (TI-RADS), lymph nodes
- **FNAC** of suspicious nodules — reported by **Bethesda system (I–VI)**
- Thyroid antibodies (anti-TPO, TRAb)
- Radioisotope scan (technetium/iodine) if TSH is low — hot vs cold nodule
- CT neck/chest for retrosternal goitre; indirect/flexible laryngoscopy for vocal cord check before surgery; serum calcium

### Management of MNG

- Small, euthyroid, asymptomatic, benign cytology: observation
- **Indications for surgery:** pressure symptoms, retrosternal extension, suspicion of malignancy, toxicity, cosmetic
- **Total thyroidectomy** (preferred, avoids recurrence) with lifelong levothyroxine; or hemithyroidectomy for dominant unilateral disease
- Radioiodine for toxic MNG in older patients unfit for surgery

## Solitary Thyroid Nodule

**Importance:** 5–15% of solitary nodules are malignant. Clinically solitary nodules are often part of an MNG on ultrasound.

**Suspicious features:** extremes of age (<20 or >60), male sex, history of neck irradiation, family history (MEN2, medullary), rapid growth, hard and fixed nodule, hoarseness, cervical lymphadenopathy.

**Ultrasound features of malignancy:** hypoechoic, solid, **microcalcifications**, irregular margins, **taller-than-wide** shape, increased internal vascularity, suspicious nodes.

### Bethesda classification and action

| Category | Meaning | Risk of malignancy | Action |
|---|---|---|---|
| I | Non-diagnostic | — | Repeat FNAC |
| II | Benign | 0–3% | Follow-up USG |
| III | Atypia of undetermined significance | 10–30% | Repeat FNAC, molecular testing, or lobectomy |
| IV | Follicular neoplasm | 25–40% | **Hemithyroidectomy** (diagnostic lobectomy) |
| V | Suspicious for malignancy | 50–75% | Lobectomy or total thyroidectomy |

| Category | Meaning | Risk of malignancy | Action |
|---|---|---|---|
| VI | Malignant | 97–99% | Total thyroidectomy ± neck dissection (or lobectomy for small low-risk) |

**Why lobectomy for Bethesda IV?** FNAC cannot distinguish follicular adenoma from follicular carcinoma — diagnosis needs **capsular or vascular invasion** on histology.

> **Exam Alert:** Thyroid swellings move with swallowing; thyroglossal cysts also move with tongue protrusion. Follicular carcinoma cannot be diagnosed on FNAC.

## Chapter 39: Thyrotoxicosis and Thyroidectomy Complications

**Definition:** Thyrotoxicosis is the clinical syndrome of excess circulating thyroid hormone.

### Causes

| Cause | Features |
|---|---|
| **Graves' disease** (commonest) | Young women; autoimmune **TSH-receptor stimulating antibodies (TRAb)**; diffuse goitre with bruit, **eye signs**, pretibial myxoedema, acropachy |
| **Toxic multinodular goitre (Plummer's disease)** | Older patients; cardiovascular features (AF, heart failure) dominate; no eye signs |
| Toxic adenoma | Single hot nodule; rest of gland suppressed |
| Thyroiditis (de Quervain's, postpartum) | Transient; low uptake on scan |
| Iatrogenic | Excess levothyroxine, amiodarone, iodine |

**Clinical features:** weight loss despite good appetite, heat intolerance, sweating, palpitations, **tachycardia, atrial fibrillation**, tremor, anxiety, irritability, diarrhoea, oligomenorrhoea, proximal myopathy, warm moist skin. **Graves' eye signs:** lid retraction, lid lag, exophthalmos (proptosis), chemosis, ophthalmoplegia, optic nerve compression.

**Investigations: suppressed TSH**, raised free T4/T3; TRAb (Graves'); anti-TPO; **radionuclide scan** (diffuse uptake in Graves', patchy in MNG, single hot nodule with suppressed gland in adenoma, low uptake in thyroiditis); USG; ECG.

### Management options

| Option | Notes |
|---|---|
| **Antithyroid drugs** | **Carbimazole** (first line) or propylthiouracil (first trimester of pregnancy, thyroid storm); 12–18 months for Graves' (~50% relapse); side effect — **agranulocytosis** (stop if sore throat; check WBC) |
| **Beta-blockers** (propranolol) | Symptom control; part of pre-op preparation |
| **Radioactive iodine (I-131)** | Simple, effective; causes hypothyroidism; **contraindicated in pregnancy and breastfeeding**; may worsen eye disease |
| **Surgery (total thyroidectomy)** | Large goitre, pressure symptoms, suspicion of malignancy, severe eye disease, pregnancy (second trimester), drug failure, patient preference, toxic MNG/adenoma |

**Preoperative preparation:** make the patient **euthyroid** with carbimazole and propranolol (to prevent thyroid storm); **Lugol's iodine** for 10 days before surgery in Graves' to reduce vascularity; vocal cord check (laryngoscopy); calcium baseline.

**Thyroid storm (thyrotoxic crisis):** after surgery, infection or stress in an unprepared patient — hyperpyrexia, extreme tachycardia, AF, agitation, delirium, heart failure. Treat with IV fluids, cooling, propranolol, propylthiouracil, Lugol's iodine (after PTU), hydrocortisone, ICU care.

### Complications of Thyroidectomy

| Complication | Key points |
|---|---|
| **Haemorrhage / haematoma** | Within 24 h (reactionary); **airway compression → open the wound at the bedside** (remove skin and muscle sutures) then return to theatre |
| **Recurrent laryngeal nerve injury** | Unilateral → hoarse voice; **bilateral → stridor, airway obstruction** (cords in paramedian position) needing re-intubation or tracheostomy |
| External branch of superior laryngeal nerve injury | Loss of high-pitched voice and voice fatigue (singers); cricothyroid paralysis |
| **Hypocalcaemia (hypoparathyroidism)** | Commonest after total thyroidectomy (day 1–3): perioral tingling, **Chvostek's and Trousseau's signs**, tetany → IV calcium gluconate, oral calcium and vitamin D (alfacalcidol) |
| Thyroid storm | Unprepared toxic patients |
| Tracheomalacia | Long-standing large goitre; airway collapse after extubation |
| Hypothyroidism | After total thyroidectomy (lifelong levothyroxine) |
| Wound infection, keloid, hypertrophic scar | — |

> **Exam Alert:** Make toxic patients euthyroid before surgery. Haematoma with stridor → open the wound at the bedside. Bilateral RLN palsy causes stridor, unilateral causes hoarseness.

## Chapter 40: Thyroid Carcinoma

**Overview:** Thyroid cancer usually presents as a painless nodule or neck lymph node. Differentiated cancers (papillary and follicular) have an excellent prognosis.

### Types

| Type | Frequency | Cell of origin | Spread | Key features | Prognosis |
|---|---|---|---|---|---|
| **Papillary** | **Commonest (~80%)** | Follicular cells | **Lymphatic** (neck nodes) | Young women; radiation exposure; multifocal; **psammoma bodies, Orphan Annie (ground-glass) nuclei**, nuclear grooves; BRAF mutation | Excellent (>95% 10-yr) |
| **Follicular** | ~10–15% | Follicular cells | **Blood** (bone, lung) | Older; iodine-deficient areas; diagnosis needs capsular/vascular invasion (not FNAC); Hürthle cell variant | Good |

| Type | Frequency | Cell of origin | Spread | Key features | Prognosis |
|---|---|---|---|---|---|
| **Medullary** | ~5% | **Parafollicular C cells** | Lymph and blood | **Calcitonin** secreting (tumour marker), CEA; amyloid stroma; **25% familial (MEN2A, MEN2B; RET proto-oncogene)**; diarrhoea, flushing | Moderate |
| **Anaplastic** | <2% | Follicular cells (dedifferentiated) | Local invasion, early | Elderly; rapidly growing hard mass, stridor, dysphagia, hoarseness | Very poor (months) |
| **Lymphoma** | <5% | Lymphocytes | — | Elderly women with **Hashimoto's thyroiditis**; rapid enlargement | Responds to chemo-radiotherapy |

**Investigations:** TFTs, **USG + FNAC** (Bethesda); USG of neck nodes ± FNAC with thyroglobulin washout; laryngoscopy; CT/MRI for advanced disease. Medullary: **calcitonin, CEA, RET testing, and exclude phaeochromocytoma (urinary/plasma metanephrines) before surgery**. Lymphoma/anaplastic: core biopsy.

### Management

#### Differentiated (papillary and follicular)

1. **Surgery:** total thyroidectomy for tumours >4 cm, extrathyroidal extension, nodal or distant metastases, previous radiation; **hemithyroidectomy** acceptable for low-risk tumours 1–4 cm; low-risk microcarcinoma (<1 cm) may be observed or treated by lobectomy
2. **Neck dissection:** central (level VI) and/or lateral for involved nodes
3. **Radioactive iodine (I-131) ablation** after total thyroidectomy in intermediate/high-risk disease — destroys remnant and metastases
4. **TSH suppression** with levothyroxine (TSH drives tumour growth)
5. Follow-up with **serum thyroglobulin** (tumour marker after total thyroidectomy) and neck USG

**Medullary:** total thyroidectomy + central neck dissection (lateral if involved); **prophylactic thyroidectomy** in RET mutation carriers in childhood; RAI is **not** effective (C cells do not take up iodine); targeted therapy (vandetanib, selpercatinib) for advanced disease.

**Anaplastic:** usually palliative — airway protection (tracheostomy), radiotherapy, chemotherapy, targeted therapy if BRAF-mutated; surgery only for rare resectable cases.

**Lymphoma:** chemotherapy (R-CHOP) and radiotherapy; surgery only for diagnosis or airway.

> **Exam Alert:** Papillary is commonest and spreads by lymphatics; follicular spreads by blood. Calcitonin is the marker for medullary carcinoma, thyroglobulin for differentiated cancer follow-up. Exclude phaeochromocytoma before operating on medullary carcinoma.

# Chapter 41: Parathyroid and Adrenal Disorders

## Primary Hyperparathyroidism

**Definition:** Excess parathyroid hormone (PTH) from the parathyroid glands, causing **hypercalcaemia with raised or inappropriately normal PTH**.

**Causes: single adenoma (~85%)**, four-gland hyperplasia (~10–15%; MEN1, MEN2A), carcinoma (<1%).

**Clinical features — "bones, stones, abdominal groans and psychic moans"**

- **Bones:** pain, osteoporosis, fractures, osteitis fibrosa cystica (brown tumours)
- **Stones:** renal calculi, nephrocalcinosis, polyuria, thirst
- **Groans:** constipation, peptic ulcer, pancreatitis, nausea
- **Moans:** fatigue, depression, confusion
- Many patients are asymptomatic (found on routine calcium)

**Investigations:** serum calcium (corrected), **PTH**, phosphate (low), vitamin D, 24-h urinary calcium (to exclude familial hypocalciuric hypercalcaemia), renal function, DEXA scan, renal USG. **Localisation** (only after biochemical diagnosis, before surgery): **sestamibi scan + neck USG**, 4D-CT.

**Management: parathyroidectomy** — focused (minimally invasive) excision of a localised adenoma, or bilateral neck exploration; subtotal (3½ gland) parathyroidectomy for hyperplasia. Indications: symptomatic disease, calcium >0.25 mmol/L (1 mg/dl) above normal, age <50, osteoporosis or fracture, renal stones, reduced renal function. **Hypercalcaemic crisis:** IV saline, bisphosphonates, calcitonin. Post-op: watch for **hungry bone syndrome** (severe hypocalcaemia).

**Secondary hyperparathyroidism:** chronic kidney disease or vitamin D deficiency (calcium low/normal, PTH high). **Tertiary:** autonomous PTH after long-standing secondary (calcium high) — subtotal parathyroidectomy.

## Phaeochromocytoma

**Definition:** Catecholamine-secreting tumour of adrenal medulla chromaffin cells (paraganglioma if extra-adrenal).

**"Rule of 10s" (classic):** 10% bilateral, 10% extra-adrenal, 10% malignant, 10% in children, 10% familial (now known to be up to 30–40% hereditary — MEN2, VHL, NF1, SDH mutations).

**Clinical features:** paroxysmal **headache, sweating, palpitations** (classic triad) with episodic or sustained hypertension, anxiety, pallor, tremor; crises triggered by exercise, anaesthesia, palpation.

**Investigations: plasma free metanephrines** or 24-h urinary metanephrines; then **CT/MRI** of adrenals; MIBG or Ga-DOTATATE PET for extra-adrenal/metastatic disease; genetic testing.

**Management: preoperative alpha-blockade first (phenoxybenzamine or doxazosin) for 2–3 weeks, then beta-blockade** (never beta-blocker first — unopposed alpha stimulation causes hypertensive crisis); liberal salt and fluid intake; then **laparoscopic adrenalectomy**. Intra-operative hypertensive surges and post-operative hypotension and hypoglycaemia.

## Other Adrenal Conditions (Brief)

| Condition | Key points |
|---|---|
| **Conn's syndrome** (primary hyperaldosteronism) | Hypertension + **hypokalaemia**; high aldosterone/renin ratio; adenoma → laparoscopic adrenalectomy; hyperplasia → spironolactone |
| **Cushing's syndrome** | Cortisol excess: central obesity, moon face, striae, hypertension, diabetes; commonest cause is exogenous steroids; Cushing's disease = pituitary ACTH adenoma; adrenal adenoma → adrenalectomy (give steroid cover post-op) |
| **Adrenal incidentaloma** | Found on imaging; check for function (metanephrines, cortisol, aldosterone) and malignancy (size >4 cm, high CT attenuation); remove if functioning or suspicious |
| Adrenocortical carcinoma | Rare, large, often functioning; open adrenalectomy |

**Exam Alert:** Single adenoma is the commonest cause of primary hyperparathyroidism. In phaeochromocytoma, give alpha-blocker before beta-blocker.

## Self-Assessment: Part 6 SBAs

**1.** A 52-year-old woman has a 2.5 cm hard, irregular lump in the upper outer quadrant of her right breast with skin tethering. What is the most appropriate way to obtain a tissue diagnosis?

A. Excision biopsy · B. FNAC · C. Image-guided core needle biopsy · D. Incision biopsy · E. Nipple discharge cytology

**Answer: C.** Core biopsy gives histology, grade and receptor status.

**2.** A 19-year-old student has a 2 cm smooth, rubbery, painless lump that slips away under the fingers. Ultrasound and core biopsy confirm the diagnosis. What is the most appropriate management?

A. Mastectomy · B. Radiotherapy · C. Reassurance and observation · D. Tamoxifen · E. Wide local excision with 1 cm margin

**Answer: C.** Small, confirmed fibroadenoma in a young woman.

**3.** A 42-year-old woman has bloody discharge from a single duct of her left nipple. There is no lump, and mammography is normal. What is the most likely diagnosis?

A. Breast abscess · B. Duct ectasia · C. Duct papilloma · D. Fibroadenosis · E. Galactorrhoea

**Answer: C.** Commonest cause of single-duct bloody discharge; treat by microdochectomy.

**4.** Three weeks after delivery, a breastfeeding mother has a painful, red, swollen breast with fever. Ultrasound shows a 3 cm collection. What is the best initial management?

A. IV antibiotics and stop breastfeeding · B. Mastectomy · C. Oral antibiotics alone · D. USG-guided aspiration, antibiotics and continued breastfeeding · E. Wide local excision

**Answer: D.** Aspiration is first-line; breastfeeding or expression helps resolution.

**5.** A 48-year-old pre-menopausal woman has had breast-conserving surgery for an ER-positive, HER2-negative invasive ductal carcinoma. Which adjuvant endocrine therapy is most appropriate?

A. Anastrozole · B. Letrozole · C. Tamoxifen · D. Trastuzumab · E. No endocrine therapy

**Answer: C.** Aromatase inhibitors alone are ineffective in pre-menopausal ovaries.

**6.** A 35-year-old woman has a 2 cm solitary thyroid nodule. TFTs are normal. FNAC is reported as Bethesda IV (follicular neoplasm). What is the next step?

A. Radioactive iodine · B. Repeat FNAC in 1 year · C. Reassurance · D. Hemithyroidectomy · E. Thyroxine suppression

**Answer: D.** Follicular carcinoma needs histology showing capsular or vascular invasion.

**7.** Four hours after total thyroidectomy, a patient develops stridor and a tense neck swelling. What is the immediate action?

A. CT neck · B. IV calcium gluconate · C. Nebulised adrenaline · D. Open the wound at the bedside to evacuate the haematoma · E. Tracheostomy in theatre next day

**Answer: D.** Reactionary haemorrhage compressing the airway; then return to theatre.

**8.** On the second day after total thyroidectomy, a woman has tingling around her mouth and carpopedal spasm when a BP cuff is inflated. What is the cause?

A. Hypocalcaemia from parathyroid injury · B. Hypokalaemia · C. Hypomagnesaemia from diuretics · D. Recurrent laryngeal nerve palsy · E. Thyroid storm

**Answer: A.** Trousseau's sign of hypocalcaemia; treat with IV calcium gluconate.

**9.** A 30-year-old man has a thyroid nodule and raised serum calcitonin. His father had a thyroid cancer and an adrenal tumour. Before thyroid surgery, which test is essential?

A. Anti-TPO antibodies · B. Plasma metanephrines · C. Serum thyroglobulin · D. Radioiodine uptake scan · E. Serum TSH only

**Answer: B.** Medullary carcinoma in MEN2; an undetected phaeochromocytoma can cause a fatal crisis during anaesthesia.

**10.** A 40-year-old woman has episodic headaches, sweating and palpitations with BP 210/120 mmHg during attacks. Plasma metanephrines are raised and CT shows a 4 cm right adrenal mass. What is the first step in preoperative preparation?

A. Alpha-blockade with phenoxybenzamine · B. Beta-blockade with propranolol · C. Emergency adrenalectomy · D. Fluid restriction · E. IV hydrocortisone

**Answer: A.** Alpha-blockade first, then beta-blockade, with liberal salt and fluids.

*References: Bailey & Love's Short Practice of Surgery, 28th Ed.; Blecha, Surgery, 4th Ed.*

PART 7

# Vascular

## Chapter 42: Chronic Lower Limb Ischaemia and Buerger's Disease

**Definition:** Chronic reduction of blood flow to the lower limb, almost always due to **atherosclerosis** (peripheral arterial disease, PAD).

**Risk factors: smoking** (most important), diabetes, hypertension, hyperlipidaemia, age, male sex, family history, chronic kidney disease.

### Fontaine classification

| Stage | Features |
|---|---|
| I | Asymptomatic |
| II | **Intermittent claudication** (IIa >200 m, IIb <200 m) |
| III | **Rest pain** (ischaemic) |
| IV | Ulceration or gangrene (tissue loss) |

Stages III and IV = **chronic limb-threatening ischaemia (CLTI)**; formerly critical limb ischaemia.

### Clinical features

- **Intermittent claudication:** cramping pain in a muscle group on walking a reproducible distance, relieved by rest within minutes. **Calf = superficial femoral artery**; thigh and buttock = aortoiliac (**Leriche syndrome**: buttock claudication, impotence, absent femoral pulses)
- **Rest pain:** burning pain in the forefoot and toes at night, relieved by hanging the leg down over the bed; patient sleeps in a chair
- Signs: cold, pale, shiny, hairless skin; thick nails; muscle wasting; **absent or weak pulses**; delayed capillary refill; **Buerger's test** (pallor on elevation, angle <20° = severe ischaemia; dependent rubor); ulcers on pressure points and toes; gangrene

**Differential of claudication: neurogenic (spinal stenosis)** claudication — pain relieved by sitting or bending forward, not by standing still; pulses present.

### Investigations

- **Ankle–brachial pressure index (ABPI):** normal 0.9–1.2; claudication 0.5–0.9; rest pain <0.5; tissue loss <0.3. **Falsely high in diabetics** (calcified, incompressible vessels) — use toe pressures
- **Duplex ultrasound** — first-line imaging
- **CT angiography / MR angiography** — to plan intervention; digital subtraction angiography (DSA) during endovascular treatment
- Blood sugar, lipids, renal function, ECG

### Management

1. **Best medical therapy (all patients): stop smoking**, **antiplatelet** (aspirin or clopidogrel), **statin**, control diabetes and BP, weight loss, foot care
2. **Supervised exercise programme** for claudication (improves walking distance); cilostazol in selected cases
3. **Revascularisation** for disabling claudication not improving, and for **CLTI** (to save the limb): - **Endovascular:** angioplasty ± stenting (short lesions, high-risk patients) - **Surgical: bypass** (femoro-popliteal, femoro-distal with **reversed great saphenous vein** — best conduit), aortobifemoral bypass, **endarterectomy** (common femoral)
4. **Amputation** for unreconstructable disease with extensive gangrene or uncontrolled pain/sepsis

**Prognosis:** claudication itself rarely leads to amputation (1–2%/year), but these patients have high risk of MI and stroke — hence aggressive risk-factor control.

## Buerger's Disease (Thromboangiitis Obliterans)

- **Young male heavy smokers** (<40–45 years); common in South Asia (bidi, cigarette smoking)
- Non-atherosclerotic inflammatory occlusion of **small and medium arteries and veins** of legs and arms
- **Features:** instep or calf claudication, rest pain, ulceration and gangrene of toes and fingers, **migratory superficial thrombophlebitis**, Raynaud's phenomenon; upper limb involvement
- **Angiography:** distal segmental occlusions with **"corkscrew" collaterals**, normal proximal arteries
- **Management: complete cessation of smoking** (the only proven treatment — disease halts); analgesia, foot care, iloprost (prostacyclin analogue), **lumbar sympathectomy** for rest pain or ulcers; amputation of gangrenous digits (high amputation rate if smoking continues)

> **Exam Alert:** Calf claudication = superficial femoral artery disease. ABPI is falsely high in diabetics. Stopping smoking is the single most important treatment in PAD and Buerger's disease.

# Chapter 43: Acute Limb Ischaemia and Compartment Syndrome

## Acute Limb Ischaemia

**Definition:** A sudden decrease in limb perfusion (<2 weeks) threatening limb viability. A **surgical emergency** — irreversible muscle damage begins after about **6 hours**.

### Causes

| Feature | Embolism | Thrombosis (in situ) |
|---|---|---|
| Source | Heart (**atrial fibrillation** — commonest; recent MI, mural thrombus, valve disease), aneurysm | Pre-existing atherosclerotic plaque, thrombosed bypass graft or popliteal aneurysm |
| Onset | Sudden, severe | Less sudden (collaterals exist) |
| Past claudication | Absent | Present |
| Other leg pulses | Normal | Reduced (bilateral PAD) |
| Common site | **Bifurcations** — common femoral (commonest), popliteal, aortic saddle | Superficial femoral artery |
| Treatment | **Embolectomy (Fogarty balloon catheter)** | Thrombolysis, angioplasty, bypass |

Other causes: trauma (fractures, dislocations, iatrogenic), arterial dissection, intra-arterial drug injection.

**Clinical features — the 6 Ps**

- **P**ain (earliest), **P**allor, **P**ulselessness, **P**erishingly cold
- **P**araesthesia and **P**aralysis — **late signs; indicate a threatened limb needing immediate revascularisation**
- Fixed mottling (non-blanching) and a hard, tender calf indicate irreversible ischaemia

**Rutherford classification:** I viable, IIa marginally threatened, IIb immediately threatened (sensory loss, mild weakness), III irreversible (profound paralysis, fixed staining).

**Investigations:** handheld Doppler; ECG (AF), echocardiography (source), CBC, U&E, CK, coagulation; **CT angiography** if time allows (do not delay surgery in IIb).

**Management**

1. **IV heparin bolus immediately** (5000 units) to prevent propagation; analgesia, oxygen, fluids
2. **Embolism:** urgent **Fogarty embolectomy** (under local or general anaesthesia via femoral arteriotomy)
3. **Thrombosis:** catheter-directed **thrombolysis** (only for viable limbs, not IIb), angioplasty, bypass
4. Irreversible ischaemia: **primary amputation** or palliation
5. Long-term anticoagulation for embolic cause; treat AF

**Complications: reperfusion injury** — hyperkalaemia, acidosis, myoglobinuria and acute kidney injury; **compartment syndrome**; limb loss; death (mortality up to 20%).

### Compartment Syndrome

**Definition:** Raised pressure within a closed fascial compartment that compromises capillary perfusion, causing muscle and nerve ischaemia.

**Causes:** fractures (**tibia** — commonest; supracondylar humerus in children), crush injury, reperfusion after acute ischaemia, tight casts and bandages, burns (circumferential eschar), prolonged immobilisation.

**Clinical features: pain out of proportion to the injury**, **pain on passive stretching of the muscles** (earliest and most reliable sign), tense swollen compartment, paraesthesia. **Pulses are often still present** — pulselessness is a very late sign.

**Diagnosis:** clinical; compartment pressure measurement when doubtful — absolute pressure >30 mmHg or **delta pressure (diastolic BP minus compartment pressure) <30 mmHg**.

**Management:** remove casts and dressings to skin; keep limb at heart level (not elevated); **urgent fasciotomy** (all four compartments of the leg through two incisions); leave wounds open, delayed closure or skin graft. Delay → **Volkmann's ischaemic contracture**, rhabdomyolysis, renal failure, amputation.

> **Exam Alert:** AF is the commonest source of an embolus. Paraesthesia and paralysis indicate a limb needing urgent revascularisation. Pain on passive stretch is the earliest sign of compartment syndrome; pulses may be normal.

## Chapter 44: Arterial Aneurysms

**Definition:** A permanent localised dilatation of an artery to **more than 1.5 times its normal diameter**.

**Classification**

- **True aneurysm:** all three layers of the wall; fusiform (spindle-shaped, commonest) or saccular

- **False (pseudo-) aneurysm:** a contained haematoma communicating with the arterial lumen, with no normal wall layers — after trauma, **femoral puncture (angiography, IV drug users)**, anastomotic breakdown
- **Dissecting aneurysm:** blood tracks between layers of the media through an intimal tear

**Causes: atherosclerosis/degenerative** (commonest), trauma, infection (mycotic — endocarditis, salmonella), syphilis (thoracic aorta), connective tissue disorders (Marfan, Ehlers–Danlos), arteritis.

## Abdominal Aortic Aneurysm (AAA)

**Definition:** infrarenal aortic diameter **≥3 cm**. Commonest true aneurysm; >90% are infrarenal.

**Risk factors:** male sex, age >65, **smoking**, hypertension, family history, COPD.

### Clinical features

- Mostly **asymptomatic**; found incidentally on USG or by screening
- **Expansile (not just transmitted) pulsatile mass** above the umbilicus
- Back or abdominal pain (expansion or leak)
- Distal embolism (trash foot), ureteric obstruction

**Ruptured AAA — classic triad:** sudden severe **abdominal or back pain**, **hypotension/collapse**, **pulsatile abdominal mass**. Often mistaken for renal colic in elderly men. Mortality about 80% overall.

**Investigations: USG** (screening and surveillance), **CT angiography** (planning repair; stable suspected rupture). In an unstable patient with known AAA — straight to theatre.

### Surveillance and treatment thresholds

| Diameter | Action |
|---|---|
| 3.0–4.4 cm | USG yearly |
| 4.5–5.4 cm | USG every 3 months |
| **≥5.5 cm** (≥5.0 cm in women), growth >1 cm/year, or symptomatic | **Repair** |

### Management

- **Best medical therapy:** stop smoking, statin, antiplatelet, control BP
- **Open repair:** laparotomy, aortic cross-clamping, **inlay Dacron graft** (tube or bifurcated)
- **EVAR (endovascular aneurysm repair):** stent-graft via femoral arteries; lower early mortality, but needs lifelong imaging surveillance for **endoleak**
- **Ruptured AAA: permissive hypotension** (SBP 70–90 mmHg, avoid aggressive fluids), cross-match, immediate transfer to theatre for open repair or EVAR

**Complications of repair:** haemorrhage, MI, renal failure, **colonic ischaemia** (inferior mesenteric artery sacrificed — bloody diarrhoea), spinal cord ischaemia, graft infection, **aorto-enteric fistula** (late GI bleeding), endoleak (EVAR), limb ischaemia, impotence.

## Popliteal Aneurysm

- Commonest peripheral aneurysm; **bilateral in ~50%**, associated with AAA in ~40% (always scan the aorta)
- Presents as a pulsatile mass in the popliteal fossa or with **thrombosis/distal embolism** causing acute limb ischaemia (rupture is rare)
- Treat if >2 cm or thrombus present: bypass with exclusion, or endovascular stent

### False Aneurysm of the Femoral Artery

- After catheterisation or in IV drug users; pulsatile groin swelling with bruit
- **USG-guided compression** or **thrombin injection**; surgical repair if large or infected

> **Exam Alert:** Expansile pulsatile mass = aneurysm. Repair AAA at ≥5.5 cm. Ruptured AAA: pain + shock + pulsatile mass → theatre without delay; keep BP low.

## Chapter 45: Varicose Veins and Chronic Venous Insufficiency

**Definition:** Dilated, tortuous, elongated superficial veins (>3 mm) caused by **valvular incompetence** and reflux.

**Anatomy in brief: great saphenous vein** (GSV) runs anterior to the medial malleolus, up the medial leg and thigh, to join the femoral vein at the **saphenofemoral junction (SFJ)**, 2.5–4 cm below and lateral to the pubic tubercle. **Small saphenous vein** (SSV) runs behind the lateral malleolus to the **saphenopopliteal junction (SPJ)**. Perforators connect superficial and deep veins.

**Types**

- **Primary (commonest):** valve weakness — family history, female sex, pregnancy, prolonged standing (shopkeepers, surgeons, nurses), obesity, age
- **Secondary:** previous DVT (post-thrombotic), pelvic tumours, pregnancy, arteriovenous fistula, Klippel–Trenaunay syndrome

**CEAP classification (clinical):** C0 none, C1 telangiectasia/reticular veins, C2 varicose veins, C3 oedema, C4 skin changes (pigmentation, eczema, lipodermatosclerosis), C5 healed ulcer, C6 active ulcer.

**Clinical features**

- Cosmetic concern, aching, heaviness, itching, ankle swelling worse at end of day
- Visible tortuous veins in GSV (medial) or SSV (posterior calf) territory
- **Saphena varix:** soft swelling at SFJ that disappears on lying, has a **cough impulse** and fluid thrill (differential: femoral hernia)
- Skin changes of chronic venous insufficiency: **haemosiderin pigmentation, venous eczema, lipodermatosclerosis** ("inverted champagne bottle" leg), **atrophie blanche**, **venous ulcer** above the medial malleolus

**Clinical tests (historical, now replaced by duplex): Trendelenburg test** (tourniquet at SFJ to test SFJ competence), tourniquet test, Perthes' test (deep vein patency), cough impulse, tap test.

**Investigations: colour duplex ultrasound** (investigation of choice) — maps reflux at SFJ/SPJ, perforators, and confirms **deep vein patency**; ABPI before compression.

**Management**

1. **Conservative:** reassurance, weight loss, exercise, leg elevation, avoid prolonged standing, **graduated compression stockings** (class II)
2. **Endovenous thermal ablation** — **radiofrequency (RFA)** or **endovenous laser ablation (EVLA)** of the GSV/SSV under tumescent local anaesthesia: **first-line intervention** (less pain, quicker return to work)
3. **Foam sclerotherapy** (sodium tetradecyl sulphate, polidocanol): tributaries, recurrent veins, small veins
4. Non-thermal: cyanoacrylate glue (VenaSeal), mechanochemical ablation
5. **Open surgery: high saphenous ligation (Trendelenburg operation) at SFJ with stripping of GSV to knee** + multiple stab avulsions (phlebectomies); SPJ ligation for SSV

6. Venous ulcer: **four-layer compression bandaging** (if ABPI >0.8), elevation, treat superficial reflux to reduce recurrence

**Indications for intervention:** symptomatic veins, skin changes, ulceration, bleeding, superficial thrombophlebitis.

**Complications of varicose veins:** haemorrhage (from minor trauma — elevate and apply pressure), superficial thrombophlebitis, eczema, pigmentation, lipodermatosclerosis, ulceration, rarely Marjolin's ulcer.

**Complications of treatment:** bruising, haematoma, **saphenous nerve injury** (GSV stripping below knee) or **sural nerve injury** (SSV), DVT, thermal skin burn, recurrence (up to 20–30% at 5 years), femoral vein injury (rare, serious).

> **Exam Alert:** Duplex ultrasound is the investigation of choice. Endovenous ablation is first-line treatment. Saphena varix has a cough impulse and disappears on lying down.

## Chapter 46: Diabetic Foot

**Importance:** Pakistan has one of the highest diabetes prevalences in the world (over a quarter of adults). Diabetic foot is a leading cause of hospital admission and **non-traumatic lower limb amputation**; most amputations are preceded by a foot ulcer and are preventable.

### Pathogenesis — the triad

1. **Neuropathy (commonest factor)** - Sensory: loss of protective sensation → unnoticed trauma, burns, ill-fitting shoes - Motor: intrinsic muscle wasting → claw toes, prominent metatarsal heads, abnormal pressure points - Autonomic: dry, cracked skin (no sweating), AV shunting → warm foot, bounding pulses
2. **Ischaemia:** macrovascular (infrapopliteal/tibial arteries, calcified) and microvascular disease
3. **Infection:** impaired immunity in hyperglycaemia; polymicrobial (Staph., Strep., gram-negatives, anaerobes)

**Clinical presentations:** neuropathic ulcer (sole, metatarsal heads, painless, callus), ischaemic ulcer (toes, heel, painful, no pulses), neuro-ischaemic ulcer (commonest type in practice), cellulitis, **deep plantar space abscess**, **wet gangrene**, osteomyelitis, **Charcot neuroarthropathy** (warm, swollen, deformed "rocker-bottom" midfoot; often mistaken for infection).

### Examination

- Inspect: ulcers, callus, deformity, web spaces, nails, shoes
- Pulses, capillary refill
- Sensation: **10 g monofilament**, vibration (128 Hz tuning fork), ankle reflexes
- **Probe-to-bone test** — if a sterile probe touches bone, osteomyelitis is likely

**Classification: Wagner grading** — 0 at-risk foot, no ulcer; 1 superficial ulcer; 2 deep ulcer to tendon or joint capsule; 3 deep ulcer with abscess or osteomyelitis; 4 forefoot gangrene; 5 whole-foot gangrene. (University of Texas and SINBAD systems also used.)

### Investigations

- Blood sugar, **HbA1c**, CBC, CRP/ESR, renal function
- Pus or deep tissue culture (not superficial swab)
- **X-ray foot:** osteomyelitis, gas in tissues, Charcot changes; **MRI** most sensitive for osteomyelitis
- Vascular: ABPI (falsely high), **toe pressures**, **duplex**, CT angiography

### Management — multidisciplinary

1. **Glycaemic control** (insulin during acute infection)

2. **Infection:** IV broad-spectrum antibiotics guided by culture; **urgent surgical drainage and debridement** of abscesses and necrotic tissue ("time is tissue")
3. **Offloading:** total contact cast, removable walker, bed rest, special footwear
4. **Revascularisation** (angioplasty or bypass) for ischaemic feet before or after debridement
5. **Wound care:** regular sharp debridement, moist dressings, negative pressure wound therapy
6. **Minor amputation** (toe, ray, transmetatarsal) for localised gangrene/osteomyelitis; **major amputation** (below-knee) for extensive gangrene or life-threatening sepsis

**Prevention — the most important part**

- Daily foot inspection (mirror), wash and dry between toes, moisturise (not between toes)
- Never walk barefoot (including at home and at mosques); check shoes before wearing
- Cut nails straight; no self-treatment of corns; avoid hot water bottles and heaters
- Well-fitting footwear; regular podiatry and annual foot screening
- Control sugar, stop smoking

> **Exam Alert:** Neuropathy is the main cause of diabetic foot ulcers. Positive probe-to-bone test suggests osteomyelitis. A diabetic foot abscess needs urgent drainage, not antibiotics alone.

## Chapter 47: Gangrene and Amputations

**Definition:** Gangrene is macroscopic death of tissue in continuity with living tissue, usually with putrefaction.

**Causes:** ischaemia (atherosclerosis, diabetes, Buerger's, embolism, Raynaud's), infection (gas gangrene, necrotising fasciitis, Fournier's), trauma (crush, tight cast), physical (burns, frostbite, electrical), chemical, drugs (vasopressors, intra-arterial injection).

**Dry vs wet gangrene**

| Feature | Dry gangrene | Wet gangrene |
|---|---|---|
| Cause | Gradual arterial occlusion | Arterial and venous occlusion with **infection** (commonest in diabetics) |
| Appearance | Dry, shrivelled, mummified, black | Swollen, moist, discoloured, blisters, foul smell |
| Line of demarcation | **Clear** | Poorly defined; spreads |
| Systemic toxicity | Absent | Present (sepsis) |
| Urgency | Allow demarcation; elective amputation | **Emergency** — debridement or guillotine amputation |

**Line of demarcation:** a red, inflamed band of granulation tissue between living and dead tissue; separation occurs through **"slough"**; auto-amputation may occur in dry gangrene of toes.

**Investigations:** blood sugar, CBC, CRP, renal function, blood cultures; Doppler/ABPI, duplex, CT angiography to assess revascularisation; X-ray for gas and osteomyelitis.

**Management:** resuscitate, control sugar, IV antibiotics; **revascularise if possible** to allow healing at a lower level; then debride or amputate dead tissue.

### Amputations

**Indications — "the 3 Ds":**

- **Dead:** gangrene from vascular disease, trauma, burns, frostbite

- **Deadly:** wet gangrene, gas gangrene, necrotising fasciitis, malignant tumours (sarcoma)
- **Dead loss (useless):** severe deformity, painful or useless limb, unreconstructable trauma, chronic infection

### Levels of lower limb amputation

| Level | Notes |
|---|---|
| Toe / ray amputation | Localised digital gangrene or osteomyelitis (diabetics) |
| Transmetatarsal | Forefoot gangrene with good blood supply |
| Syme's (ankle disarticulation) | End-bearing stump; rarely used in vascular disease |
| **Below-knee (transtibial)** | **Preferred** whenever possible — preserving the knee greatly improves walking with a prosthesis and lowers energy expenditure; long posterior myocutaneous flap (Burgess) |
| Through-knee | Bedbound patients or when below-knee not possible |
| **Above-knee (transfemoral)** | Ischaemia extending above knee, fixed flexion contracture; higher energy cost, fewer walk again |
| Hip disarticulation / hindquarter | Tumours, severe trauma or infection |

**Principles:** amputate at the most distal level that will heal; choose level by skin warmth, bleeding at incision, Doppler and imaging; handle tissues gently; bevel bone ends; cut nerves cleanly under tension so they retract (prevent painful neuroma); avoid tension; **guillotine amputation** first in severe infection, with formal closure later.

**Complications:** haemorrhage, wound infection, wound breakdown, flap necrosis, **phantom limb sensation and pain**, stump neuroma, **flexion contracture** of hip or knee (prevent by physiotherapy and positioning), DVT, stump ulceration, bone spur, psychological distress.

**Rehabilitation:** early physiotherapy, stump shaping (bandaging), prosthetic fitting at about 6–8 weeks.

> **Exam Alert:** Wet gangrene is a surgical emergency. Preserve the knee if at all possible — below-knee amputation is preferred over above-knee.

## Chapter 48: Lymphoedema

**Definition:** Accumulation of protein-rich interstitial fluid due to failure of lymphatic drainage, causing chronic swelling, usually of a limb.

### Classification

| Type | Cause / subtype | Age at onset |
|---|---|---|
| **Primary** (congenital defect of lymphatics) | **Congenital** (Milroy's disease, familial) | Birth–2 years |
| | **Praecox** (commonest primary; Meige's) | Puberty to 35 years (mainly females) |
| | **Tarda** | After 35 years |
| **Secondary** (commonest overall) | **Filariasis** (*Wuchereria bancrofti* — commonest cause worldwide; endemic in parts of South Asia) | Any |
| | **Surgery and radiotherapy** to lymph nodes (axillary clearance for breast cancer, groin dissection) | Any |

| Type | Cause / subtype | Age at onset |
|---|---|---|
| | Malignancy (lymph node infiltration, lymphoma), recurrent cellulitis, trauma, burns, podoconiosis | Any |

### Clinical features

- Painless, progressive swelling starting distally (foot or hand) and extending proximally
- Early: pitting oedema that reduces with elevation
- Late: **non-pitting**, firm, fibrotic, no reduction on elevation
- **Stemmer's sign:** inability to pinch the skin fold at the base of the second toe (positive in lymphoedema)
- "Buffalo hump" of dorsum of foot, squared-off toes
- Skin: hyperkeratosis, papillomatosis, lymphorrhoea (lymph leak), fissures; **elephantiasis** in advanced filarial disease
- Recurrent **cellulitis** (common complication; accelerates damage)

**Differential diagnosis:** venous oedema (pitting, pigmentation, varicose veins), lipoedema (bilateral, spares feet, women), cardiac, renal and hepatic oedema (bilateral, pitting), DVT.

### Investigations

- Exclude other causes: CBC, renal and liver function, albumin, echocardiography, **duplex** to exclude DVT
- **Lymphoscintigraphy** (isotope lymphangiography): investigation of choice — delayed or absent tracer uptake in nodes
- Indocyanine green (ICG) lymphography, MRI lymphangiography
- **Night blood film** or antigen test for microfilariae in endemic areas
- CT/MRI pelvis/abdomen to exclude malignancy in adult-onset secondary lymphoedema

### Management

1. **Complex decongestive therapy (mainstay):** skin care and hygiene, **manual lymphatic drainage** massage, **multilayer compression bandaging** then **compression garments**, exercise, elevation
2. **Treat and prevent cellulitis:** prompt antibiotics; long-term penicillin prophylaxis for recurrent attacks
3. Filariasis: **diethylcarbamazine (DEC)** ± albendazole; mass drug administration in endemic areas
4. **Surgery** (selected cases): - Physiological: **lymphaticovenous anastomosis (LVA)**, vascularised lymph node transfer - Debulking (excisional): **liposuction** for fat-dominant swelling; **Charles' operation** (excision of all skin and subcutaneous tissue down to deep fascia with skin grafting) for severe elephantiasis

**Complications:** cellulitis, lymphangitis, functional disability, psychological distress, **lymphangiosarcoma (Stewart–Treves syndrome)** — rare, aggressive angiosarcoma in long-standing lymphoedema, classically after mastectomy.

> **Exam Alert:** Filariasis is the commonest cause of lymphoedema worldwide. Positive Stemmer's sign indicates lymphoedema. Compression and skin care are the mainstay of treatment.

## Self-Assessment: Part 7 SBAs

**1.** A 62-year-old smoker has cramping pain in his right calf after walking 200 metres, relieved by standing still for 2 minutes. The right popliteal and foot pulses are absent; femoral pulse is normal. Which artery is most likely diseased?

A. Anterior tibial · B. Common iliac · C. Internal iliac · D. Profunda femoris · E. Superficial femoral

**Answer: E.** Calf claudication with a normal femoral pulse.

**2.** A 60-year-old diabetic man has an ABPI of 1.4 in both legs but absent foot pulses and a non-healing toe ulcer. What is the best explanation for the ABPI?

A. Arteriovenous fistula · B. Calcified, incompressible arteries · C. Deep vein thrombosis · D. Normal arterial supply · E. Venous hypertension

**Answer: B.** Medial calcification gives false high readings; use toe pressures or duplex.

**3.** A 32-year-old man who smokes 30 cigarettes a day has rest pain and ulcers on two toes, migratory superficial thrombophlebitis and cold fingers. Angiography shows distal occlusions with corkscrew collaterals. What is the most effective treatment?

A. Aortobifemoral bypass · B. Complete cessation of smoking · C. Long-term warfarin · D. Oral steroids · E. Statin therapy

**Answer: B.** Buerger's disease halts only when smoking stops.

**4.** A 70-year-old woman with atrial fibrillation develops sudden severe pain in her left leg 3 hours ago. The leg is pale, cold and pulseless below the groin, with reduced sensation in the foot. After IV heparin, what is the next step?

A. Above-knee amputation · B. Catheter-directed thrombolysis over 24 hours · C. Compression stockings · D. Femoral embolectomy with a Fogarty catheter · E. Oral aspirin and review

**Answer: D.** Embolic, immediately threatened limb with sensory loss.

**5.** Twelve hours after a closed tibial fracture is placed in a plaster cast, a man has severe leg pain not relieved by morphine and severe pain when his toes are passively extended. Foot pulses are palpable. What is the definitive management?

A. Elevate the leg and observe · B. IV heparin · C. Increase analgesia · D. Split the cast and perform urgent fasciotomy · E. Repeat X-ray

**Answer: D.** Compartment syndrome; palpable pulses do not exclude it.

**6.** A 72-year-old man collapses with sudden severe back pain. BP is 80/50 mmHg and there is a tender pulsatile mass in the epigastrium. What is the most appropriate management?

A. Aggressive IV fluids to normal BP, then CT · B. Intravenous pyelogram · C. Permissive hypotension and immediate transfer to theatre · D. Renal colic analgesia and observation · E. Thrombolysis

**Answer: C.** Ruptured AAA; do not delay for imaging in an unstable patient.

**7.** On surveillance ultrasound, a 68-year-old man's asymptomatic abdominal aortic aneurysm has grown to 5.7 cm. What is the most appropriate management?

A. Continue yearly ultrasound · B. Elective repair (EVAR or open) · C. Repeat scan in 3 months · D. Start beta-blocker only · E. Discharge from follow-up

**Answer: B.** Repair threshold is ≥5.5 cm in men.

**8.** A 45-year-old female teacher has symptomatic varicose veins along the medial thigh and leg. Duplex shows saphenofemoral junction reflux with a normal deep system. What is the first-line intervention?

A. Above-knee amputation · B. Endovenous thermal ablation of the great saphenous vein · C. Long-term warfarin · D. Lumbar sympathectomy · E. Ligation of the femoral vein

**Answer: B.** Endovenous ablation is first-line for truncal reflux.

**9.** A 55-year-old diabetic woman has a swollen, red, foul-smelling forefoot with fluctuation in the sole and fever of 39 °C. Blood sugar is 380 mg/dl. After starting IV antibiotics and insulin, what is the next step?

A. Hyperbaric oxygen · B. MRI foot next week · C. Oral antibiotics at home · D. Topical silver dressings · E. Urgent incision, drainage and debridement

**Answer: E.** Deep plantar space abscess with sepsis.

**10.** A 50-year-old woman develops progressive swelling of her right arm 2 years after mastectomy and axillary clearance. The swelling is non-pitting, and duplex scan of veins is normal. What is the mainstay of treatment?

A. Charles' operation · B. Complex decongestive therapy with compression garments · C. Diuretics · D. Long-term warfarin · E. Repeat axillary surgery

**Answer: B.** Secondary lymphoedema is managed conservatively first.

*References: Bailey & Love's Short Practice of Surgery, 28th Ed.; Blecha, Surgery, 4th Ed.*

PART 8

# Upper Gastrointestinal Tract

## Chapter 49: Gastro-oesophageal Reflux Disease, Hiatus Hernia and Barrett's Oesophagus

### Gastro-oesophageal Reflux Disease (GORD)

**Definition:** Reflux of gastric contents into the oesophagus causing troublesome symptoms and/or complications.

**Anti-reflux mechanisms:** lower oesophageal sphincter (LOS), crural diaphragm ("pinchcock"), intra-abdominal length of oesophagus, acute **angle of His**, mucosal rosette.

**Risk factors:** hiatus hernia, obesity, pregnancy, smoking, alcohol, fatty meals, large late meals, drugs (calcium channel blockers, nitrates, anticholinergics), scleroderma.

#### Clinical features

- **Heartburn** (retrosternal burning, worse after meals, bending, lying flat) and **regurgitation** — typical
- Atypical: chest pain (exclude cardiac), chronic cough, hoarseness, asthma, dental erosion
- **Alarm features (need urgent endoscopy):** dysphagia, odynophagia, weight loss, anaemia, haematemesis, persistent vomiting, age >55 with new symptoms

#### Investigations

- Young patients with typical symptoms and no alarm features: **empirical PPI trial**
- **Upper GI endoscopy (OGD):** oesophagitis (Los Angeles grade A–D), Barrett's, stricture, hiatus hernia; biopsies
- **24-hour pH monitoring / impedance** — gold standard to confirm reflux, especially before surgery or if endoscopy is normal
- **Oesophageal manometry** — before anti-reflux surgery (exclude achalasia and poor motility)
- Barium swallow — hiatus hernia, stricture

#### Management

1. **Lifestyle:** weight loss, raise head of bed, avoid late meals, stop smoking, reduce alcohol, fatty and spicy food
2. **Medical: proton pump inhibitors** (omeprazole, esomeprazole) — most effective; H2 blockers, antacids, alginates
3. **Surgical — laparoscopic Nissen fundoplication** (360° wrap of fundus around lower oesophagus) or partial wraps (Toupet 270° posterior, Dor anterior). Indications: symptoms despite or intolerance of PPI, patient unwilling to take lifelong medication, large hiatus hernia, regurgitation/aspiration, young patients
4. Complications of fundoplication: dysphagia, **gas-bloat syndrome** (cannot belch or vomit), wrap slippage, recurrence

**Complications of GORD:** oesophagitis, ulceration, bleeding, **peptic stricture** (dilate + PPI), **Barrett's oesophagus**, adenocarcinoma, aspiration pneumonia.

### Hiatus Hernia

| Type | Description | Features |
|---|---|---|
| **Type I — Sliding** (~90%) | Gastro-oesophageal junction slides up into the chest | Reflux symptoms; treat as GORD |
| **Type II — Rolling (para-oesophageal)** | Fundus rolls up beside a normally placed GOJ | Little reflux; **risk of volvulus, strangulation, bleeding**; postprandial fullness, chest pain, dyspnoea, anaemia (Cameron ulcers) |
| Type III — Mixed | Combination | As type II |
| Type IV | Other organs (colon, spleen) herniate | As type II |

**Management:** sliding — medical; **symptomatic para-oesophageal hernia → surgical repair** (reduce stomach, excise sac, crural repair ± mesh, fundoplication/gastropexy). Acute gastric volvulus (**Borchardt's triad:** severe epigastric pain, retching without vomiting, inability to pass NG tube) is an emergency.

### Barrett's Oesophagus

- Replacement of normal squamous epithelium of the lower oesophagus by **columnar epithelium with intestinal metaplasia** (goblet cells) due to chronic reflux
- Premalignant for **adenocarcinoma** (about 0.3–0.5% per year; higher with dysplasia)
- Diagnosis: endoscopy with **Prague classification** and quadrantic biopsies (Seattle protocol)
- Management: PPI; **endoscopic surveillance** every 2–5 years; **dysplasia → endoscopic therapy** (endoscopic mucosal resection, radiofrequency ablation); oesophagectomy for invasive cancer

> **Exam Alert:** PPI is first-line for GORD; 24-h pH study is the gold standard. Barrett's = intestinal metaplasia → adenocarcinoma. Para-oesophageal hernias need surgery because of strangulation risk.

## Chapter 50: Achalasia Cardia

**Definition:** A primary motility disorder of the oesophagus characterised by **failure of relaxation of the lower oesophageal sphincter (LOS)** on swallowing and **absent peristalsis** in the oesophageal body.

**Pathology:** degeneration of inhibitory neurons (nitric oxide and VIP) in the **myenteric (Auerbach's) plexus**; cause unknown (possibly autoimmune or viral). Secondary achalasia: **Chagas disease** (*Trypanosoma cruzi*, South America), pseudoachalasia from carcinoma of the cardia.

#### Clinical features

- Age 30–60, both sexes
- **Dysphagia to both solids and liquids from the onset** (contrast: mechanical obstruction starts with solids), often worse with cold drinks, intermittent then progressive
- **Regurgitation** of undigested food, especially at night → cough, aspiration pneumonia
- Retrosternal chest pain (early, "vigorous" type)
- Slow weight loss

#### Investigations

| Test | Findings |
|---|---|
| **Barium swallow** | Dilated oesophagus with smooth tapering **"bird's beak"** (rat-tail) narrowing at the cardia; absent gastric air bubble; air–fluid level; late — sigmoid (mega-) oesophagus |
| **Oesophageal manometry (high-resolution) — gold standard** | Incomplete LOS relaxation, raised resting LOS pressure, **aperistalsis**; **Chicago classification** types I (classic), II (panoesophageal pressurisation — best response to treatment), III (spastic) |
| **Upper GI endoscopy — essential** | Dilated, food-filled oesophagus; puckered cardia that the scope passes with gentle pressure; **exclude carcinoma of the cardia (pseudoachalasia)** |
| CXR | Widened mediastinum, air–fluid level behind heart, absent gastric bubble, aspiration changes |
| CT | If pseudoachalasia suspected (elderly, short history, rapid weight loss) |

**Management** (all palliative — they relieve obstruction at the LOS; peristalsis does not return)

1. **Laparoscopic Heller's cardiomyotomy with partial fundoplication** (Dor or Toupet, to prevent reflux) — most durable treatment
2. **Peroral endoscopic myotomy (POEM)** — endoscopic myotomy; very effective, especially for type III; higher reflux rate
3. **Pneumatic balloon dilatation** (30–40 mm) — effective, may need repetition; risk of **perforation** (2–5%)
4. **Botulinum toxin injection** into LOS — for elderly or unfit patients; effect lasts 6–12 months
5. Drugs (nifedipine, nitrates before meals) — limited benefit
6. Oesophagectomy for end-stage sigmoid oesophagus

**Complications:** aspiration pneumonia, lung abscess, oesophagitis from food stasis, weight loss, **squamous cell carcinoma** (risk increased several-fold; occurs after many years), reflux after treatment.

> **Exam Alert:** Dysphagia to liquids and solids from the start = motility disorder (achalasia). Bird's beak on barium; manometry is diagnostic; always do endoscopy to exclude carcinoma at the cardia.

## Chapter 51: Carcinoma of the Oesophagus

**Overview:** An aggressive cancer usually presenting late, with overall 5-year survival of about 15–20%. **Progressive dysphagia in an older patient is carcinoma until proved otherwise.**

### Types

| Feature | Squamous cell carcinoma (SCC) | Adenocarcinoma |
|---|---|---|
| Frequency | **Commonest worldwide, including Pakistan and Asia** | Commonest in the West; rising |
| Site | Upper and **middle third** | **Lower third** and GOJ |
| Risk factors | **Smoking, alcohol**, very hot drinks, nitrosamines, betel/naswar, achalasia, caustic stricture, Plummer–Vinson syndrome, tylosis, poor diet | **GORD, Barrett's oesophagus**, obesity, smoking, male sex |

### Clinical features

- **Progressive dysphagia** — solids first, then semi-solids, then liquids (by then >2/3 of the lumen is narrowed)
- **Weight loss** (rapid), anorexia
- Odynophagia, regurgitation, retrosternal pain

- Advanced: **hoarseness (recurrent laryngeal nerve)**, cough on swallowing (**tracheo-oesophageal fistula**), haematemesis, supraclavicular node, hepatomegaly, Horner's syndrome

### Investigations

- **Upper GI endoscopy with biopsy** — first and essential
- **CT chest/abdomen/pelvis** — staging (local invasion, nodes, liver and lung metastases)
- **PET-CT** — detects occult metastases in potentially curable patients
- **Endoscopic ultrasound (EUS)** — depth of invasion (T stage) and nodes (N stage)
- Bronchoscopy for upper/middle third tumours (tracheal invasion); laparoscopy for GOJ tumours (peritoneal deposits)
- Barium swallow: irregular **"rat-tail" or "apple-core"** stricture with shouldering
- Fitness: CBC, LFTs, albumin, spirometry, echocardiography

### Management

#### Curative (localised disease in fit patients, ~30–40%)

1. **Early (T1a): endoscopic mucosal resection / submucosal dissection**
2. **Locally advanced: neoadjuvant chemoradiotherapy (CROSS regimen)** or perioperative chemotherapy (FLOT for adenocarcinoma) **followed by oesophagectomy**
3. **Oesophagectomy:** Ivor Lewis (laparotomy + right thoracotomy; middle and lower third), McKeown three-stage (neck anastomosis; upper/middle third), transhiatal; minimally invasive approaches; stomach brought up as a gastric conduit
4. **Definitive chemoradiotherapy** for SCC of upper third (cervical oesophagus) or patients unfit for surgery

**Complications of oesophagectomy: anastomotic leak** (serious, mediastinitis), pneumonia (commonest), chylothorax (thoracic duct injury), recurrent laryngeal nerve palsy, conduit necrosis, stricture, dumping, reflux; mortality 2–5% in high-volume centres.

#### Palliative (majority — metastatic or unfit)

- **Self-expanding metal stent (SEMS)** — rapid relief of dysphagia; also seals tracheo-oesophageal fistula
- Palliative radiotherapy or brachytherapy, chemotherapy/immunotherapy
- Endoscopic laser or argon plasma ablation, dilatation
- Nutritional support: feeding gastrostomy or jejunostomy; good palliative care

> **Exam Alert:** Progressive dysphagia with weight loss → urgent endoscopy and biopsy. SCC is commonest in Pakistan and affects the middle third; adenocarcinoma arises in Barrett's in the lower third.

## Chapter 52: Peptic Ulcer Disease

**Definition:** A breach in the mucosa of the stomach or duodenum extending through the muscularis mucosae, caused by an imbalance between acid-pepsin attack and mucosal defence.

### Causes

- ***Helicobacter pylori*** — present in ~90% of duodenal ulcers and ~70% of gastric ulcers; very common in Pakistan
- **NSAIDs and aspirin** — second commonest cause
- Smoking, alcohol, steroids (with NSAIDs), stress ulcers (Curling's after burns, Cushing's after head injury), **Zollinger–Ellison syndrome** (gastrinoma — multiple, recurrent, unusual-site ulcers), hyperparathyroidism

### Duodenal vs gastric ulcer

| Feature | Duodenal ulcer (DU) | Gastric ulcer (GU) |
|---|---|---|
| Frequency | Commoner (about 4:1) | Less common |
| Age | Younger (30–50) | Older (50+) |
| Site | **First part of duodenum** (anterior wall → perforates; posterior wall → bleeds from **gastroduodenal artery**) | **Lesser curvature** near incisura |
| Acid secretion | High | Normal or low |
| Pain | Epigastric, **2–3 h after meals, at night (wakes patient), relieved by food** | **Worse with food**, soon after meals |
| Appetite and weight | Good appetite; weight maintained or gained | Fear of food; weight loss |
| Malignancy | **Never malignant** | **Can be malignant — always biopsy and re-scope to confirm healing** |

### Investigations

- **Upper GI endoscopy** — investigation of choice; biopsy all gastric ulcers (multiple from edge and base)
- ***H. pylori* tests: urea breath test** and **stool antigen** (non-invasive, best for diagnosis and confirming eradication), **rapid urease (CLO) test** on biopsy, histology, serology (cannot confirm eradication)
- Stop PPI 2 weeks before breath/stool testing (false negatives)
- Fasting serum gastrin if Zollinger–Ellison suspected; CBC for anaemia

### Management

1. **Stop NSAIDs**, smoking and alcohol
2. **PPI** for 4–8 weeks (8 weeks for gastric ulcer)
3. ***H. pylori* eradication — triple therapy for 14 days:** PPI + amoxicillin + clarithromycin (or metronidazole if penicillin allergic); **bismuth quadruple therapy** where clarithromycin resistance is high (as in Pakistan); confirm eradication with breath or stool test
4. NSAID users who must continue: PPI cover, or COX-2 inhibitor
5. **Surgery** is now mainly for **complications** — perforation, bleeding not controlled endoscopically, gastric outlet obstruction, suspected malignancy; elective surgery (highly selective vagotomy, partial gastrectomy) is rarely needed

**Complications: bleeding** (commonest), **perforation**, **gastric outlet obstruction** (pyloric stenosis), penetration into pancreas (back pain), malignancy (gastric ulcer only).

**Post-gastrectomy complications (exam favourite):** early and late **dumping syndrome**, bile reflux gastritis, afferent loop syndrome, diarrhoea (post-vagotomy), anaemia (iron and **B12 deficiency**), osteoporosis, recurrent ulcer, stump carcinoma.

> **Exam Alert:** H. pylori is the commonest cause of peptic ulcer. DU pain is relieved by food; GU pain is worsened by food. All gastric ulcers must be biopsied and re-scoped.

# Chapter 53: Perforated Peptic Ulcer and Upper GI Bleeding

## Perforated Peptic Ulcer

**Overview:** Commonly an **anterior duodenal ulcer**; NSAIDs, steroids and smoking are frequent triggers. A common cause of generalised peritonitis in Pakistani hospitals.

### Clinical features

- **Sudden, severe epigastric pain** that rapidly becomes generalised; may radiate to shoulder tip
- Patient lies still; breathing shallow
- **Board-like rigidity**, generalised tenderness, absent bowel sounds, **loss of liver dullness**
- **Three stages:** (1) prostration/chemical peritonitis (first 2 h), (2) reaction — deceptive improvement (2–12 h), (3) bacterial peritonitis and septic shock (after 12 h)
- Leak of gastric fluid down the right paracolic gutter can mimic appendicitis

### Investigations

- **Erect chest X-ray: free gas under the diaphragm** (present in about 75% — absence does not exclude)
- **CT abdomen:** most sensitive; free gas and fluid
- CBC, **serum amylase** (exclude pancreatitis; may be mildly raised), electrolytes, renal function, ABGs, ECG

### Management

1. Resuscitation: IV fluids, NG tube, urinary catheter, analgesia, **IV antibiotics** and PPI
2. **Laparotomy or laparoscopy: omental patch repair (Graham patch)** of duodenal perforation + **thorough peritoneal lavage**; **biopsy of gastric perforations** (or excise/wedge resect) to exclude carcinoma
3. Post-op: PPI, ***H. pylori* eradication**, stop NSAIDs
4. **Conservative (Taylor's) management** — NG suction, IV fluids, antibiotics, PPI — only for selected stable patients with a sealed perforation on contrast study

**Complications:** subphrenic/pelvic abscess, leak, wound infection, respiratory complications, sepsis; mortality 5–20% (higher in elderly and delayed cases).

## Upper Gastrointestinal Bleeding

**Definition:** Bleeding proximal to the ligament of Treitz, presenting as **haematemesis** (fresh blood or "coffee grounds") and/or **melaena** (black, tarry, offensive stool).

### Causes

| Cause | Notes |
|---|---|
| **Peptic ulcer** | **Commonest overall** |
| **Oesophageal and gastric varices** | Portal hypertension — **very common in Pakistan from hepatitis B and C cirrhosis** |
| Erosive gastritis / oesophagitis | NSAIDs, alcohol |
| **Mallory–Weiss tear** | Tear at GOJ after repeated vomiting (often alcohol); usually stops spontaneously |
| Malignancy | Gastric or oesophageal cancer |
| Dieulafoy lesion, angiodysplasia, aorto-enteric fistula | Rare |

**Risk scoring: Glasgow–Blatchford score** (before endoscopy; score 0 → safe outpatient care); **Rockall score** (after endoscopy; risk of rebleeding and death).

### Management

1. **Resuscitation (ABC):** two large-bore cannulae, crystalloid, cross-match, **restrictive transfusion (Hb target 7–8 g/dl)**; correct coagulopathy; catheter; monitor
2. **Upper GI endoscopy within 24 hours** (immediately after resuscitation if unstable)

3. **Peptic ulcer bleeding:** endoscopic haemostasis — **dual therapy** (adrenaline injection + thermal coagulation or clips); then **high-dose IV PPI**; *H. pylori* eradication
4. **Variceal bleeding: IV terlipressin** (or octreotide), **prophylactic IV antibiotics** (ceftriaxone), **endoscopic band ligation**; balloon tamponade (**Sengstaken–Blakemore tube**) as a bridge; **TIPS** for uncontrolled bleeding; secondary prevention with non-selective beta-blocker (propranolol/carvedilol) and repeated banding
5. **Failure of endoscopic therapy:** repeat endoscopy, then **interventional radiology embolisation** or **surgery** — underrunning of the bleeding vessel (gastroduodenal artery) through a duodenotomy, or partial gastrectomy

**Indicators of rebleeding/high mortality:** age >60, shock, comorbidity, varices, active bleeding or visible vessel at endoscopy (Forrest Ia, Ib, IIa).

> **Exam Alert:** Free gas under the diaphragm on erect CXR = perforated viscus. Omental patch repair for perforated DU. Peptic ulcer is the commonest cause of upper GI bleeding; give terlipressin and antibiotics for variceal bleeding.

## Chapter 54: Gastric Outlet Obstruction

**Definition:** Mechanical obstruction at the pylorus or first part of the duodenum, preventing gastric emptying. The old term "pyloric stenosis" in adults refers mainly to peptic scarring.

### Causes

- **Adults: carcinoma of the stomach (antrum)** — now commonest in many centres; **chronic duodenal or pyloric ulcer** with fibrosis (cicatrisation) — still common in Pakistan; carcinoma of the pancreatic head or duodenum; lymphoma; Crohn's; annular pancreas
- **Infants: congenital hypertrophic pyloric stenosis** (see box below)

### Clinical features

- **Projectile, non-bilious vomiting** of large volumes of **stale, undigested food eaten a day or more earlier**, often foul-smelling
- Epigastric fullness, early satiety, weight loss, dehydration
- Long ulcer history (benign) or short history with weight loss and anaemia (malignant)
- **Visible gastric peristalsis** moving from left to right in the upper abdomen
- **Succussion splash** more than 3–4 hours after a meal
- Features of tetany in severe alkalosis

### Metabolic disturbance — classic exam topic

**Hypochloraemic, hypokalaemic metabolic alkalosis with paradoxical aciduria.**

1. Vomiting loses $H^+$ and $Cl^-$ → metabolic alkalosis and hypochloraemia
2. Dehydration → aldosterone → kidney retains $Na^+$ in exchange for $K^+$ → **hypokalaemia**
3. As $K^+$ is depleted, the kidney exchanges $Na^+$ for $H^+$ instead → **acid urine despite systemic alkalosis (paradoxical aciduria)**
4. Alkalosis lowers ionised calcium → **tetany**

### Investigations

- Serum electrolytes, chloride, bicarbonate, urea, creatinine, ABGs
- **Upper GI endoscopy** (after gastric lavage to clear food) — cause and **biopsy to exclude malignancy**
- **CT abdomen** — malignancy and staging
- Barium meal — dilated stomach, delayed emptying ("bucket"-shaped stomach)

### Management

1. **Correct fluids and electrolytes first: IV 0.9% sodium chloride with potassium chloride** (supplies $Cl^-$ and corrects alkalosis); monitor urine output and electrolytes
2. **NG tube and gastric lavage** with warm saline to decompress and reduce oedema; nil by mouth
3. IV PPI; nutritional support (often malnourished — TPN or nasojejunal feeding)
4. **Benign stenosis: endoscopic balloon dilatation** + PPI + *H. pylori* eradication; surgery if dilatation fails — **gastrojejunostomy** ± vagotomy, or antrectomy
5. **Malignant obstruction:** curative gastrectomy if resectable; palliative **endoscopic duodenal stent** or **gastrojejunostomy**

**Infantile hypertrophic pyloric stenosis (box):** first-born boys aged **2–8 weeks**; projectile non-bilious vomiting after feeds, hungry baby, **olive-shaped mass** in right upper quadrant during a test feed, visible peristalsis; same metabolic alkalosis. **USG** confirms (pyloric muscle >3–4 mm thick, length >15–16 mm). Correct fluids and electrolytes, then **Ramstedt's pyloromyotomy**.

> **Exam Alert:** Gastric outlet obstruction causes hypochloraemic hypokalaemic metabolic alkalosis with paradoxical aciduria. Correct with normal saline and KCl before surgery.

## Chapter 55: Carcinoma of the Stomach

**Overview:** Gastric cancer is usually an **adenocarcinoma** and often presents late with vague symptoms. Early detection (common in Japan and Korea through screening) gives excellent cure rates.

**Risk factors:** ***H. pylori*** (class I carcinogen), diet high in salt, smoked and pickled foods, nitrosamines, low fruit and vegetables, smoking, **pernicious anaemia** and atrophic gastritis, intestinal metaplasia, **previous partial gastrectomy** (stump cancer), gastric adenomatous polyps, blood group A, family history, **CDH1 mutation (hereditary diffuse gastric cancer)**, Menetrier's disease.

### Pathology

- **Lauren classification: intestinal type** (older men, *H. pylori*/metaplasia sequence, better prognosis) and **diffuse type** (younger, signet-ring cells, infiltrative, worse prognosis; **linitis plastica** — rigid "leather-bottle" stomach)
- Site: antrum (commonest historically), body, cardia/GOJ (increasing)
- **Early gastric cancer:** confined to mucosa and submucosa regardless of nodes
- Other gastric tumours: **GIST**, lymphoma (MALT lymphoma — regresses with *H. pylori* eradication), neuroendocrine tumour

### Spread and eponymous signs

| Sign | Meaning |
|---|---|
| **Virchow's node (Troisier's sign)** | Left supraclavicular node |
| **Sister Mary Joseph nodule** | Umbilical metastasis |
| **Krukenberg tumour** | Bilateral ovarian metastases (transcoelomic) |
| **Blumer's shelf** | Rectovesical/rectouterine pouch deposits on PR |
| **Irish node** | Left axillary node |
| Ascites, hepatomegaly, jaundice | Peritoneal and liver metastases |

**Clinical features:** early — dyspepsia (new in older patient), epigastric discomfort; later — **anorexia, weight loss**, early satiety, **iron deficiency anaemia**, vomiting (antral — gastric outlet obstruction), dysphagia

(cardia), haematemesis/melaena, palpable epigastric mass. Paraneoplastic: acanthosis nigricans, Trousseau's sign (migratory thrombophlebitis), Leser–Trélat sign.

### Investigations

- **Upper GI endoscopy with multiple biopsies** — investigation of choice
- **CT chest/abdomen/pelvis** — staging
- **Staging laparoscopy** ± peritoneal washings — detects peritoneal metastases missed by CT (for T3/T4 tumours)
- **Endoscopic ultrasound** — T and N stage, especially early lesions
- PET-CT selectively; CBC, LFTs, albumin; tumour markers (CEA, CA 19-9, CA 72-4) for follow-up; **HER2** status for advanced disease

### Management

1. **Early gastric cancer** (mucosal, small, well-differentiated): **endoscopic submucosal dissection (ESD)** or mucosal resection
2. **Resectable disease: perioperative chemotherapy (FLOT regimen)** + **gastrectomy with D2 lymphadenectomy** - Distal tumours → **subtotal (distal) gastrectomy** with Billroth II or **Roux-en-Y** reconstruction (margin 5 cm, 8 cm for diffuse type) - Proximal/body tumours, diffuse type → **total gastrectomy with Roux-en-Y oesophagojejunostomy**
3. **Advanced/metastatic:** palliative chemotherapy, trastuzumab (HER2+), immunotherapy (nivolumab); palliative surgery, stents or gastrojejunostomy for obstruction or bleeding; palliative radiotherapy for bleeding

**Post-gastrectomy issues:** dumping syndrome, weight loss, **vitamin B12 deficiency** (lifelong injections after total gastrectomy), iron deficiency, osteoporosis, bile reflux, anastomotic leak (early).

**Prognosis:** early gastric cancer >90% 5-year survival; overall about 20–30%.

> **Exam Alert:** Virchow's node = Troisier's sign. Krukenberg tumour = ovarian metastasis from stomach. Staging laparoscopy detects peritoneal spread missed by CT. Total gastrectomy patients need lifelong B12.

## Self-Assessment: Part 8 SBAs

**1.** A 45-year-old obese man has had heartburn and regurgitation for 2 years, well controlled on omeprazole, but he wants to stop lifelong medication. Endoscopy shows grade B oesophagitis and a small sliding hiatus hernia. Before considering fundoplication, which test is essential?

A. Barium meal and follow-through · B. CT chest · C. Oesophageal manometry and 24-h pH study · D. Serum gastrin · E. Urea breath test

**Answer: C.** Confirms reflux and excludes a motility disorder such as achalasia.

**2.** A 35-year-old woman has had difficulty swallowing both liquids and solids for a year, with regurgitation of undigested food at night. Barium swallow shows a dilated oesophagus with a smooth tapering "bird's beak" lower end. Which investigation confirms the diagnosis?

A. CT chest · B. Endoscopic ultrasound · C. High-resolution oesophageal manometry · D. 24-h pH monitoring · E. Repeat barium swallow

**Answer: C.** Achalasia; endoscopy is also needed to exclude carcinoma.

**3.** A 65-year-old man who smokes and chews naswar has had progressive dysphagia, first to solids and now to semi-solids, over 3 months, with 8 kg weight loss. What is the first investigation?

A. Barium swallow · B. CT chest · C. Oesophageal manometry · D. PET-CT · E. Upper GI endoscopy with biopsy

**Answer: E.** Suspected carcinoma of the oesophagus.

**4.** A 38-year-old man has epigastric pain that wakes him at night and is relieved by eating. The urea breath test is positive. What is the most appropriate treatment?

A. Antacids only · B. Highly selective vagotomy · C. Partial gastrectomy · D. PPI-based H. pylori eradication therapy for 14 days · E. Sucralfate

**Answer: D.** Duodenal ulcer pattern with H. pylori infection.

**5.** A 40-year-old man taking diclofenac for back pain develops sudden severe epigastric pain spreading over the abdomen. He has board-like rigidity, and erect chest X-ray shows gas under both hemidiaphragms. After resuscitation, what is the definitive treatment?

A. Conservative NG suction alone · B. Highly selective vagotomy · C. Omental patch repair with peritoneal lavage · D. Total gastrectomy · E. Truncal vagotomy and antrectomy

**Answer: C.** Perforated duodenal ulcer.

**6.** A 50-year-old man with hepatitis C cirrhosis vomits a large amount of fresh blood. Pulse is 120/min and BP 90/60 mmHg. Along with resuscitation, which drug combination should be started before endoscopy?

A. IV PPI and tranexamic acid · B. IV terlipressin and IV antibiotics · C. Propranolol and spironolactone · D. Vitamin K only · E. Warfarin reversal with FFP only

**Answer: B.** Suspected variceal bleeding; terlipressin reduces portal pressure and antibiotics reduce mortality.

**7.** A 55-year-old man with a long history of duodenal ulcer has projectile vomiting of food eaten the previous day and a succussion splash. Which biochemical picture is expected?

A. Hyperchloraemic acidosis · B. Hyperkalaemic acidosis · C. Hypochloraemic hypokalaemic alkalosis with paradoxical aciduria · D. Hyponatraemic acidosis with alkaline urine · E. Respiratory acidosis

**Answer: C.** Gastric outlet obstruction.

**8.** A 4-week-old first-born boy has projectile non-bilious vomiting after every feed and is always hungry. An olive-shaped mass is felt in the right upper quadrant during a test feed. After correcting fluids and electrolytes, what is the operation of choice?

A. Duodenoduodenostomy · B. Gastrojejunostomy · C. Ladd's procedure · D. Partial gastrectomy · E. Ramstedt's pyloromyotomy

**Answer: E.** Infantile hypertrophic pyloric stenosis.

**9.** A 62-year-old man with weight loss and iron deficiency anaemia has a hard left supraclavicular lymph node. Endoscopy shows an ulcerated antral mass. What is this node sign called?

A. Blumer's shelf · B. Courvoisier's sign · C. Krukenberg sign · D. Sister Mary Joseph nodule · E. Troisier's sign

**Answer: E.** Virchow's node from gastric carcinoma.

**10.** A 58-year-old man has a biopsy-proven adenocarcinoma of the gastric body. CT shows no distant metastases. Before planning gastrectomy, which investigation best detects peritoneal metastases?

A. Barium meal · B. Serum CEA · C. Staging laparoscopy with peritoneal washings · D. Ultrasound abdomen · E. Upper GI endoscopy

**Answer: C.** CT misses small peritoneal deposits.

*References: Bailey & Love's Short Practice of Surgery, 28th Ed.; Blecha, Surgery, 4th Ed.*

PART 9

# Hepatobiliary, Pancreas and Spleen

## Chapter 56: Gallstones, Biliary Colic and Acute Cholecystitis

**Overview:** Gallstones (cholelithiasis) are very common, especially in women; most (about 80%) remain asymptomatic. Laparoscopic cholecystectomy is one of the commonest operations in Pakistan.

**Risk factors — "5 Fs":** **F**emale, **F**orty, **F**at, **F**ertile (multiparity, pregnancy), **F**air; also rapid weight loss, oral contraceptives, diabetes, ileal resection/Crohn's (bile salt loss), haemolysis, TPN, family history.

### Types of stones

| Type | Composition | Features |
|---|---|---|
| **Mixed** (commonest, ~80%) | Cholesterol + bile pigment + calcium | Multiple, faceted |
| Cholesterol (pure) | Cholesterol | Single, large, yellow ("solitaire") |
| **Pigment — black** | Calcium bilirubinate | Haemolysis (thalassaemia, sickle cell — relevant in Pakistan), cirrhosis |
| Pigment — brown | Calcium bilirubinate + infection | Bile duct stones, infection, parasites |

Only about 10% of gallstones are radio-opaque on plain X-ray.

### Clinical spectrum

| Condition | Features |
|---|---|
| **Biliary colic** | Severe, constant (not truly colicky) **RUQ/epigastric pain** for 30 min to several hours, often after fatty meals, radiating to right scapula; nausea; no fever; settles. Due to stone impacting at Hartmann's pouch/cystic duct |
| **Acute cholecystitis** | Pain lasting >6–24 h, **fever, RUQ tenderness, positive Murphy's sign** (inspiratory arrest on palpation of RUQ), leucocytosis; may have palpable tender gallbladder mass |
| **Mucocele / empyema** | Persistent cystic duct obstruction → distended GB with mucus (mucocele) or pus (empyema — toxic, high fever) |
| Gangrene and perforation | Elderly, diabetics; local abscess or biliary peritonitis |
| **Mirizzi syndrome** | Stone in Hartmann's pouch compresses common hepatic duct → obstructive jaundice |
| CBD stones, cholangitis, pancreatitis | See Chapters 57 and 60 |
| **Gallstone ileus** | Large stone enters duodenum via cholecystoduodenal fistula; impacts at terminal ileum → small bowel obstruction; **pneumobilia (air in biliary tree)** on X-ray (Rigler's triad) |

| Condition | Features |
|---|---|
| Carcinoma of gallbladder | Long-standing stones, porcelain gallbladder; **common in northern India and Pakistan** |

### Investigations

- **Ultrasound abdomen — investigation of choice:** echogenic foci with **acoustic shadowing**, mobile; in cholecystitis — **thickened GB wall (>3 mm)**, pericholecystic fluid, **sonographic Murphy's sign**; CBD diameter
- CBC, CRP, **LFTs** (raised bilirubin/ALP suggests CBD stone), **serum amylase/lipase**
- **MRCP** if CBD stone suspected (dilated duct, abnormal LFTs)
- HIDA scan if diagnosis uncertain (non-filling of GB in acute cholecystitis); CT for complications

### Management

1. **Asymptomatic stones:** no treatment usually (exceptions: porcelain GB, stones >3 cm, GB polyp >1 cm, haemolytic disease, diabetics in some guidelines)
2. **Biliary colic:** analgesia (NSAID/opioid); **elective laparoscopic cholecystectomy**
3. **Acute cholecystitis:** NPO, IV fluids, analgesia, **IV antibiotics** (e.g. ceftriaxone + metronidazole); **early laparoscopic cholecystectomy within 72 hours to 1 week** (preferred — shorter stay, fewer readmissions); or interval cholecystectomy after 6 weeks
4. **Empyema, gangrene, unfit patients: percutaneous cholecystostomy** (USG-guided drain), later cholecystectomy
5. Medical dissolution (ursodeoxycholic acid) and lithotripsy — rarely used

### Complications of laparoscopic cholecystectomy

- **Bile duct injury** (0.3–0.5%; most serious) — prevented by achieving the **"critical view of safety"** in Calot's triangle
- Bile leak (from cystic duct stump or ducts of Luschka), haemorrhage (cystic artery), retained CBD stones, bowel injury, port-site hernia and infection, conversion to open surgery
- **Post-cholecystectomy syndrome:** persistent symptoms (retained stone, sphincter of Oddi dysfunction, missed diagnosis)

> **Exam Alert:** Ultrasound is the investigation of choice for gallstones. Murphy's sign = acute cholecystitis. Early laparoscopic cholecystectomy is preferred. Critical view of safety prevents bile duct injury.

## Chapter 57: Obstructive Jaundice, CBD Stones and Cholangitis

**Definition:** Jaundice due to obstruction of bile flow from the liver to the duodenum (post-hepatic / surgical jaundice).

### Causes

| In the lumen | In the wall | Outside the wall |
|---|---|---|
| **CBD stones (choledocholithiasis) — commonest benign cause** | Benign stricture (post-cholecystectomy injury) | **Carcinoma head of pancreas — commonest malignant cause** |
| Worms (*Ascaris*), hydatid daughter cysts | **Cholangiocarcinoma** (Klatskin tumour at hilum) | Periampullary carcinoma |
| Blood clot (haemobilia) | Primary sclerosing cholangitis | Chronic pancreatitis, pseudocyst |

| In the lumen | In the wall | Outside the wall |
|---|---|---|
| | Choledochal cyst, biliary atresia (infants) | Mirizzi syndrome, nodes at porta hepatis |

**Clinical features:** jaundice, **pale (clay-coloured) stools, dark urine**, **pruritus** (bile salts), steatorrhoea, weight loss (malignancy).

### Painful vs painless jaundice

- **Stone:** fluctuating jaundice with biliary colic and fever; gallbladder usually **not palpable** (fibrosed by chronic cholecystitis)
- **Malignancy:** progressive **painless jaundice** with weight loss; **palpable, non-tender gallbladder**
- **Courvoisier's law:** in the presence of jaundice, a palpable gallbladder is unlikely to be due to stones (exceptions: double impaction, Mirizzi)

### Investigations

- **LFTs:** raised conjugated bilirubin, **markedly raised ALP and GGT** (cholestatic picture); urine bilirubin positive, urobilinogen absent
- **Prothrombin time/INR** — prolonged (vitamin K malabsorption) → correct before procedures
- **Ultrasound** — first-line: dilated intra- and extrahepatic ducts (CBD >6–8 mm), stones, mass
- **MRCP** — non-invasive mapping of biliary tree
- **CT (pancreatic protocol)** — suspected malignancy and staging
- **ERCP** — diagnostic and **therapeutic** (sphincterotomy, stone extraction, stenting, brushings)
- **EUS** — small stones, periampullary tumours, biopsy; PTC (percutaneous transhepatic cholangiography) if ERCP fails or hilar obstruction
- Tumour markers: **CA 19-9**, CEA

### Preoperative care in the jaundiced patient (high-risk)

- **Vitamin K** IV (and FFP if bleeding) to correct coagulopathy
- **Good hydration and urine output** — prevent **hepatorenal syndrome** (IV fluids, mannitol historically)
- **Prophylactic antibiotics** before biliary instrumentation
- Nutritional support; avoid nephrotoxins; check blood sugar

### Management of CBD stones

1. **ERCP with sphincterotomy and stone extraction**, followed by **laparoscopic cholecystectomy** (same admission)
2. Or **laparoscopic CBD exploration** at the time of cholecystectomy (single-stage)
3. Large/difficult stones: mechanical, laser or electrohydraulic lithotripsy, stenting
4. Open CBD exploration with **T-tube** drainage when other methods are unavailable or fail

## Acute Cholangitis

**Definition:** Bacterial infection of an obstructed biliary tree — a **life-threatening emergency**. Commonest cause: CBD stones; also after ERCP, strictures, stents.

**Organisms:** *E. coli*, *Klebsiella*, *Enterococcus*, anaerobes.

**Charcot's triad: fever with rigors, jaundice, RUQ pain**. **Reynolds' pentad:** triad + **hypotension (septic shock) + confusion** — severe, suppurative cholangitis.

**Diagnosis:** Tokyo guidelines — systemic inflammation + cholestasis + imaging evidence of biliary dilatation/cause. Blood cultures, LFTs, CBC, USG.

**Management:** resuscitation, **IV broad-spectrum antibiotics** (piperacillin–tazobactam or ceftriaxone + metronidazole), correct coagulopathy, then **urgent biliary drainage** — **ERCP** (stone removal or stent) within 24–48 h (immediately if severe); PTC drainage if ERCP fails. Definitive treatment of the cause later.

> **Exam Alert:** Courvoisier's law: painless jaundice + palpable gallbladder = not stones (think pancreatic cancer). Charcot's triad = cholangitis → antibiotics and urgent ERCP drainage. Give vitamin K before operating on a jaundiced patient.

## Chapter 58: Liver Abscess

**Overview:** A localised collection of pus in the liver. In Pakistan and South Asia, **amoebic liver abscess** is very common; pyogenic abscess predominates in the West.

### Amoebic vs pyogenic liver abscess

| Feature | Amoebic | Pyogenic |
|---|---|---|
| Organism | ***Entamoeba histolytica*** (trophozoites reach liver via portal vein from colon) | *E. coli*, *Klebsiella* (esp. diabetics, Asia), *Strep. milleri*, anaerobes — often polymicrobial |
| Route / source | Faeco-oral; poor sanitation, contaminated water | **Biliary (commonest — cholangitis, stones, malignancy)**, portal (appendicitis, diverticulitis), arterial (septicaemia), direct spread, trauma, cryptogenic |
| Patient | **Young adult men**, alcohol use; history of dysentery in <1/3 | Older, diabetic, biliary disease, malignancy |
| Number / site | Usually **single, right lobe** (posterosuperior) | Often **multiple** |
| Contents | **"Anchovy sauce"** pus — reddish-brown, odourless, sterile | Foul, yellow pus with bacteria |
| Clinical | Fever, **RUQ pain**, tender hepatomegaly, **intercostal tenderness**, right shoulder pain, cough; jaundice uncommon | Fever with rigors, toxic, RUQ pain, jaundice more common |
| Serology | **Amoebic serology (IHA/ELISA) positive** in >90% | Blood cultures often positive |
| Treatment | **Metronidazole** 750 mg TDS for 7–10 days, then **luminal amoebicide** (diloxanide furoate or paromomycin) | **IV antibiotics** (4–6 weeks) + **percutaneous drainage**; treat source |

### Investigations (both)

- CBC (leucocytosis, anaemia), raised ESR/CRP, **ALP raised**, albumin low
- **CXR: raised right hemidiaphragm**, right basal atelectasis, pleural effusion
- **Ultrasound:** hypoechoic lesion — investigation of choice; guides aspiration
- **CT:** multiple abscesses, source (biliary, colonic), complications
- Diagnostic aspiration, cultures; stool for cysts (often negative)

### Indications for aspiration/drainage in amoebic abscess

- Large abscess (>5–10 cm) or **impending rupture**
- **Left lobe abscess** (risk of rupture into pericardium)
- No response to metronidazole after 48–72 hours
- Diagnostic doubt (exclude pyogenic abscess)

- Pregnancy (when drugs are to be minimised)

**Methods: USG-guided needle aspiration** or **percutaneous catheter drainage**; surgical (laparoscopic/open) drainage for rupture, multiloculated abscess or failed percutaneous drainage.

**Complications:** rupture into the **peritoneum** (peritonitis — surgery), **pleura** (empyema), lung (hepatobronchial fistula — coughing up anchovy sauce sputum), **pericardium** (from left lobe — tamponade, high mortality); secondary bacterial infection; septicaemia.

> **Exam Alert:** Single right lobe abscess in a young man with anchovy sauce pus = amoebic; treat with metronidazole, then a luminal agent. Pyogenic abscesses are commonly of biliary origin and need drainage plus prolonged antibiotics.

## Chapter 59: Hydatid Cyst of the Liver

**Definition:** A parasitic cyst caused by the larval stage of the tapeworm ***Echinococcus granulosus***. **Endemic in sheep- and cattle-rearing areas — common in Pakistan (Balochistan, KPK, northern areas), Afghanistan, the Middle East and the Mediterranean.**

### Life cycle

- **Definitive host: dog** (adult worm in intestine) → eggs passed in faeces
- **Intermediate hosts: sheep, cattle** — and **humans (accidental, dead-end host)** by ingesting eggs from contaminated food, water or close contact with dogs
- Embryos penetrate the gut wall → portal circulation → **liver (~70%, mainly right lobe)**, lungs (~20%), and rarely spleen, kidney, brain, bone

### Structure of the cyst

1. **Pericyst (adventitia)** — host fibrous reaction
2. **Laminated membrane (ectocyst)** — white, acellular
3. **Germinal layer (endocyst)** — produces brood capsules, **scolices ("hydatid sand")** and daughter cysts
4. Clear **hydatid fluid** — highly antigenic (anaphylaxis if spilled)

### Clinical features

- Often asymptomatic for years; found incidentally on USG
- Dull RUQ pain, hepatomegaly, smooth cystic mass; **hydatid thrill** (classic but rarely elicited)
- Pressure effects: obstructive jaundice (rupture into bile ducts or compression)

### Complications

- **Rupture into biliary tree** → obstructive jaundice and cholangitis (commonest complication)
- **Rupture into peritoneum** → **anaphylactic shock**, secondary peritoneal hydatidosis
- Rupture into pleura/bronchi (expectoration of "grape-skin" membranes)
- Secondary infection → abscess
- Calcification (dead cyst)

### Investigations

- **Ultrasound** — first-line; **WHO-IWGE classification (CE1–CE5)**: water-lily sign (detached membranes), daughter cysts ("cartwheel/honeycomb"), calcified wall
- **CT/MRI** — size, number, relation to vessels and bile ducts, other organs
- **Serology** (ELISA, indirect haemagglutination) — supportive; may be negative
- Eosinophilia (in ~25%); LFTs; **CXR** for lung cysts
- **Never perform diagnostic aspiration without precautions** (risk of anaphylaxis and spillage)

### Management

1. **Albendazole** (10–15 mg/kg/day) — for small cysts, inoperable/multiple cysts, and **perioperatively** (start 1–4 weeks before and continue 1–6 months after surgery/PAIR) to reduce recurrence
2. **PAIR** (Puncture, Aspiration, Injection of scolicidal agent — hypertonic saline 20% or alcohol 95% — Re-aspiration) under USG guidance with albendazole cover; for CE1 and CE3a cysts; **contraindicated if communicating with bile ducts**
3. **Surgery** (large, complicated, multivesicular, infected, communicating with biliary tree): - **Conservative:** pack field with scolicidal-soaked swabs, aspirate, open cyst, remove membranes and daughter cysts, irrigate with scolicidal agent, close biliary radicles, **partial pericystectomy** and drainage or omentoplasty (laparoscopic or open) - **Radical:** total pericystectomy or liver resection (lower recurrence)
4. Watch and wait for inactive calcified cysts (CE4, CE5)

**Prevention:** deworming dogs, not feeding offal to dogs, hand washing, safe slaughter practices, washing vegetables.

> **Exam Alert:** Dog is the definitive host; humans are accidental intermediate hosts. Avoid spillage — risk of anaphylaxis and recurrence. Give albendazole before and after surgery or PAIR.

## Chapter 60: Acute Pancreatitis

**Definition:** Acute inflammation of the pancreas due to premature activation of pancreatic enzymes (trypsin) causing autodigestion, ranging from mild self-limiting disease to severe multi-organ failure.

### Causes — "I GET SMASHED"

- **I**diopathic
- **G**allstones (**commonest overall**, ~40–50%)
- **E**thanol (alcohol — second commonest)
- **T**rauma
- **S**teroids
- **M**umps and other viruses
- **A**utoimmune
- **S**corpion venom
- **H**ypercalcaemia, **H**ypertriglyceridaemia (>1000 mg/dl), hypothermia
- **E**RCP (post-ERCP pancreatitis)
- **D**rugs (azathioprine, thiazides, valproate, oestrogens)

### Clinical features

- **Sudden severe epigastric pain radiating to the back**, relieved by leaning forward
- Persistent nausea and **vomiting**
- Tachycardia, fever, dehydration, shock in severe cases; epigastric tenderness and guarding; reduced bowel sounds (ileus)
- **Grey Turner's sign** (flank bruising) and **Cullen's sign** (periumbilical bruising) — retroperitoneal haemorrhage in severe necrotising pancreatitis
- Jaundice (gallstone), hypocalcaemic tetany, pleural effusion (left)

**Diagnosis (2 of 3):** (1) characteristic pain, (2) **serum lipase or amylase >3× upper limit of normal** (lipase is more specific and stays raised longer), (3) characteristic imaging findings.

### Investigations

- **Serum amylase/lipase**; CBC, CRP (**>150 mg/L at 48 h indicates severe disease**), urea, creatinine, electrolytes, **calcium**, glucose, LFTs, triglycerides, **ABGs**, LDH
- **Ultrasound** — all patients, to look for **gallstones**
- **Contrast-enhanced CT** — **not routinely on admission**; at **72–96 hours** if severe or not improving, to assess **necrosis** and complications (CT severity index); early CT only if diagnosis is in doubt
- Erect CXR — exclude perforated ulcer; "sentinel loop", "colon cut-off sign" on AXR
- MRCP/EUS for suspected CBD stones

### Severity assessment

- **Modified Glasgow (Imrie) score** at 48 h — **PANCREAS: P**$aO_2$ <8 kPa, **A**ge >55, **N**eutrophils (WBC) >15 × $10^9$/L, **C**alcium <2 mmol/L, **R**aised urea >16 mmol/L, **E**nzymes (LDH >600 IU/L, AST >200 IU/L), **A**lbumin <32 g/L, **S**ugar >10 mmol/L. **Score ≥3 = severe**
- Ranson's criteria, APACHE II, BISAP, CRP
- **Revised Atlanta classification: mild** (no organ failure), **moderately severe** (transient organ failure <48 h or local complications), **severe** (**persistent organ failure >48 h**)

### Management

1. **Aggressive but goal-directed IV fluids** (Ringer's lactate preferred), urine output >0.5 ml/kg/h
2. **Analgesia** (opioids are acceptable)
3. Oxygen; HDU/ICU for severe disease; monitor organ function
4. **Early oral or enteral nutrition** (within 24–72 h as tolerated; nasojejunal/nasogastric if unable to eat) — better than TPN
5. **No routine prophylactic antibiotics**; give only for **infected necrosis** or cholangitis
6. **Gallstone pancreatitis: urgent ERCP** if **cholangitis** or persistent biliary obstruction; **cholecystectomy during the same admission** for mild disease (prevents recurrence); delay until resolution of collections in severe disease
7. **Infected necrosis** (gas on CT, clinical deterioration): antibiotics (carbapenem), then **"step-up approach"** — percutaneous or endoscopic drainage first, then **minimally invasive necrosectomy** if needed; delay intervention to ≥4 weeks when necrosis becomes walled-off

### Complications

- **Local:** acute peripancreatic fluid collection, **pancreatic pseudocyst** (>4 weeks), acute necrotic collection, **walled-off necrosis**, infected necrosis, abscess, splenic vein thrombosis, pseudoaneurysm
- **Systemic:** SIRS, **ARDS**, acute kidney injury, shock, DIC, **hypocalcaemia**, hyperglycaemia, multi-organ failure
- Mortality: mild <1%; severe up to 20–30%

> **Exam Alert:** Gallstones and alcohol are the commonest causes. Lipase >3× normal confirms diagnosis. CT is done after 72 hours, not on admission. Same-admission cholecystectomy after mild gallstone pancreatitis.

# Chapter 61: Chronic Pancreatitis and Pancreatic Pseudocyst

## Chronic Pancreatitis

**Definition:** Progressive, irreversible inflammation and fibrosis of the pancreas with loss of exocrine and endocrine function.

**Causes: alcohol (commonest)**, smoking, idiopathic, **tropical (fibrocalculous) pancreatitis** (young people in South Asia and Africa; large ductal calculi; diabetes), hereditary (PRSS1, SPINK1, CFTR), autoimmune (IgG4), hypercalcaemia, hypertriglyceridaemia, recurrent acute pancreatitis, pancreas divisum, duct obstruction.

### Clinical features

- **Chronic epigastric pain radiating to the back**, worse after meals and alcohol, relieved by leaning forward — the main problem; may lead to opioid dependence
- **Exocrine failure: steatorrhoea** (pale, bulky, oily, foul-smelling stools that float), weight loss, fat-soluble vitamin deficiency
- **Endocrine failure: diabetes mellitus** (type 3c)
- Classic triad (late): **pancreatic calcification, steatorrhoea, diabetes**

### Investigations

- Serum amylase/lipase — often normal
- **Faecal elastase** (low) — test of exocrine function
- Blood glucose, HbA1c; LFTs; calcium, lipids; IgG4
- **Plain X-ray: pancreatic calcification** (speckled)
- **CT** — calcification, duct dilatation, atrophy, pseudocysts, exclude cancer
- **MRCP / secretin-MRCP** — "**chain of lakes**" (beaded, dilated main duct with strictures)
- **EUS** — early changes, biopsy of masses

### Management

1. **Stop alcohol and smoking** (most important)
2. **Pain:** analgesic ladder, tricyclic antidepressants/gabapentinoids; coeliac plexus block
3. **Pancreatic enzyme replacement (Creon)** with meals + PPI; low-fat diet, fat-soluble vitamins (A, D, E, K)
4. **Diabetes:** insulin (risk of hypoglycaemia as glucagon also deficient)
5. **Endoscopic therapy:** ERCP with stone extraction, **extracorporeal shock wave lithotripsy (ESWL)**, stenting of strictures
6. **Surgery** for intractable pain, complications or suspected cancer: - **Dilated duct (>7 mm):** drainage — **lateral pancreaticojejunostomy (Partington–Rochelle / Puestow procedure)**, **Frey procedure** (local head coring + drainage) - **Inflammatory head mass: Beger procedure** (duodenum-preserving head resection) or Whipple's - Total pancreatectomy with islet autotransplantation (selected)

**Complications:** pseudocyst, biliary or duodenal obstruction, **splenic vein thrombosis** (left-sided/sinistral portal hypertension → gastric varices), pancreatic ascites or pleural effusion, pseudoaneurysm, **pancreatic cancer** (increased risk).

## Pancreatic Pseudocyst

**Definition:** A collection of pancreatic fluid enclosed by a **wall of fibrous or granulation tissue without an epithelial lining**, persisting **>4 weeks** after acute pancreatitis (or in chronic pancreatitis or trauma). Commonest in the **lesser sac**.

**Clinical features:** persistent epigastric pain, early satiety, nausea, vomiting, **epigastric mass**; persistently raised amylase.

**Investigations:** USG, **CT** (investigation of choice), EUS (to differentiate from **cystic neoplasm** — fluid CEA, amylase, cytology; neoplastic cysts have an epithelial lining).

### Management

- **Asymptomatic:** observe — many resolve spontaneously (especially <6 cm)

- **Symptomatic, enlarging or complicated** → drainage after the wall matures (≥4–6 weeks):
- **Endoscopic (EUS-guided) cystgastrostomy** with stents — first-line
- Percutaneous drainage (risk of external pancreatic fistula)
- **Surgical cystgastrostomy** or **Roux-en-Y cystjejunostomy** (laparoscopic or open)

**Complications:** infection (abscess), **haemorrhage** (pseudoaneurysm of splenic or gastroduodenal artery — embolisation), rupture (pancreatic ascites, peritonitis), obstruction of stomach, duodenum or bile duct.

> **Exam Alert:** Alcohol is the commonest cause of chronic pancreatitis; tropical pancreatitis occurs in young non-drinkers in South Asia. Pseudocyst has no epithelial lining; wait 4–6 weeks before drainage.

## Chapter 62: Carcinoma of the Pancreas and Periampullary Region

**Overview:** Pancreatic ductal adenocarcinoma is one of the most lethal cancers (5-year survival about 10%), because most patients present with locally advanced or metastatic disease. **Periampullary tumours** (ampulla of Vater, distal CBD, duodenum, head of pancreas) present earlier with jaundice and have a better prognosis.

**Risk factors: smoking** (most important modifiable), age >60, chronic pancreatitis, new-onset diabetes in the elderly, obesity, family history, hereditary syndromes (BRCA2, Lynch, Peutz–Jeghers, FAMMM), intraductal papillary mucinous neoplasm (IPMN), alcohol.

**Pathology: ductal adenocarcinoma (~90%)**; **head of pancreas (~70%)**, body and tail (~30%). Others: cystic neoplasms (mucinous cystic neoplasm, IPMN, serous cystadenoma — benign), neuroendocrine tumours (insulinoma, gastrinoma — better prognosis).

### Clinical features

| Head / periampullary | Body and tail |
|---|---|
| **Progressive painless obstructive jaundice** with pruritus, pale stools, dark urine | **Epigastric pain radiating to the back** (coeliac plexus invasion — poor sign) |
| **Palpable non-tender gallbladder (Courvoisier's law)** | Weight loss, anorexia |
| Weight loss, anorexia, new-onset diabetes | Usually late, metastatic at presentation |
| Periampullary: intermittent jaundice, **"silver stool"** (melaena + acholic stool), anaemia | Splenomegaly (splenic vein thrombosis) |

Other: **Trousseau's sign** (migratory thrombophlebitis), gastric outlet obstruction, Virchow's node, ascites, hepatomegaly.

### Investigations

- LFTs (obstructive picture), **CA 19-9** (raised in ~80%; useful for follow-up; false positives in jaundice), CEA
- **USG** — dilated ducts, mass
- **Pancreatic-protocol triphasic CT** — investigation of choice: diagnosis, **resectability** (relationship to SMA, SMV/portal vein, coeliac axis, hepatic artery) and metastases
- **EUS with FNA/biopsy** — small tumours, tissue diagnosis (needed before chemotherapy)
- MRCP, MRI liver; **staging laparoscopy** for high-risk resectable cases; PET-CT selectively
- **ERCP** with brushings and **stenting** — for cholangitis, palliation, or when surgery is delayed (routine pre-operative biliary drainage is avoided unless bilirubin is very high or neoadjuvant therapy is planned)

**Resectability categories:** resectable, **borderline resectable** (limited vascular contact), locally advanced (unresectable), metastatic. Only **15–20%** are resectable at presentation.

### Management

1. **Resectable head/periampullary tumours: pancreaticoduodenectomy (Whipple's operation)** — removal of head of pancreas, duodenum, distal CBD, gallbladder ± distal stomach; reconstruction with **pancreaticojejunostomy, hepaticojejunostomy and gastrojejunostomy**; or pylorus-preserving pancreaticoduodenectomy (PPPD)
2. **Body/tail tumours: distal pancreatectomy with splenectomy**
3. **Adjuvant chemotherapy** (modified **FOLFIRINOX** or gemcitabine + capecitabine) for 6 months — improves survival; **neoadjuvant chemotherapy** for borderline resectable disease
4. **Palliation (majority):** - Jaundice → **endoscopic metal biliary stent** (or surgical hepaticojejunostomy) - Duodenal obstruction → **duodenal stent** or gastrojejunostomy (**"double bypass"** at surgery) - Pain → opioids, **coeliac plexus block** (EUS-guided) - Palliative chemotherapy; pancreatic enzymes, nutrition, palliative care

**Complications of Whipple's: pancreatic fistula/leak** (commonest serious), delayed gastric emptying, haemorrhage (post-pancreatectomy, from pseudoaneurysm), bile leak, intra-abdominal abscess, diabetes, exocrine insufficiency; mortality <5% in high-volume centres.

> **Exam Alert:** Painless progressive jaundice + palpable gallbladder in an elderly patient = carcinoma head of pancreas. Triphasic CT assesses resectability. Whipple's operation for resectable head tumours; most patients need palliation.

## Chapter 63: The Spleen — Splenomegaly and Splenectomy

**Anatomy in brief:** lies in the left hypochondrium under ribs 9–11; normally **not palpable** (must enlarge about 2–3 times). Blood supply: **splenic artery** (from coeliac trunk) and short gastric arteries; drains via splenic vein to portal vein. Accessory spleens (splenunculi) in 10–20%, commonly at the hilum.

**Functions:** filtration and removal of old red cells and particles, **immune defence against encapsulated bacteria** (opsonising antibodies — IgM, tuftsin, properdin), extramedullary haematopoiesis, platelet storage.

### Clinical features of an enlarged spleen (differentiating from left kidney)

- Enlarges towards the **right iliac fossa** (downwards and medially)
- **Notch** on the medial (anterior) border
- **Cannot get above it** (upper border not palpable)
- Moves with respiration; **dull to percussion** (no colonic band in front)
- Not ballotable

### Causes of splenomegaly (relevant to Pakistan)

| Size | Causes |
|---|---|
| **Massive** (>20 cm, crosses midline) | **Chronic myeloid leukaemia**, myelofibrosis, **chronic malaria**, **kala-azar (visceral leishmaniasis)**, **thalassaemia major** |
| Moderate | Portal hypertension (cirrhosis — hepatitis B/C), lymphoma, haemolytic anaemias, leukaemias |
| Mild | Infections (typhoid, infective endocarditis, viral, TB, brucellosis), autoimmune (SLE, RA — Felty's) |

**Hypersplenism:** splenomegaly + cytopenias (anaemia, leucopenia, thrombocytopenia) + compensatory bone marrow hyperplasia, corrected by splenectomy.

**Investigations:** CBC with peripheral smear, reticulocytes, LFTs, viral markers; malaria parasites, rK39 (kala-azar); bone marrow biopsy; **USG/CT** for size and lesions; Doppler for portal hypertension.

### Indications for splenectomy

- **Trauma** (unstable or failed non-operative management — see Chapter 20)
- **Haematological: immune thrombocytopenic purpura (ITP)** not responding to medical treatment (commonest elective indication), **hereditary spherocytosis**, **thalassaemia** with hypersplenism or high transfusion requirement, autoimmune haemolytic anaemia, sickle cell (sequestration crises), myelofibrosis
- Splenic **abscess**, **hydatid cyst**, cysts, tumours, splenic artery aneurysm
- **Hypersplenism**; during other operations (distal pancreatectomy, radical gastrectomy)
- Wandering spleen with torsion

**Approach: laparoscopic splenectomy** preferred for normal/moderately enlarged spleens; open for massive spleens or trauma. Search for **accessory spleens** (failure to remove them causes relapse of ITP).

**Pre-operative preparation: vaccination at least 2 weeks before elective surgery** (or 2 weeks after emergency surgery): **pneumococcal, Haemophilus influenzae type b, meningococcal (ACWY and B)**, and annual influenza; platelet transfusion for ITP only after clamping the splenic artery; correct anaemia.

### Complications of splenectomy

- **Early:** haemorrhage, **left lower lobe atelectasis and left pleural effusion** (commonest), **pancreatic tail injury** (fistula, pancreatitis), gastric fistula (short gastric vessel ligation), subphrenic abscess
- **Haematological: thrombocytosis** (peaks day 7–10 → risk of thrombosis, portal vein thrombosis; aspirin if very high), Howell–Jolly bodies and target cells on smear
- **Late: overwhelming post-splenectomy infection (OPSI)** — fulminant sepsis by **encapsulated organisms** (*Streptococcus pneumoniae* — commonest, *H. influenzae*, *Neisseria meningitidis*); highest risk in children and within first 2 years; mortality up to 50%. **Prevention:** vaccines, **prophylactic penicillin** (lifelong or for at least 2 years; children until 16), emergency antibiotic supply, medical alert card, malaria prophylaxis when travelling

> **Exam Alert:** Spleen enlarges towards the right iliac fossa, has a notch, and you cannot get above it. ITP is the commonest elective indication for splenectomy. OPSI is most commonly due to pneumococcus — vaccinate and give penicillin prophylaxis.

## Self-Assessment: Part 9 SBAs

**1.** A 42-year-old obese woman has had RUQ pain for 36 hours with fever of 38.3 °C. She stops breathing in when the examiner presses below the right costal margin. Ultrasound shows gallstones, a 6 mm thick gallbladder wall and pericholecystic fluid. LFTs are normal. What is the best management?

A. Discharge with oral analgesia · B. ERCP · C. IV antibiotics and early laparoscopic cholecystectomy in the same admission · D. Oral ursodeoxycholic acid · E. Percutaneous cholecystostomy in all cases

**Answer: C.** Acute cholecystitis; early cholecystectomy is preferred.

**2.** A 68-year-old man has progressive painless jaundice, pruritus and weight loss over 6 weeks. A non-tender, smooth, pear-shaped mass is palpable in the right hypochondrium. What is the most likely diagnosis?

A. Acute cholecystitis · B. Carcinoma of the head of pancreas · C. CBD stone · D. Hepatitis A · E. Mirizzi syndrome

**Answer: B.** Courvoisier's law.

**3.** A 55-year-old woman has fever with rigors, jaundice and RUQ pain. BP is 85/55 mmHg and she is confused. Ultrasound shows a dilated CBD with a stone. After resuscitation and IV antibiotics, what is the most important next step?

A. Elective cholecystectomy in 6 weeks · B. HIDA scan · C. MRCP · D. Oral antibiotics and discharge · E. Urgent ERCP and biliary drainage

**Answer: E.** Reynolds' pentad — severe cholangitis.

**4.** A 30-year-old man from a rural area has fever and RUQ pain for 2 weeks with tender hepatomegaly and intercostal tenderness. Ultrasound shows a single 6 cm hypoechoic lesion in the right lobe. Amoebic serology is positive. What is the first-line treatment?

A. Albendazole · B. Laparotomy and drainage · C. Metronidazole followed by a luminal amoebicide · D. PAIR technique · E. Right hepatectomy

**Answer: C.** Amoebic liver abscess.

**5.** A 35-year-old shepherd from Balochistan has a 10 cm cystic lesion in the right lobe of the liver with daughter cysts on ultrasound. What is the definitive host of the causative organism?

A. Cat · B. Cattle · C. Dog · D. Human · E. Sheep

**Answer: C.** Echinococcus granulosus; humans are accidental intermediate hosts.

**6.** A 50-year-old woman with gallstones has severe epigastric pain radiating to the back. Serum lipase is 8 times the upper limit of normal. She is stable with no organ failure. When is contrast-enhanced CT indicated?

A. Immediately on admission in all patients · B. Only if not improving or severe, after 72 hours · C. Before discharge in all patients · D. Never · E. Within 6 hours to grade necrosis

**Answer: B.** Early CT underestimates necrosis and does not change management.

**7.** The same patient recovers fully from mild gallstone pancreatitis in 4 days. What is the most appropriate definitive management?

A. Cholecystectomy during the same admission · B. Cholecystectomy only if symptoms recur · C. Lifelong ursodeoxycholic acid · D. Low-fat diet only · E. Routine ERCP for all

**Answer: A.** Prevents recurrent attacks, which are common while awaiting surgery.

**8.** A 45-year-old man has an epigastric mass and early satiety 6 weeks after an attack of acute pancreatitis. CT shows an 8 cm thick-walled fluid collection in the lesser sac compressing the stomach. What is the preferred treatment?

A. Distal pancreatectomy · B. EUS-guided endoscopic cystgastrostomy · C. External surgical drainage · D. Observation only · E. Whipple's operation

**Answer: B.** Symptomatic mature pseudocyst.

**9.** A 40-year-old alcoholic has recurrent epigastric pain radiating to the back, pale bulky offensive stools that float, and recently diagnosed diabetes. Abdominal X-ray shows speckled calcification in the upper abdomen. What will MRCP most likely show?

A. Bird's beak narrowing · B. Chain of lakes appearance of the pancreatic duct · C. Double duct sign only · D. Normal ducts · E. Water-lily sign

**Answer: B.** Chronic pancreatitis.

**10.** A 25-year-old woman is listed for elective laparoscopic splenectomy for ITP not responding to steroids. When should vaccination against encapsulated organisms be given?

A. At least 2 weeks before surgery · B. Immediately after surgery · C. Not needed in adults · D. Only if she develops fever · E. 6 months after surgery

**Answer: A.** Pneumococcal, Hib and meningococcal vaccines respond best when the spleen is still present.

*References: Bailey & Love's Short Practice of Surgery, 28th Ed.; Blecha, Surgery, 4th Ed.*

PART 10

# Small and Large Bowel

## Chapter 64: Intestinal Obstruction

**Definition:** Interruption of the normal aboral passage of intestinal contents. It may be **dynamic (mechanical)** — peristalsis works against an obstruction — or **adynamic** — no peristalsis (paralytic ileus, pseudo-obstruction).

### Causes of mechanical obstruction

| Site | Small bowel | Large bowel |
|---|---|---|
| Commonest | **Adhesions** (previous surgery) — commonest overall in adults; **obstructed/strangulated hernia** (commonest where surgery is less common and in virgin abdomen) | **Colorectal carcinoma** (commonest) |
| Others | Abdominal TB (ileocaecal — **common in Pakistan**), Crohn's stricture, intussusception, volvulus, gallstone ileus, bolus obstruction (worms — *Ascaris* in children, food), tumours | **Sigmoid volvulus** (common in Pakistan/Africa), diverticular stricture, faecal impaction, hernia |
| Children | Intussusception, malrotation with volvulus, hernia, Meckel's band, Hirschsprung's, atresia | — |

**Classification:** small vs large bowel; acute, chronic or acute-on-chronic; **simple** (blood supply intact) vs **strangulated** (blood supply compromised); **closed loop** (obstructed at two points — volvulus, or colonic obstruction with competent ileocaecal valve → risk of caecal perforation).

### Cardinal features

| Feature | High small bowel | Low small bowel | Large bowel |
|---|---|---|---|
| Pain | Colicky, central, early | Colicky, central | Colicky, lower abdomen, less severe |
| Vomiting | **Early, profuse, bilious** | Later, may be faeculent | **Late** (or absent) |
| Distension | Minimal | Central, moderate | **Marked**, flanks |
| Absolute constipation | Late | Later | **Early** |

**Signs:** dehydration, tachycardia, distension, visible peristalsis, high-pitched **tinkling bowel sounds** (absent late), scars, **hernial orifices (always examine)**, PR examination (empty rectum, mass, blood).

**Features of strangulation (urgent surgery): constant (not colicky) pain**, tachycardia, fever, **localised tenderness, guarding and rebound**, tender irreducible hernia, leucocytosis, raised lactate, metabolic acidosis, shock.

### Investigations

- CBC, electrolytes, urea, creatinine, **ABGs and lactate**, amylase, group and save

- **Plain abdominal X-ray (supine):** dilated loops — small bowel (>3 cm, central, **valvulae conniventes** crossing whole width — "ladder" pattern) vs large bowel (>6 cm, caecum >9 cm, peripheral, **haustra** not crossing whole width); **coffee-bean sign** (sigmoid volvulus); erect CXR for perforation
- **CT abdomen with contrast — investigation of choice:** confirms obstruction, level (**transition point**), cause, strangulation (reduced wall enhancement, free fluid, pneumatosis)
- Water-soluble contrast (Gastrografin) follow-through — diagnostic and therapeutic in adhesive obstruction (contrast in colon by 24 h predicts resolution)

### Management

1. **"Drip and suck": IV fluids** (Ringer's lactate/normal saline + potassium), **NG tube** decompression, urinary catheter, fluid balance chart, analgesia, correct electrolytes
2. **Conservative trial (up to 48–72 h)** for **adhesive obstruction without strangulation**, with Gastrografin
3. **Urgent surgery** for strangulation, obstructed hernia, closed-loop obstruction, virgin abdomen without hernia (usually a cause needing surgery), failure of conservative treatment, peritonitis
4. **At laparotomy:** relieve cause (adhesiolysis, hernia repair, resection); **assess viability** — colour, peristalsis, mesenteric pulsation, bleeding from cut edge; wrap in warm saline packs and reassess; resect non-viable bowel with anastomosis or stoma
5. **Large bowel obstruction from cancer:** right-sided → right hemicolectomy with primary anastomosis; left-sided → **Hartmann's procedure**, resection with anastomosis ± defunctioning stoma, or **colonic stent** as a bridge to surgery or palliation

**Signs of non-viable bowel:** black or dark purple colour, loss of sheen, no peristalsis, no pulsation in mesentery, thin and flaccid wall, no bleeding on cutting.

**Pseudo-obstruction (Ogilvie's syndrome):** massive colonic dilatation **without mechanical cause** in elderly, post-operative, bed-bound patients (electrolyte imbalance, drugs, sepsis). CT excludes mechanical obstruction. Treat with correction of the cause, **neostigmine**, colonoscopic decompression; surgery if caecum >12 cm or perforation.

> **Exam Alert:** Adhesions are the commonest cause of small bowel obstruction; carcinoma of large bowel. Always examine hernial orifices. Constant pain, fever, tachycardia and peritonism = strangulation → operate.

## Chapter 65: Acute Appendicitis

**Definition:** Acute inflammation of the vermiform appendix — the **commonest surgical emergency of the abdomen**, with a lifetime risk of about 7–8%, peaking at 10–30 years.

**Surgical anatomy:** base at the confluence of the three **taeniae coli**; surface marking **McBurney's point** (junction of lateral one-third and medial two-thirds of a line from ASIS to umbilicus). Positions: **retrocaecal (~65%, commonest)**, pelvic (~30%), subcaecal, pre-ileal, post-ileal. **Appendicular artery** (from ileocolic) is an **end artery** → gangrene.

**Aetiology: luminal obstruction** — lymphoid hyperplasia (children), **faecolith** (adults; higher perforation risk), foreign body, worms, tumour (carcinoid, adenocarcinoma in elderly) → rising pressure → venous congestion → bacterial invasion → gangrene → **perforation** (often within 24–36 h) → localised (mass/abscess) or generalised peritonitis.

### Clinical features

- **Murphy's sequence:** periumbilical (visceral) pain → shifts to **RIF** (somatic) after 6–12 h → anorexia, nausea, vomiting (after pain) → low-grade fever
- **Anorexia** is almost constant

- Signs: tachycardia, furred tongue, **tenderness and guarding at McBurney's point**, rebound and percussion tenderness
- **Special signs: Rovsing's** (LIF pressure → RIF pain), **psoas** (pain on hip extension — retrocaecal), **obturator** (pain on internal rotation of flexed hip — pelvic), Dunphy's (pain on coughing), right-sided tenderness on PR (pelvic)

**Alvarado (MANTRELS) score — total 10: M**igration of pain 1, **A**norexia 1, **N**ausea/vomiting 1, **T**enderness RIF 2, **R**ebound 1, **E**levated temperature 1, **L**eucocytosis 2, **S**hift to left 1. **1–4 unlikely; 5–6 possible (observe, image); 7–10 probable (operate).** AIR score is preferred in newer guidance.

**Differential diagnosis:** children — mesenteric lymphadenitis, Meckel's diverticulitis, intussusception; **women — ruptured ectopic pregnancy, ovarian cyst torsion/rupture, PID, mittelschmerz**; adults — right ureteric colic, cholecystitis, perforated DU, Crohn's/ileocaecal TB; elderly — caecal carcinoma, diverticulitis; medical — right lower lobe pneumonia, DKA, UTI.

**Investigations:** CBC (neutrophilic leucocytosis), CRP, urine R/E, **β-hCG in all women of reproductive age**, **ultrasound** (children, young women, pregnancy: non-compressible tube >6 mm), **CT abdomen** (adults with doubtful diagnosis, suspected mass, elderly), MRI in pregnancy, diagnostic laparoscopy if doubt persists.

**Management**

1. NPO, IV fluids, analgesia (does not mask signs), IV antibiotics (ceftriaxone + metronidazole)
2. **Appendicectomy — laparoscopic preferred** (less pain, fewer wound infections, inspection of pelvis); open via **Grid-iron (McBurney)** or **Lanz** incision
3. Normal appendix at surgery → look for **Meckel's diverticulum** (2 feet from ileocaecal valve), ovaries/tubes, mesenteric nodes
4. **Antibiotics-only** treatment: option in selected uncomplicated cases without faecolith (25–40% recurrence)
5. **Appendix mass (Ochsner–Sherren regimen):** tender RIF mass after 3–5 days → conservative (NPO, IV fluids, antibiotics, mark margins, chart pulse/temperature/size); **abandon and operate** if rising pulse, increasing pain/size or spreading peritonitis; interval appendicectomy optional; colonoscopy/CT in patients >40 to exclude caecal cancer
6. **Appendix abscess:** USG/CT-guided percutaneous drainage + antibiotics
7. **Perforation with generalised peritonitis:** resuscitate, urgent appendicectomy, thorough peritoneal lavage

**Special groups: children** (thin omentum, perforate early), **elderly** (atypical, high perforation rate, exclude cancer), **pregnancy** (commonest non-obstetric emergency; appendix displaced upward; laparoscopy safe; perforation increases fetal loss).

**Complications:** wound infection (commonest post-op), pelvic/subphrenic abscess, ileus, adhesive obstruction, faecal fistula, stump appendicitis, **pylephlebitis** (portal pyaemia → liver abscess), right inguinal hernia (ilioinguinal nerve injury), infertility in women after perforation.

> **Exam Alert:** Retrocaecal is the commonest position. Pain precedes vomiting. Always do β-hCG in women. Carcinoid is the commonest tumour of the appendix.

## Chapter 66: Abdominal Tuberculosis

**Importance:** Pakistan has one of the highest TB burdens in the world. Abdominal TB is a common cause of chronic abdominal pain, subacute intestinal obstruction, ascites and "doughy" abdomen in young adults, and is often called "the great mimic" (Crohn's disease, lymphoma, carcinoma).

**Routes of infection:** swallowed sputum (from pulmonary TB), ingestion of infected (unpasteurised) milk (*M. bovis*), haematogenous spread, lymphatic spread, direct extension from adjacent organs (fallopian tubes).

### Types

| Type | Features |
|---|---|
| **Intestinal — ileocaecal (commonest site, ~75%)** | Abundant lymphoid tissue (Peyer's patches), stasis. **Ulcerative** (transverse, "girdle" ulcers → strictures), **hyperplastic** (mass in RIF, mimics carcinoma/Crohn's), ulcerohypertrophic |
| **Peritoneal** | **Wet (ascitic)** — exudative ascites; **dry (plastic/adhesive)** — dense adhesions, "doughy abdomen"; **fibrotic/loculated** — matted omentum and bowel ("abdominal cocoon") |
| Lymph node (mesenteric) | Enlarged, caseating, calcified nodes; may form cold abscess |
| Solid organ | Liver, spleen, pancreas (rare) |

### Clinical features

- **Constitutional:** low-grade evening fever, night sweats, weight loss, anorexia, malaise
- Chronic abdominal pain, altered bowel habit (diarrhoea/constipation)
- **Subacute intestinal obstruction** (recurrent colicky pain, distension, vomiting, relieved spontaneously) — commonest surgical presentation
- **RIF mass** (hyperplastic ileocaecal TB)
- Ascites, **doughy abdomen**, rolled-up omentum
- Acute presentations: complete obstruction, **perforation** (usually ileal, proximal to stricture), fistula, bleeding
- Evidence of pulmonary TB in only ~25%

### Investigations

- CBC (anaemia, lymphocytosis), **raised ESR/CRP**, low albumin
- **Chest X-ray** (active or healed TB)
- Mantoux test / IGRA (supportive only)
- **Ultrasound / CT abdomen:** ascites with septations, thickened ileocaecal wall, **pulled-up contracted caecum**, mesenteric lymph nodes with central necrosis, omental thickening
- **Ascitic fluid:** exudate (protein >3 g/dl, **SAAG <1.1**), lymphocytic, **adenosine deaminase (ADA) >40 U/L** (strongly suggests TB), GeneXpert, culture
- **Barium follow-through:** narrowed terminal ileum, **"pulled-up" caecum**, obtuse ileocaecal angle, **Fleischner (inverted umbrella) sign**, **Stierlin sign** (rapid emptying of terminal ileum), strictures
- **Colonoscopy with ileal biopsy:** transverse ulcers, nodularity; histology — **caseating granulomas**, AFB, culture, GeneXpert
- **Diagnostic laparoscopy with peritoneal biopsy:** tubercles ("millet seeds") on peritoneum, adhesions — most useful for peritoneal TB

### TB vs Crohn's disease (key differences)

| TB | Crohn's |
|---|---|
| Transverse ulcers | Longitudinal, aphthous ulcers, skip lesions |
| Caseating, large, confluent granulomas | Non-caseating, small granulomas |
| Necrotic lymph nodes, ascites | Fistulae, perianal disease more common |
| ADA raised, AFB/GeneXpert positive | — |

### Management

1. **Anti-tuberculous therapy (ATT) for 6 months** — 2 months **HRZE** (isoniazid, rifampicin, pyrazinamide, ethambutol), then 4 months **HR** (longer in some cases); pyridoxine with isoniazid; monitor LFTs
2. Nutritional support; treat ascites
3. **Surgery** for complications: - Obstruction: **stricturoplasty** for short strictures; **limited ileocaecal resection** or right hemicolectomy for hyperplastic disease; adhesiolysis - **Perforation:** resection with anastomosis or exteriorisation (stoma), peritoneal lavage - Diagnostic laparoscopy/biopsy - Avoid bypass procedures (blind-loop syndrome)
4. Continue ATT after surgery

> **Exam Alert:** Ileocaecal region is the commonest site. Transverse ulcers, caseating granulomas and high ascitic ADA point to TB. ATT for 6 months is the mainstay; surgery is for complications.

## Chapter 67: Inflammatory Bowel Disease — Crohn's Disease and Ulcerative Colitis

**Definition:** Chronic, relapsing, idiopathic inflammatory diseases of the gut, thought to result from an abnormal immune response to gut bacteria in genetically susceptible people. Peak onset 15–35 years; increasing in South Asia.

### Crohn's disease vs ulcerative colitis

| Feature | Crohn's disease | Ulcerative colitis |
|---|---|---|
| Distribution | **Anywhere from mouth to anus**; terminal ileum commonest; **skip lesions** | **Rectum always involved**; extends **continuously** proximally; colon only (backwash ileitis) |
| Depth | **Transmural** | **Mucosal and submucosal** only |
| Gross | **Cobblestone mucosa**, deep fissuring ulcers, **strictures**, fat wrapping ("creeping fat"), thick wall | Diffuse erythema, friable mucosa, **pseudopolyps**, loss of haustra ("**lead-pipe**" colon on barium) |
| Histology | **Non-caseating granulomas**, transmural lymphoid aggregates | **Crypt abscesses**, goblet cell depletion, no granulomas |
| Symptoms | Abdominal pain, diarrhoea (often non-bloody), weight loss, RIF mass | **Bloody diarrhoea** with mucus, urgency, tenesmus |
| Perianal disease | **Common** (fistulae, abscesses, fissures, skin tags) | Rare |
| Fistulae, strictures, obstruction | **Common** | Rare |
| Smoking | **Worsens** | **Protective** |
| Cancer risk | Increased (less than UC) | **Increased** (extent and duration; PSC) |
| Surgery | **Not curative** — recurrence common; conserve bowel | **Curative** (proctocolectomy) |
| Associated | — | **Primary sclerosing cholangitis** |

**Extra-intestinal manifestations (both):** joints (arthritis, ankylosing spondylitis, sacroiliitis), skin (**erythema nodosum**, **pyoderma gangrenosum**), eyes (uveitis, episcleritis), liver (**PSC** — mainly UC), gallstones and renal oxalate stones (Crohn's ileal disease), amyloidosis, thromboembolism.

### Investigations

- CBC (anaemia), ESR, CRP, albumin, **faecal calprotectin** (distinguishes IBD from IBS)
- **Stool culture** including *C. difficile* (exclude infection); **amoebiasis and TB must be excluded in Pakistan**
- **Colonoscopy with ileoscopy and biopsies** — investigation of choice
- **MR enterography** (small bowel Crohn's), CT, capsule endoscopy
- **Pelvic MRI** for perianal Crohn's fistulae
- **Plain AXR** in acute severe colitis — **toxic megacolon** (transverse colon >6 cm)

### Medical management

- **Induction of remission: corticosteroids** (prednisolone; IV hydrocortisone in severe attacks), **5-ASA (mesalazine)** in UC, exclusive enteral nutrition in paediatric Crohn's
- **Maintenance:** mesalazine (UC), **azathioprine**/6-mercaptopurine, methotrexate (Crohn's)
- **Biologics:** anti-TNF (**infliximab**, adalimumab), vedolizumab, ustekinumab; JAK inhibitors
- Antibiotics (metronidazole, ciprofloxacin) for perianal Crohn's
- **Stop smoking** in Crohn's

**Acute severe ulcerative colitis (Truelove and Witts):** ≥6 bloody stools/day plus fever, tachycardia, anaemia or raised ESR. Admit, IV fluids, **IV hydrocortisone**, DVT prophylaxis, daily AXR and bloods; if no response by day 3 → **rescue therapy (infliximab or ciclosporin)** or **colectomy**.

### Surgery

**Ulcerative colitis — indications:** acute severe colitis failing medical therapy, **toxic megacolon**, perforation, massive haemorrhage, **dysplasia or carcinoma**, chronic disease with poor quality of life or steroid dependence, growth retardation in children.

- **Emergency: subtotal colectomy with end ileostomy** (rectal stump left) — safest
- **Elective: restorative proctocolectomy with ileal pouch–anal anastomosis (IPAA, J-pouch)**; or panproctocolectomy with permanent end ileostomy
- Pouch complication: **pouchitis** (treat with metronidazole/ciprofloxacin)

**Crohn's disease — indications:** obstruction from fibrotic stricture, fistula, abscess, perforation, bleeding, failure of medical therapy, cancer.

- **Principles: conserve bowel** — **limited resection** with macroscopically clear margins (commonest: **ileocaecal resection**), **stricturoplasty** for multiple short strictures, drain abscesses (percutaneously first)
- **Perianal Crohn's:** drain abscess, **loose seton** for fistulae (avoid fistulotomy of complex tracts — incontinence risk), biologics
- Recurrence after resection is common; **stop smoking** reduces it

> **Exam Alert:** Rectum is always involved in UC; Crohn's has skip lesions, transmural inflammation, granulomas, fistulae and perianal disease. Surgery cures UC but not Crohn's — conserve bowel in Crohn's.

## Chapter 68: Colorectal Carcinoma

**Overview:** The third commonest cancer worldwide. In Pakistan it increasingly affects **younger patients (<50)**, often presenting late. Almost all are **adenocarcinomas** arising through the **adenoma–carcinoma sequence** (APC → KRAS → p53).

**Risk factors:** age >50, **adenomatous polyps** (villous > tubular; size >1 cm, high-grade dysplasia), **familial adenomatous polyposis (FAP)** (APC mutation — hundreds of polyps, ~100% cancer by 40), **Lynch syndrome / HNPCC** (mismatch repair genes; right-sided, young), **ulcerative colitis** and Crohn's colitis, family history, diet (red and processed meat, low fibre), obesity, smoking, alcohol, diabetes, previous colorectal cancer, pelvic radiation.

**Distribution:** rectum and sigmoid ~60–70%; caecum and ascending colon ~20%.

### Clinical features by site

| Right colon (caecum, ascending) | Left colon (descending, sigmoid) | Rectum |
|---|---|---|
| **Iron deficiency anaemia** (occult bleeding), fatigue | **Change in bowel habit**, alternating constipation/diarrhoea | **Rectal bleeding** (dark, mixed with stool) |
| Weight loss, **RIF mass** | Dark blood mixed with stool | **Tenesmus**, sense of incomplete evacuation |
| Obstruction is late (wide lumen, liquid stool) | **Obstruction** (narrow lumen, solid stool) — "apple-core" | Mucus discharge; palpable on **PR examination** |

Advanced: hepatomegaly, ascites, jaundice, perforation, fistula. Emergency presentation (obstruction/perforation) in ~20–30%.

### Investigations

- **Digital rectal examination** (many rectal cancers are palpable)
- CBC (anaemia), LFTs, renal function
- **Colonoscopy with biopsy — investigation of choice**; examine whole colon (synchronous tumours in ~5%); CT colonography if colonoscopy is incomplete
- **Staging: CT chest, abdomen and pelvis**
- **Rectal cancer: MRI pelvis** — T stage, nodes, **circumferential resection margin (CRM)**, extramural venous invasion; endorectal ultrasound for early tumours
- **CEA** — baseline and follow-up for recurrence (not for diagnosis)
- PET-CT for suspected recurrence or metastases; MSI/MMR testing

**Staging: TNM** (replaces Dukes' — A: within bowel wall, B: through wall, C: lymph nodes involved, D: distant metastases).

### Management — colon cancer

| Site | Operation |
|---|---|
| Caecum, ascending colon, hepatic flexure | **Right hemicolectomy** (ileocolic, right colic, right branch of middle colic) |
| Transverse colon | Extended right hemicolectomy / transverse colectomy |
| Splenic flexure, descending colon | Left hemicolectomy (extended right in some) |
| Sigmoid colon | **Sigmoid colectomy / high anterior resection** |

- Principles: **en-bloc resection** with **complete mesocolic excision**, high vascular ligation, ≥12 lymph nodes; laparoscopic surgery preferred
- **Adjuvant chemotherapy (FOLFOX/CAPOX)** for node-positive (stage III) and high-risk stage II disease

### Management — rectal cancer

- **Neoadjuvant chemoradiotherapy** (or short-course radiotherapy / total neoadjuvant therapy) for locally advanced tumours or threatened CRM
- **Total mesorectal excision (TME)** — key to reducing local recurrence

- Upper and middle rectum → **anterior resection** (low anterior resection with temporary **defunctioning loop ileostomy**)
- Low rectum involving sphincters → **abdominoperineal resection (APR)** with permanent end colostomy
- Early T1 tumours → transanal excision (TEMS/TAMIS); watch-and-wait for complete clinical response after neoadjuvant therapy (selected)
- **Emergency obstruction:** Hartmann's procedure, resection with anastomosis ± stoma, or self-expanding stent; right-sided → right hemicolectomy with primary anastomosis
- **Liver/lung metastases:** resection if limited (5-year survival up to 40%); palliative chemotherapy with targeted agents (bevacizumab, cetuximab for RAS wild-type), immunotherapy for MSI-high

**Complications of surgery: anastomotic leak** (commonest after low anterior resection), wound infection, ileus, bleeding, ureteric injury (left ureter), sexual and bladder dysfunction (pelvic nerve injury), **low anterior resection syndrome**, stoma problems.

**Screening and prevention:** faecal immunochemical test (FIT) or colonoscopy from age 45–50; colonoscopic surveillance after polypectomy; genetic counselling and **prophylactic colectomy in FAP**; colonoscopy every 1–2 years in Lynch syndrome.

> **Exam Alert:** Right-sided cancer presents with anaemia, left-sided with obstruction and altered bowel habit. Colonoscopy and biopsy for diagnosis; MRI pelvis for rectal cancer staging. TME is the gold standard for rectal cancer surgery. CEA is for follow-up, not diagnosis.

# Chapter 69: Volvulus and Intussusception

## Volvulus

**Definition:** Twisting of a loop of bowel around its own mesenteric axis, producing a **closed-loop obstruction** with a high risk of **strangulation**.

**Sigmoid volvulus (commonest, ~70%)**

- Elderly, institutionalised, constipated men; **chronic constipation**, high-fibre diet with **long, redundant sigmoid on a narrow mesentery** — **common in Pakistan, India, Africa, Eastern Europe ("volvulus belt")**; also psychiatric/neurological patients, Chagas
- **Clinical:** sudden colicky lower abdominal pain, **gross asymmetrical distension**, absolute constipation, late vomiting; previous similar episodes
- **Plain AXR:** massively dilated sigmoid loop — **"coffee-bean" / "bent inner tube" sign** pointing to right upper quadrant from the pelvis
- **CT: "whirl sign"** of twisted mesentery; signs of ischaemia
- **Management:** 1. Resuscitation, NG tube 2. **Endoscopic (flexible sigmoidoscopic) decompression** and insertion of a **flatus tube** (left for 24–48 h) — first-line if no peritonitis or ischaemia 3. **Elective sigmoid colectomy** in the same admission (recurrence up to 60% otherwise) 4. **Emergency laparotomy** for gangrene, perforation, peritonitis or failed decompression → **Hartmann's procedure** (or resection with anastomosis in selected stable patients)

**Caecal volvulus (~25%):** younger patients; mobile caecum (failure of fixation). AXR: dilated caecum displaced to **left upper quadrant** ("comma" or "embryo" sign). Endoscopic decompression rarely works → **right hemicolectomy**.

**Gastric volvulus:** see Chapter 49 (Borchardt's triad). **Midgut volvulus** in infants with malrotation: **bilious vomiting** in a neonate is a surgical emergency → upper GI contrast (corkscrew duodenum) → **Ladd's procedure**.

### Intussusception

**Definition:** Invagination (telescoping) of a proximal segment of bowel (**intussusceptum**) into the adjacent distal segment (**intussuscipiens**), causing obstruction and ischaemia.

**In children (commonest cause of obstruction from 3 months to 3 years; peak 6–9 months)**

- Usually **ileocolic**; **idiopathic** — hypertrophied **Peyer's patches** after viral infection (adenovirus, rotavirus) act as lead point
- **Pathological lead points (~5%, older children): Meckel's diverticulum**, polyp, lymphoma, Henoch–Schönlein purpura, duplication cyst
- **Clinical: paroxysmal screaming episodes** with drawing up of legs and pallor, settling between attacks; vomiting (later bilious); **"red-currant jelly" stools** (blood and mucus — late sign); **sausage-shaped mass** in right upper quadrant; empty right iliac fossa (**Dance's sign**); lethargy, shock
- **Investigation: ultrasound — "target" or "doughnut" sign** (transverse), "pseudokidney" sign (longitudinal)
- **Management:** 1. Resuscitation, NG tube, IV fluids, antibiotics 2. **Radiological reduction** — **air (pneumatic) enema** or hydrostatic (saline/contrast) enema under fluoroscopic or USG guidance — success ~80–90%; **contraindicated with peritonitis, perforation or shock** 3. **Surgery** (failed reduction, peritonitis, perforation, lead point): laparotomy/laparoscopy, **manual reduction by squeezing distal to proximal (never pulling)**, resection if non-viable or lead point

**In adults (rare, ~5% of obstructions)**

- **Pathological lead point in ~90%** — often **malignant** in colon (carcinoma, lymphoma, melanoma metastases), benign in small bowel (lipoma, polyp, Meckel's, Peutz–Jeghers polyps)
- Chronic intermittent pain, obstruction; CT **target sign**
- **Management: surgical resection** (usually without prior reduction, especially in the colon, because of malignancy risk)

> **Exam Alert:** Coffee-bean sign = sigmoid volvulus → sigmoidoscopic decompression, then elective sigmoid colectomy. Infant with screaming episodes, red-currant jelly stool and sausage mass = intussusception → USG target sign → air enema reduction. Adult intussusception needs resection.

## Chapter 70: Diverticular Disease and Meckel's Diverticulum

### Colonic Diverticular Disease

**Definitions**

- **Diverticulum:** an outpouching of the colonic wall; colonic diverticula are **false (pulsion) diverticula** — mucosa and submucosa herniating through the muscle at weak points where **vasa recta penetrate**
- **Diverticulosis:** presence of diverticula (usually asymptomatic)
- **Diverticular disease:** symptomatic diverticula
- **Diverticulitis:** inflammation/infection of diverticula

**Aetiology: low-fibre diet** → small hard stools → high intraluminal pressure; age (>60), obesity, smoking, NSAIDs, connective tissue weakness. **Sigmoid colon** is the commonest site in the West; right-sided diverticula are more common in Asians.

**Clinical features**

- Diverticular disease: intermittent left iliac fossa pain, bloating, altered bowel habit

- **Acute diverticulitis ("left-sided appendicitis"):** LIF pain and tenderness, fever, leucocytosis, possibly a tender mass
- **Bleeding:** sudden **painless, large-volume fresh rectal bleeding** (commoner from right-sided diverticula); usually stops spontaneously

**Complications — Hinchey classification of perforated diverticulitis**

| Stage | Description | Management |
|---|---|---|
| I | Pericolic abscess | Antibiotics ± percutaneous drainage |
| II | Pelvic / distant abscess | **CT-guided percutaneous drainage** + antibiotics |
| III | **Purulent peritonitis** | Laparoscopic lavage (selected) or **Hartmann's procedure** / resection with anastomosis |
| IV | **Faecal peritonitis** | **Hartmann's procedure** (resection, end colostomy, closed rectal stump) |

Other complications: **fistula** (**colovesical — commonest; pneumaturia, faecaluria, recurrent UTI**; colovaginal, colocutaneous), **stricture** (obstruction — must exclude carcinoma), haemorrhage.

**Investigations:** CBC, CRP; **CT abdomen with contrast — investigation of choice** in acute diverticulitis (thickening, fat stranding, abscess, free gas); **avoid colonoscopy/barium enema during the acute attack** (perforation risk) — **colonoscopy 6 weeks later to exclude carcinoma**; cystoscopy/CT for colovesical fistula; CT angiography/colonoscopy for bleeding.

**Management**

1. **Uncomplicated diverticulitis:** analgesia, clear fluids; **antibiotics selectively** (immunocompromised, systemic illness); outpatient if well
2. **Complicated:** admit, IV antibiotics, drainage of abscesses, surgery for peritonitis (as above)
3. **Elective sigmoid colectomy** for recurrent complicated attacks, fistula, stricture, or persistent symptoms
4. **Prevention: high-fibre diet**, fluids, weight loss, stop smoking
5. Bleeding: resuscitation, colonoscopic or angiographic control, resection if persistent

## Meckel's Diverticulum

**Definition:** A remnant of the **vitellointestinal (omphalomesenteric) duct**; a **true diverticulum** (all layers) on the **antimesenteric border of the ileum**.

**"Rule of 2s": 2%** of population, **2 feet (60 cm)** from the ileocaecal valve, **2 inches** long, **2 types of ectopic mucosa** (**gastric** — commonest, and pancreatic), symptomatic in **2%**, usually presents before **2 years**, **2:1** male to female.

**Complications / presentations**

- **Painless rectal bleeding in children** (ulceration of adjacent ileum by acid from ectopic gastric mucosa) — commonest in children
- **Intestinal obstruction** — commonest in adults: intussusception (lead point), volvulus around a fibrous band to umbilicus, **Littre's hernia** (Meckel's in a hernial sac)
- **Meckel's diverticulitis** — mimics appendicitis; perforation
- Umbilical fistula, sinus, cyst; tumours (carcinoid)

**Investigations: technetium-99m pertechnetate scan ("Meckel's scan")** — detects ectopic gastric mucosa; CT; diagnostic laparoscopy; often found incidentally at surgery.

**Management: symptomatic → diverticulectomy or segmental small bowel resection** (wedge/segmental resection if bleeding, to remove ulcer in adjacent ileum); incidental asymptomatic Meckel's — resection is debated (consider in young males, narrow neck, palpable ectopic tissue, fibrous band).

> **Exam Alert:** Colonic diverticula are false diverticula; Meckel's is a true diverticulum. CT is the investigation of choice in acute diverticulitis; colonoscopy only after 6 weeks. Hartmann's procedure for faecal peritonitis. Painless rectal bleeding in a child = Meckel's → technetium scan.

## Chapter 71: Intestinal Stomas

**Definition:** A stoma is a surgically created opening of the bowel (or urinary tract) onto the skin surface. Stomas may be **temporary** or **permanent**, **end** or **loop**.

**Purposes: diversion** (protect a distal anastomosis, perianal sepsis, fistula), **decompression** (obstruction), **exteriorisation** (perforation, ischaemic or injured bowel when anastomosis is unsafe), **evacuation/excretion** (after APR or panproctocolectomy), feeding (gastrostomy, jejunostomy).

### Ileostomy vs colostomy

| Feature | Ileostomy | Colostomy |
|---|---|---|
| Usual site | **Right iliac fossa** | **Left iliac fossa** (sigmoid/descending); transverse colostomy in upper abdomen |
| Spout | **Spouted (2–3 cm)** — protects skin from enzyme-rich effluent | **Flush** with skin (1–2 mm) |
| Output | **Liquid, continuous**, 500–1000 ml/day; rich in enzymes and sodium | **Formed stool**, intermittent |
| Skin problems | Common (enzymatic excoriation) | Less common |
| Dehydration and electrolyte loss | **High risk** (high-output stoma) | Low |
| Examples | Panproctocolectomy (end), protecting a low anterior resection (**loop**), subtotal colectomy for UC | **APR (permanent end)**, **Hartmann's procedure (end, potentially reversible)**, loop colostomy for obstruction/defunctioning |

### Types

- **End stoma:** one opening; bowel divided
- **Loop stoma:** loop of bowel brought out, opened on its antimesenteric side — two openings (afferent functioning, efferent non-functioning); quick, easy to reverse; usually temporary
- **Double-barrelled (Paul–Mikulicz) stoma** and mucous fistula: both ends brought out after resection
- **Continent ileostomy (Kock pouch)**, urostomy (ileal conduit — urology)

**Pre-operative preparation:** counselling by a **stoma care nurse**; **siting of the stoma** with the patient sitting, standing and lying — within the rectus muscle, on a flat area away from skin creases, scars, bony prominences, belt line, and visible to the patient; consider religious and cultural practices (prayer positions, cleanliness for salah).

### Complications

| Early | Late |
|---|---|
| **Ischaemia/necrosis** (dusky, black stoma) | **Parastomal hernia** (commonest late complication; colostomy > ileostomy) |

| Early | Late |
|---|---|
| Retraction | **Prolapse** (loop transverse colostomy) |
| **High output** → dehydration, hypokalaemia, hypomagnesaemia, acute kidney injury (ileostomy) | **Stenosis** |
| Bleeding, mucocutaneous separation | Skin excoriation, irritant/allergic dermatitis |
| Obstruction (food bolus, oedema) | Psychological, sexual and social problems; body image |
| Peristomal abscess | Recurrence of disease (Crohn's), varices (portal hypertension) |

**Management of high-output ileostomy (>1.5–2 L/day):** IV fluids and electrolytes; restrict hypotonic oral fluids; **oral rehydration solution (St Mark's solution)**; **loperamide** (before meals), codeine; PPI; treat cause (sepsis, obstruction, *C. difficile*).

**Reversal:** loop ileostomy usually closed at 8–12 weeks after confirming anastomotic healing (contrast enema/endoscopy); Hartmann's reversal is a major operation, done after 3–6 months in selected patients.

> **Exam Alert:** Ileostomy is spouted, in the RIF, with liquid output and risk of dehydration; colostomy is flush, in the LIF, with formed stool. Parastomal hernia is the commonest late complication. Pre-operative stoma siting by a stoma nurse is essential.

## Self-Assessment: Part 10 SBAs

**1.** A 55-year-old woman who had a hysterectomy 5 years ago has colicky central abdominal pain, bilious vomiting and distension for 24 hours. She is afebrile with no peritonism, and hernial orifices are normal. CT shows small bowel obstruction with a transition point and no signs of ischaemia. What is the initial management?

A. Colonoscopy · B. Emergency laparotomy · C. IV fluids, NG decompression and water-soluble contrast study · D. Oral laxatives · E. Rectal enema

**Answer: C.** Adhesive obstruction without strangulation — conservative trial.

**2.** A 70-year-old man with a known irreducible inguinal hernia has 12 hours of vomiting and distension, with constant pain, pulse 118/min, fever, and a tense, tender hernia. What is the next step?

A. Attempt forceful reduction (taxis) · B. Conservative management for 72 hours · C. Elective repair next week · D. Urgent surgical exploration and repair · E. Water-soluble contrast study

**Answer: D.** Strangulated hernia.

**3.** A 24-year-old woman has RIF pain for 18 hours, anorexia and vomiting. Her last period was 7 weeks ago. Which is the most important first investigation?

A. Abdominal X-ray · B. CT abdomen · C. Serum amylase · D. Urine or serum β-hCG · E. Urine culture

**Answer: D.** Exclude ectopic pregnancy.

**4.** A 28-year-old man has evening fever, weight loss and recurrent colicky abdominal pain with distension for 4 months. CT shows a thickened ileocaecal region, a pulled-up caecum and necrotic mesenteric nodes. Colonoscopic biopsy shows caseating granulomas. What is the mainstay of treatment?

A. Anti-tuberculous therapy for 6 months · B. Azathioprine · C. Infliximab · D. Oral prednisolone · E. Right hemicolectomy alone

**Answer: A.** Ileocaecal tuberculosis; surgery is reserved for complications.

**5.** A 22-year-old man has bloody diarrhoea 8 times a day, fever and tachycardia. Colonoscopy shows continuous inflammation from the rectum to the splenic flexure. After 3 days of IV hydrocortisone he has not improved and AXR shows a transverse colon of 7 cm. What is the most appropriate operation?

A. Hartmann's procedure · B. Ileocaecal resection · C. Restorative proctocolectomy with ileal pouch · D. Right hemicolectomy · E. Subtotal colectomy with end ileostomy

**Answer: E.** Acute severe UC with toxic megacolon; emergency subtotal colectomy is the safest operation.

**6.** A 60-year-old man has fatigue and iron deficiency anaemia but no bowel symptoms. A mass is palpable in the right iliac fossa. Colonoscopy and biopsy show adenocarcinoma of the caecum; CT shows no metastases. What is the appropriate operation?

A. Abdominoperineal resection · B. Anterior resection · C. Left hemicolectomy · D. Right hemicolectomy · E. Sigmoid colectomy

**Answer: D.** Caecal carcinoma.

**7.** A 75-year-old constipated man from a rural area has sudden lower abdominal pain and gross distension. AXR shows a massively dilated loop arising from the pelvis like a bent inner tube. There is no peritonism. What is the first-line treatment?

A. Barium enema · B. Emergency Hartmann's procedure · C. Flexible sigmoidoscopic decompression with flatus tube · D. Oral laxatives · E. Right hemicolectomy

**Answer: C.** Sigmoid volvulus, followed by elective sigmoid colectomy.

**8.** An 8-month-old baby has episodes of inconsolable screaming with drawing up of the legs, vomiting, and stools resembling red-currant jelly. Ultrasound shows a target sign in the right upper quadrant. There is no peritonitis. What is the treatment of choice?

A. Air enema reduction under imaging guidance · B. Barium meal · C. Emergency laparotomy · D. IV antibiotics only · E. Oral rehydration and observation

**Answer: A.** Intussusception.

**9.** A 65-year-old woman has LIF pain, fever and tenderness. CT shows sigmoid diverticulitis with a 5 cm pelvic abscess; there is no generalised peritonitis. What is the most appropriate management?

A. Colonoscopy now · B. CT-guided percutaneous drainage and IV antibiotics · C. Emergency Hartmann's procedure · D. Laxatives and discharge · E. Total colectomy

**Answer: B.** Hinchey II.

**10.** A 3-year-old boy has painless, large-volume dark red rectal bleeding. He is otherwise well. Which investigation is most likely to confirm the diagnosis?

A. Barium enema · B. Plain AXR · C. Technetium-99m pertechnetate scan · D. Ultrasound abdomen · E. Upper GI endoscopy

**Answer: C.** Meckel's diverticulum with ectopic gastric mucosa.

*References: Bailey & Love's Short Practice of Surgery, 28th Ed.; Blecha, Surgery, 4th Ed.*

PART 11

# Anorectal Disorders and Hernia

## Chapter 72: Haemorrhoids (Piles)

**Definition:** Symptomatic enlargement and distal displacement of the normal **anal vascular cushions** (submucosal tissue containing arteriovenous plexuses, smooth muscle and connective tissue) that help maintain continence.

**Position:** the three primary cushions lie at **3, 7 and 11 o'clock** with the patient in the **lithotomy position** (left lateral, right anterior, right posterior). Secondary piles lie between them.

**Aetiology: chronic constipation and straining**, low-fibre diet, prolonged sitting on the toilet (including mobile phone use), pregnancy, obesity, chronic cough, heavy lifting; ageing of supporting tissue. Portal hypertension causes **anorectal varices**, which are different from haemorrhoids.

**Types: internal** (above the **dentate line**, covered by insensitive mucosa — **painless**), **external** (below the dentate line, covered by sensitive anoderm — can be painful when thrombosed), mixed (interno-external).

### Goligher's classification of internal haemorrhoids

| Grade | Description | Treatment |
|---|---|---|
| **I** | Bleed but do not prolapse | Diet, fibre, fluids, topical agents, flavonoids; banding/sclerotherapy if persistent |
| **II** | Prolapse on straining, **reduce spontaneously** | **Rubber band ligation** (Barron's); sclerotherapy; infrared coagulation |
| **III** | Prolapse, need **manual reduction** | Banding (some); **haemorrhoidectomy**, stapled haemorrhoidopexy, HAL-RAR, **laser haemorrhoidoplasty** |
| **IV** | **Permanently prolapsed**, irreducible | **Haemorrhoidectomy** (Milligan–Morgan open or Ferguson closed) |

### Clinical features

- **Painless, bright red bleeding** at the end of defecation — "splash in the pan" or streaks on toilet paper, not mixed with stool
- Prolapse, mucus discharge, pruritus ani, perianal discomfort
- **Pain is not a feature** of uncomplicated internal piles — think of fissure, thrombosis or abscess

### Examination and investigations

- Inspection, **digital rectal examination** (piles are not palpable unless thrombosed), **proctoscopy** (diagnostic)
- **Rigid/flexible sigmoidoscopy**; **colonoscopy** if age >40–45, change in bowel habit, dark or mixed blood, anaemia, weight loss or family history — **never attribute rectal bleeding to piles without excluding colorectal cancer**
- CBC (anaemia)

### Management

1. **Conservative (all grades):** high-fibre diet (25–30 g/day), fluids, stool softeners (ispaghula husk), avoid straining and prolonged toilet sitting, sitz baths, topical anaesthetic/steroid creams (short courses), oral flavonoids (diosmin/hesperidin)
2. **Office procedures (grade I–III): rubber band ligation** (most effective office treatment; band placed **above the dentate line** — painless), injection sclerotherapy (5% phenol in almond oil), infrared coagulation
3. **Surgery (grade III–IV, failed office treatment, mixed piles):** - **Excisional haemorrhoidectomy** (Milligan–Morgan open, Ferguson closed) — most effective, lowest recurrence; more pain; preserve mucocutaneous bridges between wounds to prevent stenosis - **Stapled haemorrhoidopexy (PPH)** — less pain; higher recurrence - **Doppler-guided haemorrhoidal artery ligation with recto-anal repair (HAL-RAR / THD)** - **Laser haemorrhoidoplasty (LHP)** — a diode laser fibre is inserted into the haemorrhoidal tissue to shrink it from within; minimal post-operative pain, quick recovery, day-case; suitable for grade II–III piles

**Complications of piles:** anaemia, **thrombosis/strangulation** of prolapsed piles (severe pain, oedematous dark mass — analgesia, ice packs, stool softeners, bed rest; early or delayed surgery), ulceration, gangrene, rarely portal pyaemia.

**Thrombosed external haemorrhoid (perianal haematoma):** sudden painful bluish lump at the anal verge after straining; if presenting within 72 hours → **evacuation of clot under local anaesthesia**; later → conservative (resolves).

**Complications of haemorrhoidectomy: pain**, **urinary retention** (commonest early), reactionary or secondary haemorrhage (day 7–10, infection), **anal stenosis** (too much skin removed), incontinence, recurrence, fissure, infection.

> **Exam Alert:** Piles cause painless bright red bleeding; pain suggests another diagnosis. Primary piles are at 3, 7 and 11 o'clock. Exclude colorectal cancer in older patients with rectal bleeding. Rubber band ligation for grade II; haemorrhoidectomy for grade IV.

## Chapter 73: Anal Fissure (Fissure-in-Ano)

**Definition:** A longitudinal tear in the anoderm of the anal canal, **distal to the dentate line**.

**Site: posterior midline (6 o'clock) in ~90%** (least supported and least perfused area); anterior midline in ~10% of women (especially after childbirth). **Fissures off the midline or multiple fissures suggest secondary causes: Crohn's disease, tuberculosis**, syphilis, HIV, herpes, carcinoma, leukaemia.

**Pathogenesis:** passage of a hard stool tears the anoderm → pain → **spasm of the internal anal sphincter** → raised resting anal pressure → **reduced blood flow to the posterior anoderm (ischaemia)** → failure to heal → vicious cycle.

### Types

- **Acute** (<6 weeks): superficial tear with clean edges
- **Chronic** (>6 weeks): deep ulcer with exposed **internal sphincter fibres** in the base, indurated edges, and the classic triad of **sentinel pile (skin tag) at the distal end**, **hypertrophied anal papilla at the proximal end**, and the fissure itself

### Clinical features

- **Severe, sharp, tearing pain during and after defecation** lasting minutes to hours — cardinal symptom; patient fears passing stool
- Small amount of bright red blood on paper

- Constipation (from fear of pain)
- Common in young adults; also infants (commonest cause of rectal bleeding in infants)

**Examination:** gently part the buttocks — fissure seen at 6 o'clock, sentinel tag; **digital rectal examination and proctoscopy are usually too painful and should be avoided** at first visit (examine under anaesthesia if needed or if atypical).

**Investigations:** usually none; **EUA with biopsy** for atypical, lateral or non-healing fissures; colonoscopy if Crohn's suspected; anal manometry/endoanal ultrasound before surgery in women after childbirth or with incontinence.

### Management

1. **Conservative (acute fissures heal in most):** high-fibre diet, fluids, stool softeners/bulking agents, **warm sitz baths**, topical local anaesthetic (lidocaine gel), analgesia
2. **Chemical sphincterotomy (first-line for chronic fissure, 6–8 weeks):** - **Topical diltiazem 2%** (calcium channel blocker) — preferred, fewer side effects - Glyceryl trinitrate (GTN) 0.2–0.4% — **headache** is common - **Botulinum toxin injection** into the internal sphincter — second-line
3. **Surgery (failed medical treatment):** - **Lateral internal sphincterotomy (LIS)** — gold standard; divides the distal internal sphincter up to the apex of the fissure (or dentate line), usually at **3 o'clock**; **healing >90%**; risk of minor **incontinence to flatus/soiling** (higher in women) - **Fissurectomy** ± botulinum toxin; **advancement flap** (V–Y anoplasty) for patients at risk of incontinence - **Laser treatment** of the fissure is an emerging sphincter-sparing option in some centres - **Anal dilatation (Lord's) is obsolete** — uncontrolled sphincter damage

> **Exam Alert:** Posterior midline fissure; severe pain on defecation. Avoid PR examination in an acute fissure. Lateral or multiple fissures → suspect Crohn's or TB. Topical diltiazem first, then lateral internal sphincterotomy.

## Chapter 74: Anorectal Abscess

**Definition:** A collection of pus in the tissue spaces around the anus and rectum. Abscess and fistula are **two stages of the same disease** — the abscess is the acute phase, the fistula the chronic phase.

**Aetiology — cryptoglandular theory (~90%):** infection of an **anal gland** opening into an **anal crypt at the dentate line** → spreads into the intersphincteric space → tracks in different directions. Secondary causes: **Crohn's disease, tuberculosis**, diabetes, immunosuppression (HIV, chemotherapy), trauma, foreign body, malignancy, hidradenitis suppurativa.

**Organisms:** mixed — *E. coli*, *Bacteroides*, enterococci (gut origin → higher chance of fistula); *Staph. aureus* (skin origin → less likely to form a fistula).

### Classification by site

| Type | Frequency | Features |
|---|---|---|
| **Perianal** | **Commonest (~60%)** | Tender, red, fluctuant swelling at anal margin |
| **Ischiorectal (ischioanal)** | ~20–30% | Diffuse, indurated, tender swelling of buttock; fever; fluctuation late; can spread to opposite side (**horseshoe abscess** via deep postanal space) |
| **Intersphincteric** | ~5% | Severe deep pain, little external sign; tender bulge on PR |
| **Supralevator (pelvirectal)** | Rare | Deep pelvic pain, fever, urinary symptoms; tender mass above anorectal ring on PR; origin may be pelvic (diverticulitis, Crohn's) |

**Clinical features: throbbing, constant perianal pain** worsening over days, worse on sitting and walking; swelling; fever and malaise; spontaneous discharge of pus. Examine for tenderness and fluctuation; DRE (may need EUA).

**Investigations:** usually clinical; **blood sugar (exclude diabetes)**, CBC; **MRI pelvis or endoanal ultrasound** for deep, recurrent or complex abscesses; pus for culture (gut organisms suggest a fistula); HIV test and Crohn's work-up when indicated.

**Management**

- **Incision and drainage under anaesthesia — promptly; do not wait for fluctuation** (antibiotics alone are inadequate and allow spread into deeper spaces, with risk of sphincter destruction and necrotising infection)
- Incision close to the anal verge (keeps any later fistula tract short); **cruciate or elliptical incision with deroofing**, break loculi, pack or leave open; avoid damage to sphincters
- **Examine under anaesthesia** for an internal opening; if an obvious low fistula is found, an experienced surgeon may lay it open; otherwise place a **loose seton**
- Supralevator abscess: drain via the rectum if from an intersphincteric source, or via the skin if from an ischiorectal source (draining through the wrong route creates a complex fistula)
- **Antibiotics** only for cellulitis, diabetes, immunosuppression, valvular heart disease, or systemic sepsis
- Sitz baths, analgesia, stool softeners; daily dressing

**Complications: fistula-in-ano** (in ~30–50%), recurrence, **Fournier's gangrene** (necrotising fasciitis — especially in diabetics; emergency radical debridement), septicaemia, incontinence (iatrogenic).

> **Exam Alert:** Perianal abscess is the commonest type. Drain early; do not wait for fluctuation or rely on antibiotics alone. Always check blood sugar. Fistula-in-ano develops in up to half of patients.

## Chapter 75: Fistula-in-Ano

**Definition:** An abnormal chronic track lined by granulation tissue connecting an **internal opening in the anal canal (usually at the dentate line, in a crypt)** to an **external opening on the perianal skin**. Usually follows an anorectal abscess (cryptoglandular origin).

**Secondary causes: Crohn's disease, tuberculosis** (important in Pakistan), HIV, malignancy, radiation, trauma, lymphogranuloma venereum.

**Parks' classification (relation to the external sphincter)**

| Type | Frequency | Course |
|---|---|---|
| **Intersphincteric** | **Commonest (~45–70%)** | Through internal sphincter only, in the intersphincteric plane to skin |
| **Trans-sphincteric** | ~25–40% | Crosses both internal and external sphincters into the ischiorectal fossa |
| Suprasphincteric | ~5% | Loops above puborectalis, down through ischiorectal fossa |
| Extrasphincteric | ~1–3% | From rectum above levators, outside all sphincters (often iatrogenic, Crohn's, pelvic sepsis) |
| (Submucosal / superficial) | — | Below the sphincters entirely |

**Simple vs complex fistula: complex** = involves >30% of external sphincter, high trans-sphincteric, supra/extrasphincteric, anterior fistula in women, multiple tracks, horseshoe, recurrent, associated with Crohn's/TB/radiation, or pre-existing incontinence. Complex fistulae need **sphincter-preserving** operations.

**Goodsall's rule (predicts the internal opening)**

- Draw a transverse line through the centre of the anus
- External opening **anterior** to the line → track runs **radially straight** to the internal opening
- External opening **posterior** to the line → track **curves to the posterior midline (6 o'clock)**
- Exception: anterior openings >3 cm from the anal verge may also curve to the posterior midline

**Clinical features:** recurrent or persistent **discharge of pus, blood or mucus** from a perianal opening; pruritus; intermittent pain and swelling when the external opening closes and pus re-accumulates; history of previous abscess drainage. Examination: external opening with granulation tissue; palpable cord-like track; internal opening on DRE/proctoscopy.

**Investigations**

- **MRI pelvis (fistula protocol) — gold standard** for complex/recurrent fistulae: track, extensions, abscesses, relation to sphincters
- **Endoanal ultrasound** (with hydrogen peroxide enhancement)
- **Examination under anaesthesia (EUA)** with probing; injection of dilute hydrogen peroxide or methylene blue through the external opening to find the internal opening
- Biopsy of track/granulation (TB, Crohn's, malignancy); colonoscopy for Crohn's; chest X-ray; HIV
- Fistulogram (rarely), anal manometry

**Management** — the aims are to eradicate the track and preserve continence

1. **Fistulotomy (laying open)** — for **simple, low** fistulae (intersphincteric and low trans-sphincteric): the track is opened along a probe, curetted, and left to heal by secondary intention — high cure rate. **Fistulectomy** (coring out the track) is an alternative
2. **Seton:** - **Loose (draining) seton** — controls sepsis, drains the track; used in complex fistulae, Crohn's, and before definitive surgery - **Cutting seton** (tightened gradually) — traditional; **Ksharasutra** (medicated thread, widely used in South Asia) works on a similar principle; risk of incontinence
3. **Sphincter-preserving procedures (complex/high fistulae):** - **LIFT** (ligation of the intersphincteric fistula tract) - **Advancement flap** (endorectal mucosal flap closing the internal opening) - **FiLaC** (**fistula laser closure** — a radial-emitting diode laser fibre is passed along the track to destroy the epithelium and shrink the track, preserving the sphincter) - **VAAFT** (video-assisted anal fistula treatment) - Fibrin glue and anal fistula plug (lower success)
4. **Crohn's fistula:** loose seton + **biologics (infliximab/adalimumab)**; avoid aggressive surgery; diverting stoma or proctectomy in severe disease
5. **TB fistula:** anti-tuberculous therapy in addition to surgery

**Complications of treatment: recurrence** (commonest), **incontinence** (sphincter division), delayed healing, bleeding, anal deformity (keyhole deformity).

> **Exam Alert:** Goodsall's rule — posterior external openings track to the posterior midline. Intersphincteric is the commonest type. MRI is the gold standard for complex fistulae. Fistulotomy for low simple fistulae; sphincter-preserving procedures (LIFT, flap, FiLaC) or seton for complex ones.

## Chapter 76: Pilonidal Sinus

**Definition:** A sinus (blind track lined by granulation tissue) in the skin of the **natal cleft (sacrococcygeal region)**, usually containing **hair** (pilus = hair, nidus = nest).

**Aetiology — acquired theory (accepted):** loose hairs are driven into the skin of the deep natal cleft by friction and the suction of buttock movement → foreign body reaction → infection → sinus formation. Rarely occurs in barbers' hands (interdigital), axilla, umbilicus.

**Risk factors: young hairy men (15–35 years)**, deep natal cleft, **prolonged sitting** (drivers — "jeep disease" in World War II soldiers; office workers, students), obesity, poor hygiene, family history, sweating.

### Clinical features

- **Asymptomatic** midline pits (one or more) in the natal cleft, about 5 cm above the anus, often with **hair protruding**
- **Acute pilonidal abscess:** painful, red, tender, fluctuant swelling, usually **off the midline** (lateral, cranial)
- **Chronic sinus:** recurrent or persistent discharge of pus/blood, secondary openings lateral to the midline
- Rarely, squamous cell carcinoma in very long-standing disease

**Differential diagnosis:** perianal abscess/fistula-in-ano (connects to anal canal), hidradenitis suppurativa, furuncle, tuberculous sinus, osteomyelitis, sacrococcygeal dermoid.

**Investigations:** clinical diagnosis; blood sugar (recurrent infection); MRI rarely (complex/recurrent disease or suspected fistula).

### Management

1. **Asymptomatic pits:** hygiene, **hair removal** (shaving, depilatory creams, **laser epilation** — reduces recurrence), weight loss, avoid prolonged sitting
2. **Acute abscess: incision and drainage** — incise **off the midline** (heals better than midline wounds); antibiotics only for cellulitis; definitive surgery later
3. **Chronic sinus — definitive treatment options**

| Procedure | Description | Comment |
|---|---|---|
| **Excision and laying open** (healing by secondary intention) | Wide excision down to presacral fascia, wound packed | Low recurrence but **slow healing (weeks to months)**, daily dressings |
| **Excision with primary midline closure** | Excise and close in the midline | Faster healing but **high recurrence and wound breakdown** — avoid |
| **Off-midline closure / flap procedures** | **Karydakis procedure**, **Bascom cleft lift**, **Limberg (rhomboid) flap** | **Flatten the natal cleft** and place the scar away from the midline → low recurrence, faster healing; preferred for extensive or recurrent disease |
| **Minimally invasive** | **Pit picking (Bascom I, Gips trephine)**, **EPSiT** (endoscopic pilonidal sinus treatment), **SiLaC** (**sinus laser closure** — a radial laser fibre destroys the sinus epithelium after hair and debris are cleared) | Small wounds, minimal pain, rapid return to work/study; good for primary, limited disease |
| Phenol injection | Chemical destruction of the track | Simple; variable success |

4. **Post-operative care:** keep the area clean and hair-free (laser epilation), avoid prolonged sitting, wound care

**Complications:** recurrence (commonest; 10–40% depending on method), wound infection and breakdown, delayed healing, rarely malignant change.

> **Exam Alert:** Young hairy men who sit a lot; midline pits in the natal cleft. Drain abscesses off the midline. Avoid midline primary closure; off-midline flaps (Karydakis, Limberg, Bascom) and minimally invasive options (pit picking, EPSiT, laser) reduce recurrence.

# Chapter 77: Inguinal Hernia

**Definition:** A hernia is the protrusion of a viscus or part of a viscus through an abnormal opening in the walls of its containing cavity. Inguinal hernia is the **commonest hernia (~75% of abdominal wall hernias)**, far commoner in men (about 9:1); the **right side** is more often affected.

**Anatomy of the inguinal canal (4 cm long, above the medial half of the inguinal ligament)**

- **Deep ring:** opening in transversalis fascia, **1.25 cm above the midpoint of the inguinal ligament** (midway between ASIS and pubic tubercle), **lateral to the inferior epigastric vessels**
- **Superficial ring:** opening in external oblique aponeurosis, **above and medial to the pubic tubercle**
- **Walls ("MALT"):** roof — **M**uscles (internal oblique, transversus abdominis arching fibres); anterior — **A**poneurosis of external oblique; floor — **L**igaments (inguinal and lacunar); posterior — **T**ransversalis fascia and conjoint **T**endon
- **Contents:** spermatic cord (male) or round ligament (female), **ilioinguinal nerve**
- **Hesselbach's triangle:** inferior epigastric vessels (lateral), lateral border of rectus sheath (medial), inguinal ligament (inferior) — site of direct hernia

**Indirect vs direct inguinal hernia**

| Feature | Indirect | Direct |
|---|---|---|
| Frequency | **Commoner** (~65%); all ages, **children** (patent processus vaginalis) | Older men; acquired weakness of posterior wall |
| Route | Through **deep ring**, along canal, **lateral to inferior epigastric vessels** | Through **Hesselbach's triangle**, **medial to inferior epigastric vessels** |
| Sac | Within the cord (congenital sac) | Behind the cord, broad neck |
| Descent into scrotum | **Common** | Rare |
| Deep ring occlusion test | **Controlled** by pressure over deep ring | **Not controlled** |
| Shape | Elliptical, oblique | Round, symmetrical; reduces on lying down |
| Strangulation | **More common** (narrow neck) | Rare (wide neck) |
| Bilateral | Less | Often |

**Pantaloon hernia:** both direct and indirect sacs straddling the inferior epigastric vessels.

**Risk factors (raised intra-abdominal pressure and weakness):** chronic cough (smoking, COPD, TB), **constipation**, **straining at micturition (BPH — check prostate in elderly men)**, heavy lifting, obesity, ascites, pregnancy, previous appendicectomy (ilioinguinal nerve injury), connective tissue disorders.

**Clinical features:** groin swelling appearing on standing, coughing or straining, disappearing on lying; dragging discomfort. Examination standing and lying: **cough impulse**, reducibility, "getting above the swelling" (cannot — extends into canal), relation to pubic tubercle (**inguinal hernia above and medial; femoral below and lateral**); examine the opposite side, scrotum, abdomen, prostate and chest.

**Differential diagnosis:** femoral hernia, hydrocele, encysted hydrocele of cord, varicocele, undescended/ectopic testis, saphena varix, lymph nodes, lipoma of cord, psoas abscess, femoral aneurysm.

**Investigations:** usually clinical; **ultrasound** for occult or uncertain hernia; CBC, blood sugar, chest X-ray (cough), urine flow/PSA if prostatism; fitness for surgery.

**Complications: irreducibility (incarceration)**, **obstruction** (colicky pain, vomiting, distension), **strangulation** (tense, tender, irreducible, no cough impulse, overlying redness, systemic signs —

emergency), Richter's hernia (only part of bowel wall trapped — strangulation without obstruction), Littre's hernia (Meckel's diverticulum), Maydl's hernia (W-loop — strangulated loop lies in the abdomen), sliding hernia (viscus forms part of the sac wall).

### Management

1. **Elective repair** for symptomatic hernias (watchful waiting acceptable for minimally symptomatic hernias in men, but most become symptomatic)
2. **Lichtenstein tension-free mesh repair (open)** — gold standard open repair, under local, spinal or general anaesthesia; polypropylene mesh
3. **Laparoscopic repair — TEP (totally extraperitoneal) or TAPP (transabdominal preperitoneal)** — preferred for **bilateral** and **recurrent** hernias (after open repair), and in women; less pain, faster return to work
4. Tissue repairs: **Shouldice** (multilayer), Bassini, Desarda — when mesh is unavailable or contraindicated (contamination)
5. **Children: herniotomy** (ligation and excision of the sac at the deep ring, no repair of the posterior wall) — operate soon after diagnosis (high incarceration risk in infants)
6. **Obstructed or strangulated hernia:** emergency surgery — resuscitation, NG tube, explore, assess bowel viability, resect non-viable bowel, repair (mesh can often be used in clean-contaminated fields; tissue repair if gross contamination)
7. Treat predisposing causes (cough, constipation, prostatism) before elective repair

**Complications of repair:** haematoma, seroma, wound infection, urinary retention, **chronic groin pain** (ilioinguinal, iliohypogastric, genitofemoral nerve entrapment), **recurrence** (1–5%), **ischaemic orchitis and testicular atrophy** (cord damage), injury to vas, mesh infection, bladder/bowel injury (laparoscopic).

> **Exam Alert:** Indirect hernia passes lateral to the inferior epigastric vessels and is controlled by deep-ring occlusion. Inguinal hernias lie above and medial to the pubic tubercle. Lichtenstein mesh repair is the gold standard open repair; laparoscopic repair for bilateral and recurrent hernias. Herniotomy alone in children.

## Chapter 78: Femoral Hernia

**Definition:** Protrusion of abdominal contents through the **femoral ring** into the **femoral canal**, the medial compartment of the femoral sheath.

### Anatomy of the femoral ring (boundaries)

- **Anterior:** inguinal ligament
- **Posterior:** pectineal ligament (Cooper's ligament) over the pectineus
- **Medial: lacunar ligament** (sharp edge — responsible for strangulation)
- **Lateral:** femoral vein

The femoral canal normally contains fat, lymphatics and the **lymph node of Cloquet**.

**Epidemiology:** more common in **women** (wider pelvis, pregnancy) — but **inguinal hernia is still the commonest hernia in women**; rare in children; more common on the right.

### Clinical features

- Small, globular swelling in the groin **below and lateral to the pubic tubercle**
- Often irreducible and with little or no cough impulse (narrow neck, fat)
- May turn upward over the inguinal ligament after emerging through the saphenous opening

- **Frequently presents for the first time with obstruction or strangulation** — always examine the groins in a woman with small bowel obstruction
- **Richter's hernia** is common at the femoral site (part of bowel wall trapped — strangulation with vomiting but without complete obstruction)

**Differential diagnosis:** inguinal hernia, **saphena varix** (cough thrill, disappears on lying, blue tinge, varicose veins), enlarged femoral lymph node, lipoma, femoral artery aneurysm, psoas abscess, ectopic testis.

**Investigations:** clinical; ultrasound or CT if uncertain; CT in intestinal obstruction.

**Management: all femoral hernias should be repaired, preferably soon after diagnosis**, because the risk of **strangulation is the highest of all groin hernias** (~20–40%).

**Approaches**

| Approach | Description | Use |
|---|---|---|
| **Low (Lockwood) — infra-inguinal** | Incision below inguinal ligament over the swelling | Elective, uncomplicated hernia |
| **High (McEvedy) — pararectal / extraperitoneal** | Vertical incision over the femoral canal, approach from above via preperitoneal space | **Strangulated hernias** — good access to bowel for resection |
| **Inguinal (Lotheissen)** | Through inguinal canal floor | Weakens inguinal canal; less used |
| **Laparoscopic (TEP/TAPP)** | Mesh covering the myopectineal orifice | Elective; repairs all groin defects |

**Principle:** reduce contents, excise sac, close the femoral canal by suturing the inguinal ligament to the pectineal ligament (avoiding compression of the femoral vein), or plug/mesh repair. In strangulation, the **lacunar ligament may be incised** (beware of an **abnormal obturator artery** running along it — "corona mortis").

**Complications:** strangulation, bowel resection, **femoral vein injury or compression** (DVT), wound infection, recurrence.

> **Exam Alert:** Femoral hernia is below and lateral to the pubic tubercle, commoner in women, and has the highest strangulation risk — repair all femoral hernias. Use the high (McEvedy) approach for strangulated hernias.

# Chapter 79: Umbilical, Paraumbilical, Epigastric and Incisional Hernias

## Umbilical Hernia (True, Congenital) — Infants

- Herniation through a **weak umbilical scar** at the umbilical ring; common in infants (more in **Black African** children, premature babies, Down syndrome, hypothyroidism)
- Soft, reducible, painless; protrudes on crying; strangulation is **rare**
- **Most close spontaneously by 2–4 years** — observe
- **Repair** if persisting beyond 4–5 years, large defect (>1.5–2 cm), symptomatic, or incarceration: **Mayo's repair or simple sutured repair** through a curved infra-umbilical incision
- **Avoid strapping or coins** — ineffective and can cause skin damage

## Paraumbilical Hernia — Adults

- Herniation through the **linea alba just above or below the umbilicus** (not through the umbilical scar itself); the umbilicus is pushed into a crescent shape
- **Obese, multiparous middle-aged women**, ascites, chronic cough
- Narrow neck relative to contents → **high risk of incarceration and strangulation**; contents often omentum or transverse colon
- Skin overlying may become thin, intertrigo, ulcerated
- **Management:** repair all; **open mesh repair** (sublay/preperitoneal) for defects >1–2 cm, laparoscopic IPOM for larger or multiple defects; sutured repair for small defects; Mayo's "vest-over-pants" repair is now largely replaced by mesh; weight loss beforehand helps

## Epigastric Hernia

- Protrusion of **extraperitoneal fat** (sometimes a peritoneal sac) through a defect in the **linea alba between the xiphisternum and umbilicus**
- Young to middle-aged men, manual workers; often multiple
- Small, firm, tender lump; may cause **epigastric pain mimicking peptic ulcer** (exclude peptic ulcer and gallstones)
- Often no cough impulse (fat only)
- **Management:** sutured repair or small mesh; laparoscopic for multiple defects; associated **divarication of recti** (diastasis) is not a true hernia and does not need surgery unless symptomatic

## Incisional Hernia

**Definition:** Hernia through a defect in a previous surgical scar. Occurs in **10–20% of laparotomies**; most appear within the first 1–3 years.

### Risk factors

- **Patient:** obesity, smoking, diabetes, malnutrition, jaundice, uraemia, steroids, chemotherapy, chest infection/chronic cough, ascites, old age
- **Wound: wound infection (most important)**, haematoma, poor closure technique (suture length to wound length ratio <4:1, wrong suture material), **midline and vertical incisions**, emergency surgery, drains through the wound, burst abdomen

**Clinical features:** bulge in the scar on standing, coughing or straining; discomfort; wide neck (usually less risk of strangulation than narrow-necked hernias, but multiloculated hernias can obstruct); skin changes over large hernias; **loss of domain** in giant hernias (contents live outside the abdomen).

**Investigations:** clinical; **CT abdomen** for size of defect, contents, loss of domain and occult defects; optimise comorbidities.

### Management

1. **Pre-operative optimisation:** weight loss, **stop smoking**, control diabetes, treat cough; **progressive pneumoperitoneum** or **botulinum toxin** to lateral abdominal muscles for giant hernias with loss of domain
2. **Mesh repair** (sutured repair has high recurrence) — **open sublay (retromuscular, Rives–Stoppa)** is the preferred open technique; onlay; **laparoscopic IPOM** (intraperitoneal onlay mesh with tissue-separating mesh)
3. **Component separation** (anterior or **transversus abdominis release**) for large defects to allow midline closure
4. Abdominal binder for unfit patients

**Prevention: small-bite closure (5 mm bites, 5 mm apart)** with slowly absorbable monofilament suture, **suture-to-wound length ratio ≥4:1**; prophylactic mesh in high-risk patients; avoid wound infection.

**Complications of repair:** seroma (commonest), wound infection, mesh infection, recurrence, bowel injury, adhesions/fistula (intraperitoneal mesh), abdominal compartment syndrome (giant hernias).

> **Exam Alert:** Umbilical hernias in infants usually close by 4 years — observe. Paraumbilical hernias in adults (obese women) have a high strangulation risk — repair. Wound infection is the main risk factor for incisional hernia; prevent it with small-bite closure at a 4:1 ratio.

## Self-Assessment: Part 11 SBAs

**1.** A 35-year-old man has painless bright red bleeding at the end of defecation. Proctoscopy shows haemorrhoids at 3, 7 and 11 o'clock that prolapse on straining and return spontaneously. What is the most appropriate treatment after dietary advice?

A. Lateral internal sphincterotomy · B. Milligan–Morgan haemorrhoidectomy · C. Observation without treatment · D. Rubber band ligation · E. Stapled haemorrhoidopexy

**Answer: D.** Grade II haemorrhoids.

**2.** A 58-year-old man has had rectal bleeding mixed with stool and a change in bowel habit for 2 months. Proctoscopy shows grade I haemorrhoids. What is the next step?

A. Colonoscopy · B. Haemorrhoidectomy · C. Rubber band ligation · D. Sclerotherapy · E. Topical steroid cream and review

**Answer: A.** Colorectal cancer must be excluded; dark or mixed blood and altered habit are not explained by piles.

**3.** A 25-year-old woman has severe tearing anal pain during defecation for 3 months, with a little fresh blood on the paper. Parting the buttocks shows a posterior midline tear with a skin tag at its lower end. What is the first-line treatment?

A. Anal dilatation · B. Fistulotomy · C. Haemorrhoidectomy · D. Lateral internal sphincterotomy · E. Topical diltiazem with stool softeners

**Answer: E.** Chronic anal fissure — chemical sphincterotomy first; surgery if it fails.

**4.** A 30-year-old man has a fissure at the 3 o'clock position along with perianal skin tags, abdominal pain and weight loss. What is the most likely underlying diagnosis?

A. Constipation alone · B. Crohn's disease · C. Haemorrhoids · D. Irritable bowel syndrome · E. Pilonidal sinus

**Answer: B.** A lateral fissure suggests a secondary cause such as Crohn's or TB.

**5.** A 45-year-old diabetic man has a 4-day history of throbbing perianal pain and fever. There is a tender, red, indurated swelling at the anal margin without definite fluctuation. What is the most appropriate management?

A. Await fluctuation before drainage · B. Incision and drainage under anaesthesia · C. Oral antibiotics and review in a week · D. Sitz baths only · E. Topical anaesthetic cream

**Answer: B.** Perianal abscess — drain early.

**6.** A man has a fistula with an external opening at 5 o'clock, 2 cm from the anal verge, in the lithotomy position. According to Goodsall's rule, where is the internal opening most likely to be?

A. 3 o'clock · B. 5 o'clock · C. 6 o'clock (posterior midline) · D. 9 o'clock · E. 12 o'clock (anterior midline)

**Answer: C.** Posterior external openings track in a curve to the posterior midline.

**7.** A 40-year-old woman has a recurrent anal fistula after two previous operations and has mild faecal incontinence. Which investigation should be done before further surgery?

A. Barium enema · B. CT abdomen · C. MRI pelvis (fistula protocol) · D. Plain X-ray pelvis · E. Ultrasound abdomen

**Answer: C.** MRI is the gold standard for complex and recurrent fistulae.

**8.** A 22-year-old hairy male driver has recurrent discharge from two small midline pits in the natal cleft, 5 cm above the anus. What is the least appropriate surgical option?

A. Bascom cleft lift · B. Endoscopic pilonidal sinus treatment · C. Excision with primary midline closure · D. Karydakis procedure · E. Limberg flap

**Answer: C.** Midline closure has the highest recurrence and wound breakdown rates.

**9.** A 6-year-old boy has a reducible right groin swelling extending into the scrotum. What is the appropriate operation?

A. Bassini repair · B. Herniotomy · C. Laparoscopic TEP repair with mesh · D. Lichtenstein mesh repair · E. Shouldice repair

**Answer: B.** Congenital indirect hernia from a patent processus vaginalis — ligation of the sac alone.

**10.** A 68-year-old woman has colicky abdominal pain, vomiting and distension for 2 days. She has never had surgery. Examination shows a small, tender, irreducible lump below and lateral to the right pubic tubercle. What is the most likely diagnosis?

A. Direct inguinal hernia · B. Incisional hernia · C. Indirect inguinal hernia · D. Obstructed femoral hernia · E. Saphena varix

**Answer: D.** Femoral hernias lie below and lateral to the pubic tubercle and often present with obstruction.

*References: Bailey & Love's Short Practice of Surgery, 28th Ed.; Blecha, Surgery, 4th Ed.*

PART 12

# Genitourinary

## Chapter 80: Urolithiasis (Urinary Stones)

**Importance:** Pakistan lies in the **Afro-Asian "stone belt"** — hot climate, dehydration and diet make urinary stones very common, including **bladder stones in children**.

**Risk factors: dehydration** (hot climate, low fluid intake), high salt and animal protein, family history, male sex, obesity, hyperparathyroidism, gout, recurrent UTI (urease-producing *Proteus*), urinary stasis (obstruction, diverticula, horseshoe kidney), immobilisation, drugs (indinavir, topiramate), Crohn's/ileal resection (enteric hyperoxaluria), renal tubular acidosis, cystinuria.

### Types of stones

| Stone | Frequency | Features |
|---|---|---|
| **Calcium oxalate** | **Commonest (~70–80%)** | Radio-opaque; spiky (monohydrate hard); hypercalciuria, hyperoxaluria, hypocitraturia |
| Calcium phosphate | ~10% | Radio-opaque; renal tubular acidosis, hyperparathyroidism |
| **Struvite (magnesium ammonium phosphate, "triple phosphate")** | ~10–15% | **Urease-splitting organisms (*Proteus*)**, alkaline urine; **staghorn calculi**; women |
| **Uric acid** | ~5–10% | **Radiolucent** on X-ray (visible on CT); gout, acidic urine, chemotherapy; dissolves with urinary alkalinisation |
| Cystine | ~1% | Faintly radio-opaque; autosomal recessive cystinuria; hexagonal crystals |

### Clinical features

- **Renal/ureteric colic:** sudden, severe, colicky **loin pain radiating to the groin**, testis or labia; patient restless (rolls about — unlike peritonitis); nausea, vomiting
- Lower ureteric/vesicoureteric junction stone: **frequency, urgency, strangury**, pain at tip of penis
- **Haematuria** (microscopic in ~85%)
- Renal stones may be asymptomatic or cause dull loin ache; infection; **staghorn** — recurrent UTI, silent loss of renal function
- **Bladder stone:** interruption of stream, pain at tip of penis at end of micturition, haematuria, children pulling penis
- **Danger: obstructed infected kidney (fever + obstruction) — urological emergency**

### Investigations

- **Urine R/E** (blood, crystals, pus cells, pH), culture
- CBC, creatinine, electrolytes, **calcium, uric acid**, CRP; β-hCG in women
- **Non-contrast CT KUB — investigation of choice** (sensitivity >95%; detects all stones including uric acid; shows hydronephrosis)

- **Ultrasound** — first-line in **pregnancy and children**; shows hydronephrosis and renal/bladder stones
- **Plain X-ray KUB** — follow-up of radio-opaque stones
- IVU (historical); DTPA/MAG3 renogram for split function
- Stone analysis and **24-hour urine metabolic screen** in recurrent stone formers

**Management**

**1. Acute renal colic**

- **Analgesia: NSAIDs (diclofenac IM/PR) are first-line**; opioids if needed; antiemetics
- Hydration (not forced diuresis)
- **Medical expulsive therapy: tamsulosin** (alpha-blocker) for distal ureteric stones 5–10 mm
- **Chance of spontaneous passage:** <5 mm ~70–90%; 5–10 mm ~50%; >10 mm unlikely

**2. Emergency decompression** — for **infected obstructed kidney (pyonephrosis)**, obstruction of a single kidney, bilateral obstruction, anuria, uncontrollable pain or renal failure: **percutaneous nephrostomy** or **retrograde ureteric (DJ) stent**, with IV antibiotics. Definitive stone treatment later.

**3. Definitive stone removal**

| Stone | Treatment |
|---|---|
| Renal stone <2 cm | **Extracorporeal shock wave lithotripsy (ESWL)** or **flexible ureteroscopy with laser (RIRS)** |
| **Renal stone >2 cm, staghorn** | **Percutaneous nephrolithotomy (PCNL)** |
| Ureteric stone (persistent, large) | **Ureteroscopy with laser lithotripsy (URS)** or ESWL |
| Bladder stone | **Cystolitholapaxy** (endoscopic) or open cystolithotomy; treat outflow obstruction |
| Uric acid stones | **Urinary alkalinisation (potassium citrate)**, allopurinol — dissolution |
| Open/laparoscopic surgery | Rarely (complex anatomy, failed endourology) |

**Prevention: drink 2.5–3 litres of fluid daily** (urine output >2 L), reduce salt and animal protein, normal dietary calcium (low-calcium diets increase stone risk), reduce oxalate-rich foods, lemon juice/citrate; thiazides for hypercalciuria; allopurinol for hyperuricosuria; treat hyperparathyroidism and infection.

**Complications:** obstruction, **hydronephrosis**, infection, **pyonephrosis**, renal failure, ureteric stricture, squamous cell carcinoma (chronic irritation in bladder/renal pelvis — rare).

> **Exam Alert:** Non-contrast CT KUB is the investigation of choice. Uric acid stones are radiolucent and dissolve with alkalinisation. Infected obstructed kidney = emergency drainage (nephrostomy or stent). NSAIDs are first-line analgesia for colic.

# Chapter 81: Benign Prostatic Hyperplasia and Urinary Retention

## Benign Prostatic Hyperplasia (BPH)

**Definition:** Non-malignant hyperplasia of glandular and stromal tissue of the prostate, arising in the **transition zone** (periurethral), causing bladder outlet obstruction. Present in ~50% of men at 60 and ~90% at 85.

**Pathogenesis:** requires **testosterone converted to dihydrotestosterone (DHT) by 5α-reductase**; age-related hormonal changes. (Carcinoma usually arises in the **peripheral zone** — palpable on DRE.)

### Clinical features — lower urinary tract symptoms (LUTS)

- **Voiding (obstructive):** hesitancy, poor/weak stream, intermittency, straining, terminal dribbling, incomplete emptying
- **Storage (irritative):** frequency, **nocturia**, urgency, urge incontinence
- **Complications: acute urinary retention**, chronic retention with **overflow incontinence**, recurrent UTI, **bladder stones**, haematuria, bladder diverticula, **obstructive uropathy** (hydronephrosis, renal failure), inguinal hernia and haemorrhoids (straining)

### Assessment

- **International Prostate Symptom Score (IPSS)** — mild 0–7, moderate 8–19, severe 20–35; frequency–volume chart
- **DRE: smooth, firm, rubbery, enlarged**, median sulcus preserved (vs **hard, nodular, irregular, obliterated sulcus in carcinoma**)
- Urine R/E and culture, **creatinine**
- **PSA** (after counselling) — raised in BPH, infection, retention, carcinoma
- **Ultrasound:** prostate volume, **post-void residual (PVR)**, upper tract dilatation, bladder stones
- **Uroflowmetry:** Qmax <10 ml/s suggests obstruction; urodynamics in selected cases
- Cystoscopy if haematuria or before surgery

### Management

1. **Watchful waiting** + lifestyle (mild symptoms): reduce evening fluids, caffeine and alcohol, double voiding, bladder training
2. **Medical** - **Alpha-1 blockers (tamsulosin, alfuzosin)** — relax prostatic smooth muscle; rapid onset; side effects: postural hypotension, retrograde ejaculation, floppy iris syndrome in cataract surgery - **5α-reductase inhibitors (finasteride, dutasteride)** — shrink large prostates (>30–40 ml) over 6 months; reduce retention and surgery risk; **halve PSA**; sexual side effects - **Combination therapy** for large prostates with moderate–severe symptoms - Antimuscarinics/beta-3 agonists for storage symptoms; PDE5 inhibitors (tadalafil)
3. **Surgical — indications: refractory/recurrent urinary retention**, failed medical therapy, recurrent UTI, **bladder stones**, recurrent haematuria, **renal impairment due to obstruction**, large bladder diverticula - **Transurethral resection of prostate (TURP)** — gold standard (glands 30–80 ml) - **Holmium laser enucleation (HoLEP)**, photoselective vaporisation (GreenLight), bipolar TURP/enucleation - **Open (Millin's retropubic or transvesical) prostatectomy** for very large glands (>80–100 ml) or with large bladder stones - Minimally invasive: Urolift, Rezum, prostatic artery embolisation

**Complications of TURP:** bleeding, clot retention, infection, **TUR syndrome** (absorption of glycine irrigation → **dilutional hyponatraemia**, confusion, hypertension then hypotension, bradycardia, seizures; reduced with bipolar saline TURP), **retrograde ejaculation** (commonest late, ~70%), urethral stricture, bladder neck contracture, incontinence, erectile dysfunction, recurrence.

## Urinary Retention

| Feature | Acute retention | Chronic retention |
|---|---|---|
| Pain | **Painful**, inability to pass urine | **Painless** |
| Volume | Usually 500–1000 ml | Often >1000 ml, large residual |
| Features | Palpable, tender bladder | **Overflow incontinence, nocturnal enuresis**; may have hydronephrosis and **renal failure** (high-pressure) |

| Feature | Acute retention | Chronic retention |
|---|---|---|
| Causes | BPH (commonest), constipation, drugs (anticholinergics, opioids, alcohol), post-operative (anorectal/hernia surgery, spinal), UTI, clot, stricture, neurological | BPH, stricture, neurogenic bladder (diabetes, spinal) |

**Management of acute retention: urethral catheterisation** (14–16 Fr); **suprapubic catheter** if urethral fails or is contraindicated (urethral trauma — blood at meatus); record residual volume; treat cause (constipation, drugs, UTI); start alpha-blocker and **trial without catheter (TWOC)** after 2–3 days; surgery if TWOC fails.

**Chronic high-pressure retention:** catheterise; monitor for **post-obstructive diuresis** (urine output >200 ml/h) — replace fluids and electrolytes; check creatinine; definitive surgery once renal function stabilises.

> **Exam Alert:** BPH arises in the transition zone; carcinoma in the peripheral zone. TURP is the gold standard surgery; retrograde ejaculation is its commonest late effect; TUR syndrome causes hyponatraemia. Watch for post-obstructive diuresis after draining chronic retention.

# Chapter 82: Renal Tumours — Renal Cell Carcinoma and Wilms' Tumour

## Renal Cell Carcinoma (RCC, Hypernephroma, Grawitz Tumour)

**Overview:** The commonest primary renal malignancy in adults (~90%), arising from the **proximal convoluted tubule epithelium**. Peak age 50–70; male:female about 2:1. Increasingly found **incidentally** on ultrasound/CT (more than half of cases).

**Risk factors: smoking**, obesity, hypertension, acquired cystic disease in **dialysis patients**, **von Hippel–Lindau syndrome** (VHL gene — bilateral, multiple, young), tuberous sclerosis, occupational exposure (cadmium, trichloroethylene).

**Pathology: clear cell (~75%, commonest)**, papillary (~15%), chromophobe (~5%), collecting duct (rare, aggressive). Benign mimics: oncocytoma, **angiomyolipoma** (fat on CT; tuberous sclerosis; risk of bleeding if >4 cm).

**Spread:** direct into perinephric fat; **into the renal vein and IVC (tumour thrombus)**, even to the right atrium; lymphatic (para-aortic); **blood — lungs ("cannonball" metastases), bone (lytic, pulsatile), liver, brain**.

### Clinical features

- **Classic triad (only ~10%): haematuria, loin pain, palpable flank mass** — indicates advanced disease
- Painless haematuria (commonest symptom)
- **Left-sided varicocele** that does not empty on lying (left testicular vein obstructed by tumour in left renal vein)
- Constitutional: fever (pyrexia of unknown origin), weight loss, night sweats
- **Paraneoplastic syndromes ("internist's tumour"): polycythaemia** (erythropoietin), **hypercalcaemia** (PTHrP), hypertension (renin), Cushing's, **Stauffer's syndrome** (reversible hepatic dysfunction without metastases), anaemia, raised ESR
- Symptoms of metastases: cough, haemoptysis, bone pain, pathological fracture

### Investigations

- Urine R/E (haematuria), CBC (anaemia/polycythaemia), ESR, creatinine, calcium, LFTs
- **Ultrasound** — solid vs cystic mass

- **Contrast-enhanced CT abdomen (triphasic) — investigation of choice:** enhancing solid mass; staging, renal vein/IVC involvement, nodes, contralateral kidney function
- **CT chest** — lung metastases; bone scan if bone pain/raised ALP; MRI for IVC thrombus extent
- **Biopsy** — not routine (only for small masses before ablation/surveillance, metastatic disease before systemic therapy, or suspected lymphoma/metastasis)
- **Bosniak classification** for cystic renal lesions (I–IV; III and IV need surgery)

**Management**

1. **Localised disease:** - **Partial nephrectomy (nephron-sparing)** — preferred for **T1 tumours (≤7 cm)**, bilateral tumours, solitary kidney, VHL - **Radical nephrectomy** (kidney, perinephric fat within Gerota's fascia ± adrenal and nodes) — larger tumours; laparoscopic or open; removal of IVC tumour thrombus - **Active surveillance** or **thermal ablation** (radiofrequency, cryoablation) for small renal masses (<3–4 cm) in elderly/unfit patients
2. **Metastatic disease: targeted therapy and immunotherapy** (tyrosine kinase inhibitors — sunitinib, pazopanib, cabozantinib; immune checkpoint inhibitors — nivolumab + ipilimumab, pembrolizumab + axitinib); cytoreductive nephrectomy in selected patients; **metastasectomy** of solitary metastases; radiotherapy for bone/brain metastases. **RCC is resistant to conventional chemotherapy and radiotherapy.**

**Prognosis:** stage-dependent — >90% 5-year survival for small localised tumours; poor for metastatic disease, though improving with immunotherapy.

### Wilms' Tumour (Nephroblastoma)

- **Commonest renal malignancy of childhood**; peak 2–5 years; arises from embryonic renal tissue (metanephric blastema)
- Associations: **WT1 gene**, **WAGR syndrome** (Wilms, Aniridia, Genitourinary anomalies, Retardation), **Beckwith–Wiedemann syndrome**, Denys–Drash
- **Presentation: large, smooth abdominal (flank) mass** noticed by the parent while bathing the child, usually **not crossing the midline**; haematuria, hypertension, abdominal pain, fever
- **Differential: neuroblastoma** (crosses midline, calcification, raised urinary VMA/HVA, child more unwell, <2 years), hydronephrosis, multicystic kidney
- **Investigations:** USG, **CT/MRI** (also check contralateral kidney — bilateral in ~5%, IVC), CT chest (lung metastases)
- **Management: multimodal** — nephrectomy + chemotherapy (vincristine, actinomycin D, ± doxorubicin) ± radiotherapy; pre-operative chemotherapy (SIOP protocol) or upfront surgery (COG protocol); **avoid biopsy/rupture** (upstages the tumour)
- **Prognosis: excellent — ~90% cure**

> **Exam Alert:** Classic triad of RCC is present in only 10%. Left varicocele not emptying on lying down suggests left renal vein tumour thrombus. Partial nephrectomy for T1 tumours. RCC is chemo- and radio-resistant. Wilms' tumour does not cross the midline; neuroblastoma does.

## Chapter 83: Haematuria and Carcinoma of the Bladder

### Approach to Haematuria

**Definition:** blood in the urine — **visible (macroscopic/gross)** or **non-visible (microscopic, ≥3 RBC/hpf)**. **Painless visible haematuria in an adult is a urological cancer until proved otherwise.**

### Causes by site

| Site | Causes |
|---|---|
| Kidney | RCC, stones, glomerulonephritis (IgA), polycystic kidney, TB, trauma, papillary necrosis |
| Ureter | Stones, urothelial carcinoma |
| **Bladder** | **Urothelial carcinoma**, cystitis (bacterial, TB, **schistosomiasis**, radiation, cyclophosphamide), stones, trauma |
| Prostate / urethra | BPH, prostate cancer, prostatitis, urethritis, stricture, trauma |
| General | Anticoagulants, bleeding disorders, sickle cell, exercise; mimics — beetroot, rifampicin, myoglobin, menstruation |

**Timing clue:** initial haematuria (urethra), **terminal haematuria (bladder neck/prostate, bladder stones, schistosomiasis)**, total haematuria (bladder or upper tract).

**Haematuria investigation ("one-stop clinic"):** urine R/E and culture, urine cytology, creatinine/eGFR, clotting, **flexible cystoscopy** (bladder) + **upper tract imaging — CT urogram** (or USG in younger/low-risk patients); PSA in men (with counselling).

## Carcinoma of the Bladder

### Pathology

- **Urothelial (transitional cell) carcinoma — ~90%** (commonest)
- **Squamous cell carcinoma** — associated with **schistosomiasis (*S. haematobium*, endemic in Egypt/ Middle East/Africa)**, chronic irritation (stones, long-term catheters), bladder diverticula
- Adenocarcinoma — urachal remnant (dome)

**Risk factors: smoking (most important — ~50%)**, **occupational aromatic amines** (β-naphthylamine, benzidine — dye, rubber, leather, paint and printing industries), cyclophosphamide, pelvic radiation, schistosomiasis, chronic irritation, phenacetin, male sex, age >60.

### Classification

- **Non-muscle invasive bladder cancer (NMIBC) ~75%:** Ta (papillary, mucosa only), T1 (lamina propria), **CIS (carcinoma in situ — flat, high grade, aggressive)**
- **Muscle invasive bladder cancer (MIBC) ~25%:** T2 and above — risk of metastasis

**Clinical features: painless, intermittent, total visible haematuria** (commonest, ~85%); storage symptoms (frequency, urgency, dysuria — especially CIS); clot retention; advanced — pelvic pain, leg oedema, ureteric obstruction (loin pain, renal failure), bone pain, weight loss.

### Investigations

- **Flexible cystoscopy — diagnostic** (outpatient, local anaesthesia)
- **Transurethral resection of bladder tumour (TURBT)** — **diagnostic (histology, grade, depth of invasion — must include detrusor muscle) and therapeutic**; bimanual examination under anaesthesia
- **Urine cytology** (sensitive for high-grade tumours and CIS)
- **CT urogram** — upper tract tumours (urothelial tumours can be multifocal — "field change")
- **CT chest/abdomen/pelvis or MRI pelvis** — staging of muscle-invasive disease; bone scan if indicated

### Management

#### NMIBC

1. **Complete TURBT**

2. **Single post-operative intravesical instillation of chemotherapy (mitomycin C)** within 24 h — reduces recurrence in low-risk tumours
3. **Intravesical BCG immunotherapy** (induction + maintenance) — for **high-risk NMIBC and CIS**
4. **Re-resection (re-TURBT)** at 2–6 weeks for T1/high-grade tumours
5. **Surveillance cystoscopy** (high recurrence rate — up to 50–70%)
6. Radical cystectomy for BCG-refractory high-risk disease

**MIBC**

1. **Neoadjuvant cisplatin-based chemotherapy** followed by **radical cystectomy** with pelvic lymph node dissection and **urinary diversion** — **ileal conduit** (commonest), orthotopic neobladder, continent diversion; in men, cystoprostatectomy; in women, anterior exenteration
2. **Bladder-preserving trimodality therapy:** maximal TURBT + **chemoradiotherapy** (selected patients)
3. **Metastatic:** cisplatin-based chemotherapy, immunotherapy (checkpoint inhibitors), enfortumab vedotin; palliative radiotherapy for bleeding

**Complications of ileal conduit:** stomal problems, urinary leak, infection, **hyperchloraemic metabolic acidosis**, stones, ureteroileal stricture, **vitamin B12 deficiency**.

> **Exam Alert:** Painless visible haematuria in an adult = cancer until proved otherwise → cystoscopy + CT urogram. Smoking is the main risk factor; schistosomiasis causes squamous cell carcinoma. TURBT is both diagnostic and therapeutic; BCG for high-risk NMIBC and CIS; radical cystectomy for muscle-invasive disease.

## Chapter 84: Undescended Testis (Cryptorchidism)

**Definition:** A testis that has **failed to descend into the scrotum** and lies arrested somewhere along its **normal path of descent** (abdomen → inguinal canal → superficial ring → upper scrotum).

**Incidence:** about **3–4% of full-term** and up to **30% of preterm** boys at birth; many descend spontaneously in the first 3–6 months; **~1% at 1 year**. Right side more common; bilateral in ~10–20%.

**Embryology:** testis descends from the posterior abdominal wall, guided by the **gubernaculum**, under hormonal (testosterone, insulin-like factor 3) and mechanical influences; reaches the deep ring by 7 months and the scrotum by birth.

**Classification**

| Type | Description |
|---|---|
| **True undescended (cryptorchid)** | Arrested in the normal path — intra-abdominal, inguinal (canalicular — commonest), high scrotal |
| **Ectopic testis** | Deviated **from the normal path** after passing through superficial ring — **superficial inguinal pouch (commonest ectopic site)**, perineum, femoral triangle, root of penis, opposite scrotum |
| **Retractile testis** | Normally descended but pulled up by an active **cremasteric reflex**; can be manipulated into the scrotum and stays there — **normal; no surgery** (follow up — some become "ascending") |
| **Ascending (acquired) testis** | Previously in scrotum, later ascends |
| **Absent testis (anorchia)** | Vanishing testis (prenatal torsion) |

**Complications of undescended testis — reasons to treat**

1. **Infertility** — higher temperature damages spermatogenesis (changes begin after 6–12 months of age)

2. **Malignancy** — risk of **testicular germ cell tumour 4–10×** (mainly seminoma); orchidopexy does not abolish the risk but allows **easy self-examination**
3. **Torsion** — increased risk
4. **Trauma** — vulnerable in the inguinal canal against the pubic bone
5. **Associated inguinal hernia** (patent processus vaginalis in ~90%)
6. Psychological and cosmetic

**Clinical examination:** warm hands, relaxed child (squatting or frog-leg position); inspect for an empty, underdeveloped hemiscrotum; "milk" from the anterior superior iliac spine towards the scrotum to locate a palpable testis; examine ectopic sites; check for hernia, hypospadias. **Bilateral impalpable testes with hypospadias → exclude a disorder of sex development (e.g. congenital adrenal hyperplasia in a virilised girl)** — karyotype urgently.

### Investigations

- **Imaging (USG/MRI) is not routinely recommended** — low accuracy and does not change management
- **Diagnostic laparoscopy** — **investigation and treatment of choice for impalpable testes**
- Bilateral impalpable: karyotype, hormones (hCG stimulation test, AMH/inhibin B) to confirm testicular tissue

### Management

1. **Observe until 6 months of age** (spontaneous descent possible)
2. **Orchidopexy between 6 and 18 months (ideally by 12 months)** — preserves fertility potential
3. **Palpable testis: inguinal orchidopexy** — mobilise testis and cord, **ligate the patent processus vaginalis**, fix testis in a **dartos pouch** in the scrotum
4. **Impalpable testis: laparoscopy** — (a) intra-abdominal testis → laparoscopic orchidopexy, or **two-stage Fowler–Stephens orchidopexy** (divide testicular vessels first, relying on collateral supply from the vas, then bring down the testis 6 months later) for high testes; (b) blind-ending vessels → vanishing testis, no further action; (c) vessels entering the deep ring → inguinal exploration
5. **Orchidectomy** — for an atrophic, dysgenetic testis, or for an undescended testis found after puberty (malignancy risk; poor function), with prosthesis option
6. Hormonal therapy (hCG/GnRH) — not recommended routinely

**Complications of orchidopexy:** testicular atrophy (vascular injury), retraction (re-ascent), injury to vas, haematoma, infection.

> **Exam Alert:** Retractile testis is normal and needs no surgery. Orchidopexy by 12–18 months reduces infertility and facilitates cancer detection, but cancer risk remains. Laparoscopy is the investigation of choice for impalpable testes. Bilateral impalpable testes with hypospadias → exclude a disorder of sex development.

## Chapter 85: The Acute Scrotum — Testicular Torsion and Epididymo-orchitis

**Principle: An acutely painful scrotum in a child or young man is testicular torsion until proved otherwise.** Testicular salvage depends on time: ~90–100% if detorsed within **6 hours**, ~50% at 12 hours, <10% after 24 hours. **Do not delay surgery for investigations.**

## Testicular Torsion

**Definition:** Twisting of the spermatic cord, compromising testicular blood supply.

**Types: intravaginal (commonest)** — adolescents (peak 12–18 years), due to the **"bell-clapper" deformity** (high investment of tunica vaginalis allows the testis to rotate freely; often **bilateral**); **extravaginal** — neonates (whole cord and tunica twist).

### Clinical features

- **Sudden severe testicular pain**, often waking the boy from sleep or after exercise/trauma; may radiate to the lower abdomen (**boys may present with abdominal pain only — always examine the scrotum**)
- Nausea and vomiting
- **High-riding testis with a horizontal lie** ("bell-clapper"), very tender, swollen
- **Absent cremasteric reflex** (most sensitive sign)
- **Prehn's sign negative** (elevating the testis does **not** relieve pain)
- Previous episodes of intermittent pain (intermittent torsion)

**Investigations: clinical diagnosis — urgent surgical exploration**; **colour Doppler ultrasound** (reduced/absent flow, "whirlpool" sign) only if the diagnosis is genuinely doubtful and it causes **no delay**.

### Management

1. **Emergency scrotal exploration** through a midline raphe/scrotal incision
2. **Detorsion** and assessment of viability (warm saline packs)
3. **Viable testis → orchidopexy** (fixation with non-absorbable sutures, three-point fixation)
4. **Non-viable testis → orchidectomy**
5. **Always fix the contralateral testis** (bell-clapper deformity is usually bilateral)
6. Manual detorsion (rotating outward — "opening a book") may be attempted as a temporising measure while arranging theatre; exploration is still required

## Torsion of the Testicular Appendage (Hydatid of Morgagni)

- Commonest cause of acute scrotum in **pre-pubertal boys (7–12 years)**
- Pain more gradual, localised to the **upper pole**; **"blue dot sign"** (infarcted appendage visible through the skin); cremasteric reflex present
- Self-limiting: analgesia and rest; explore if torsion of the testis cannot be excluded

## Epididymo-orchitis

**Causes: sexually transmitted** (*Chlamydia trachomatis*, *N. gonorrhoeae*) in men <35 years; **urinary pathogens** (*E. coli*) in older men (with BPH, catheterisation, instrumentation) and children (urological anomalies); **mumps orchitis** (post-pubertal, 4–6 days after parotitis, risk of atrophy and subfertility); **tuberculosis** (chronic, "beaded" vas, craggy epididymis, scrotal sinus — important in Pakistan); brucellosis.

**Clinical features: gradual onset** of pain and swelling over hours to days, fever, dysuria, urethral discharge, urinary frequency; tender, swollen epididymis (posterior) then testis; scrotal erythema; **cremasteric reflex present**; **Prehn's sign positive** (elevation relieves pain — unreliable).

**Investigations:** urine R/E and culture, first-void urine **NAAT for Chlamydia/gonorrhoea**, urethral swab, CBC; **Doppler USG — increased blood flow**; screen for other STIs.

**Management:** analgesia, scrotal support, rest; **antibiotics** — STI-related: **ceftriaxone IM + doxycycline** (14 days); enteric organisms: **fluoroquinolone (ofloxacin/levofloxacin)** for 2 weeks; treat partners; drain abscess if formed; ATT for TB.

**Complications:** abscess, testicular infarction and atrophy, chronic pain, infertility.

### Torsion vs Epididymo-orchitis

| Feature | Torsion | Epididymo-orchitis |
|---|---|---|
| Age | 12–18 years | Sexually active adults, elderly |
| Onset | **Sudden** | **Gradual** |
| Urinary symptoms, fever | Absent | Present |
| Testis position | High, horizontal | Normal |
| Cremasteric reflex | **Absent** | **Present** |
| Doppler flow | **Reduced/absent** | **Increased** |
| Treatment | **Immediate surgery** | Antibiotics |

> **Exam Alert:** Acute scrotum in a teenager = torsion until proved otherwise — explore within 6 hours without waiting for ultrasound, and fix both testes. Absent cremasteric reflex favours torsion. Blue dot sign = torsion of the appendix testis.

## Chapter 86: Testicular Tumours

**Overview:** The **commonest solid malignancy in men aged 15–35**; ~95% are **germ cell tumours (GCTs)**. Highly curable (>95% overall), even when metastatic.

**Risk factors: undescended testis** (most important; also raises risk in the contralateral testis), previous testicular cancer, family history (father/brother), **germ cell neoplasia in situ (GCNIS)**, Klinefelter syndrome, infertility/testicular atrophy, HIV, white ethnicity.

### Classification

| Group | Types | Features |
|---|---|---|
| **Seminoma (~50%)** | Classic, spermatocytic (elderly, benign behaviour) | Age **30–45**; slow-growing; **radiosensitive and chemosensitive**; markers usually normal (β-hCG mildly raised in ~15%; **AFP never raised**) |
| **Non-seminomatous GCT (NSGCT, ~50%)** | **Embryonal carcinoma**, **yolk sac tumour** (commonest in infants; **AFP**), **choriocarcinoma** (**very high β-hCG**, early haematogenous spread, gynaecomastia), **teratoma** (mature/immature), **mixed GCT** (commonest NSGCT) | Age **20–30**; more aggressive; less radiosensitive |
| Non-germ cell (~5%) | **Leydig cell** (precocious puberty, gynaecomastia), Sertoli cell, **lymphoma** (commonest testicular tumour in men **>60**) | — |

**Spread: lymphatic to para-aortic (retroperitoneal) nodes at the renal hilum** (testicular lymphatics follow the testicular vessels), **not to inguinal nodes** (unless the scrotal skin is involved or after scrotal surgery); haematogenous to lungs, liver, brain, bone (choriocarcinoma early).

### Clinical features

- **Painless, hard lump or enlargement of the testis** (commonest), sense of heaviness
- Testis cannot be separated from the swelling; **positive "heavy" feel**, loss of testicular sensation

- Secondary hydrocele (always examine testis by USG behind a hydrocele in young men)
- ~10% present with acute pain (haemorrhage) — mimics epididymo-orchitis
- **Gynaecomastia** (β-hCG), back pain (para-aortic nodes), abdominal mass, cough/dyspnoea (lung metastases), supraclavicular node

**Investigations**

- **Scrotal ultrasound** — **investigation of choice** (hypoechoic intratesticular mass)
- **Tumour markers (before and after orchidectomy): AFP** (yolk sac, embryonal — **never raised in pure seminoma**), **β-hCG** (choriocarcinoma, some seminomas), **LDH** (tumour burden)
- **Staging: CT chest, abdomen and pelvis**; brain MRI if very high hCG or symptoms
- Fertility counselling and **sperm banking before treatment**
- **No scrotal (transscrotal) biopsy or FNAC** — risk of seeding and altered lymphatic drainage

**Management**

1. **Radical inguinal orchidectomy** — through an **inguinal incision** with **early high clamping and division of the cord at the deep ring** (not scrotal approach); testicular prosthesis offered
2. **Seminoma** - Stage I: **surveillance** (preferred), or single-dose **carboplatin**, or para-aortic radiotherapy - Advanced: **chemotherapy (BEP — bleomycin, etoposide, cisplatin)**; radiotherapy for small-volume nodal disease
3. **NSGCT** - Stage I: **surveillance** or adjuvant BEP (1 cycle) for high-risk (lymphovascular invasion) - Metastatic: **BEP chemotherapy** (3–4 cycles) → **retroperitoneal lymph node dissection (RPLND)** for residual masses (teratoma, viable tumour)
4. Follow-up with markers and CT for recurrence

**Complications of treatment:** infertility, retrograde ejaculation (RPLND — sympathetic chain injury), bleomycin lung fibrosis, cisplatin nephro-/oto-/neurotoxicity, cardiovascular risk, second malignancy.

**Prognosis:** stage I >98% cure; metastatic disease — ~90% (good-risk) to ~50% (poor-risk) cure.

> **Exam Alert:** Painless hard testicular lump in a young man = cancer. Ultrasound + AFP, β-hCG, LDH. Treat by radical **inguinal** orchidectomy — never scrotal biopsy. AFP is never raised in pure seminoma. Lymphatic spread is to para-aortic nodes.

# Chapter 87: Hydrocele and Varicocele

## Hydrocele

**Definition:** An abnormal collection of serous fluid within the **tunica vaginalis** (or along the processus vaginalis).

**Types**

| Type | Mechanism / features |
|---|---|
| **Congenital (communicating)** | **Patent processus vaginalis** — peritoneal fluid flows into the scrotum; fluctuates in size (smaller in the morning, larger by evening); may be compressible; associated with inguinal hernia |
| **Primary (idiopathic, vaginal)** | Commonest in adults; imbalance of secretion and absorption; slowly enlarging painless swelling |
| **Secondary** | Underlying disease of testis/epididymis — **tumour**, infection (epididymo-orchitis, TB), trauma, torsion; also **filariasis** (endemic areas — chylous hydrocele) and after varicocele surgery/ hernia repair |

| Type | Mechanism / features |
|---|---|
| Encysted hydrocele of the cord | Localised collection along the cord, separate from testis; moves with traction on the testis (female equivalent: **hydrocele of the canal of Nuck**) |
| Infantile | Extends up to the deep ring, processus closed at the ring |

**Clinical features:** painless, smooth, cystic scrotal swelling; **"can get above it"** (confined to scrotum — distinguishes from inguinoscrotal hernia, except communicating/infantile types); **fluctuant** and **brilliantly transilluminant**; **testis cannot be felt separately** (it lies within the swelling, posteriorly) — compare with epididymal cyst, where the testis is felt separately below the cyst.

**Investigations: scrotal ultrasound** — confirms fluid and **assesses the underlying testis (essential in young men to exclude tumour)**; filarial antigen/night blood film in endemic areas.

**Management**

- **Infants and children:** most congenital hydroceles **resolve by 1–2 years** — observe; persisting beyond 2 years or with hernia → **herniotomy** (ligation of patent processus vaginalis via an inguinal approach)
- **Adults (symptomatic/large):** surgery via a scrotal incision
- **Jaboulay's procedure** — eversion of the sac behind the testis (moderate/large hydroceles)
- **Lord's plication** — plication of the sac (small/moderate, thin-walled; less dissection, fewer haematomas)
- Excision of sac — large, thick-walled
- **Aspiration and sclerotherapy** — for unfit patients; high recurrence
- Secondary hydrocele — treat the cause (e.g. inguinal orchidectomy for tumour, never scrotal approach)

**Complications:** of hydrocele — hernia of the sac, infection, rupture, haematocele, calcification, testicular atrophy; of surgery — **scrotal haematoma** (commonest), infection, recurrence, injury to vas or vessels.

## Varicocele

**Definition:** Dilatation and tortuosity of the **pampiniform plexus** of veins in the spermatic cord.

**Epidemiology and causes:** ~15% of adult men; **left side in ~90%** because the **left testicular vein drains at a right angle into the left renal vein** (longer column, higher pressure, absent valves, "nutcracker" compression by the SMA). **Sudden-onset varicocele in an older man, a right-sided varicocele, or one that does not empty on lying → suspect a retroperitoneal mass (left: renal cell carcinoma with renal vein thrombus; right: IVC obstruction).**

**Clinical features:** usually asymptomatic; dull **dragging ache** worse on standing and in the evening; **"bag of worms"** feel above the testis; **decompresses on lying down**; cough impulse; may be associated with smaller testis (on the affected side) and **subfertility** (raised scrotal temperature).

**Grading:** subclinical (Doppler only); grade I — palpable only with Valsalva; grade II — palpable without Valsalva; grade III — visible.

**Investigations: colour Doppler ultrasound** (venous diameter >3 mm with reflux on Valsalva), testicular volume; **semen analysis** if fertility is a concern; renal USG/CT if suspicious features.

**Management**

- Asymptomatic with normal testis and semen: reassurance, scrotal support
- **Indications for treatment:** pain, **infertility with abnormal semen analysis** (and palpable varicocele), **testicular atrophy in adolescents**, cosmetic
- **Microsurgical subinguinal varicocelectomy** — gold standard (lowest recurrence and hydrocele rates, preserves artery and lymphatics)
- Laparoscopic or open retroperitoneal (Palomo) ligation; inguinal (Ivanissevich) approach
- **Percutaneous embolisation** (interventional radiology)

**Complications of treatment: hydrocele** (lymphatic ligation — commonest), recurrence, testicular atrophy (arterial injury).

> **Exam Alert:** Hydrocele: can get above it, brilliantly transilluminant, testis not separately palpable — always ultrasound to exclude tumour. Varicocele is left-sided (renal vein drainage); a new right-sided or non-decompressing varicocele suggests a retroperitoneal tumour.

# Chapter 88: Phimosis, Paraphimosis and Circumcision

## Phimosis

**Definition:** Inability to retract the prepuce (foreskin) over the glans penis.

**Physiological phimosis: normal in infants and young boys** — natural adhesions between prepuce and glans separate gradually; ~90% retractile by 3 years and ~99% by 17 years. **Ballooning of the foreskin during micturition** is common and harmless. **No treatment needed** — do not forcibly retract.

**Pathological phimosis:** scarring of the preputial opening — **balanitis xerotica obliterans (BXO, lichen sclerosus)** (white, scarred, non-retractile ring), recurrent balanoposthitis, forceful retraction, diabetes (in adults — check blood sugar).

**Complications:** recurrent **balanitis/balanoposthitis**, urinary retention, UTI, painful erection, paraphimosis (if forced), **squamous cell carcinoma of the penis** (chronic smegma retention and inflammation — rare in circumcised men).

### Management

- Physiological: reassurance; hygiene
- **Topical steroid cream** (0.05% betamethasone twice daily for 4–8 weeks) with gentle retraction — effective in most non-scarred phimosis
- **Circumcision** for pathological phimosis (BXO), recurrent balanoposthitis, failed topical treatment, recurrent UTI with urological anomalies; **preputioplasty** for those wishing to keep the foreskin

## Paraphimosis

**Definition:** A **retracted foreskin that cannot be returned** over the glans. The tight preputial ring acts as a constriction band → venous and lymphatic obstruction → **painful oedema of the glans and prepuce**; risk of arterial compromise and **glans necrosis** — a **urological emergency**.

**Causes:** failure to replace the foreskin after retraction — catheterisation (iatrogenic — always reduce after catheter insertion or cleaning), examination, sexual activity, hygiene.

### Management

1. Analgesia (penile block, local anaesthetic gel)
2. **Reduce oedema:** firm manual compression (squeezing glans for several minutes), ice/cold packs, compressive bandage; **multiple needle punctures** of the oedematous skin; granulated sugar (osmotic)
3. **Manual reduction:** thumbs push the glans back while the fingers draw the foreskin forward
4. Failed reduction → **dorsal slit** of the constricting band under anaesthesia
5. **Elective circumcision** later to prevent recurrence

## Circumcision

**Definition:** Surgical removal of the prepuce. Very common in Pakistan and Muslim communities for **religious and cultural reasons** (usually in infancy/childhood), as well as for medical indications.

**Medical indications:** pathological phimosis (BXO), recurrent balanoposthitis, recurrent paraphimosis, recurrent UTI in boys with urinary tract anomalies, preputial tumours, and as part of penile cancer treatment.

**Contraindications (in neonates/children): hypospadias** and epispadias (the foreskin is needed for repair), **buried/concealed penis**, chordee, webbed penis, ambiguous genitalia, bleeding disorders (correct first; screen if family history of haemophilia), unwell or premature baby.

**Techniques: dissection (sleeve) method**, **guillotine method**, **Plastibell** device (infants), Gomco clamp, stapler devices. Under local anaesthesia (penile block, EMLA) in infants or general anaesthesia in older children; sterile technique and trained operator essential.

**Complications**

- **Bleeding** (commonest — frenular artery; exclude haemophilia)
- Infection, meatitis, **meatal stenosis** (late; thin stream, spraying)
- Excess or inadequate skin removal, skin bridges, concealed penis, retained Plastibell ring
- **Glans/urethral injury, urethrocutaneous fistula**
- Rare but serious: **glans amputation**, penile necrosis (diathermy injury — **avoid monopolar diathermy**; use bipolar)

**Benefits:** reduced UTI in infancy, reduced penile cancer, reduced risk of some sexually transmitted infections including HIV, improved hygiene.

> **Exam Alert:** Non-retractile foreskin in young boys is physiological — do not force retraction. Paraphimosis is an emergency; always replace the foreskin after catheterisation. Never circumcise a boy with hypospadias. Avoid monopolar diathermy in circumcision.

## Self-Assessment: Part 12 SBAs

**1.** A 35-year-old man has sudden severe colicky left loin pain radiating to the groin, with nausea and microscopic haematuria. He is restless and afebrile. Which investigation is most appropriate to confirm the diagnosis?

A. Cystoscopy · B. Intravenous urogram · C. MRI abdomen · D. Non-contrast CT KUB · E. Plain X-ray KUB only

**Answer: D.** Investigation of choice for suspected ureteric colic.

**2.** A 50-year-old man with a 7 mm left ureteric stone and hydronephrosis develops fever of 39.5 °C with rigors and loin tenderness. What is the most urgent intervention?

A. ESWL · B. Oral antibiotics and tamsulosin at home · C. Percutaneous nephrostomy or ureteric stent with IV antibiotics · D. Percutaneous nephrolithotomy · E. Ureteroscopic stone removal the same day

**Answer: C.** An infected obstructed kidney needs urgent drainage; definitive stone treatment later.

**3.** A 68-year-old man has hesitancy, poor stream and nocturia. DRE shows a smooth, enlarged, rubbery prostate with a preserved median sulcus. He develops recurrent acute urinary retention despite tamsulosin and finasteride. What is the most appropriate treatment?

A. Long-term indwelling catheter only · B. Radical prostatectomy · C. Radiotherapy · D. Transurethral resection of the prostate · E. Increase tamsulosin dose

**Answer: D.** Recurrent retention despite medical therapy is an indication for TURP.

**4.** One hour into a TURP under spinal anaesthesia with glycine irrigation, a patient becomes confused and nauseated, with BP 180/100 mmHg and bradycardia. Which biochemical abnormality is most likely?

A. Hypercalcaemia · B. Hyperkalaemia · C. Hypernatraemia · D. Hypoglycaemia · E. Hyponatraemia

**Answer: E.** TUR syndrome from absorption of hypotonic irrigation fluid.

**5.** A 58-year-old smoker has painless visible haematuria and a left-sided varicocele that does not empty on lying down. What is the most likely diagnosis?

A. Bladder carcinoma · B. Left renal cell carcinoma · C. Prostatic carcinoma · D. Renal stone · E. Testicular tumour

**Answer: B.** Tumour thrombus in the left renal vein obstructs the left testicular vein.

**6.** A 65-year-old man who worked in a dye factory has painless intermittent visible haematuria. Flexible cystoscopy shows a papillary bladder tumour. What is the next step?

A. Intravesical BCG immediately · B. Radical cystectomy · C. Radiotherapy · D. Systemic chemotherapy · E. Transurethral resection of bladder tumour (TURBT)

**Answer: E.** TURBT is both diagnostic (stage, grade, muscle invasion) and therapeutic.

**7.** A 10-month-old boy has a right testis that cannot be felt in the scrotum but is palpable in the inguinal canal and cannot be brought down to the scrotum. What is the most appropriate management?

A. hCG injections only · B. Inguinal orchidopexy now · C. Observe until 5 years · D. Orchidectomy · E. Ultrasound every 6 months

**Answer: B.** Orchidopexy between 6 and 18 months.

**8.** A 15-year-old boy is woken at 4 a.m. by sudden severe left testicular pain and vomiting. The left testis is high-riding with a horizontal lie, and the cremasteric reflex is absent. What is the next step?

A. Antibiotics for epididymo-orchitis · B. Colour Doppler ultrasound and review in the morning · C. Immediate scrotal exploration with bilateral fixation · D. Scrotal support and analgesia · E. Urine culture

**Answer: C.** Testicular torsion; do not delay for imaging.

**9.** A 28-year-old man has a painless, hard lump in his right testis. Ultrasound shows a hypoechoic intratesticular mass. AFP is 450 ng/ml (raised) and β-hCG is normal. What is the most appropriate next step?

A. Antibiotics and review · B. FNAC of the testis · C. Radical inguinal orchidectomy · D. Radiotherapy alone · E. Transscrotal biopsy

**Answer: C.** Raised AFP excludes pure seminoma; inguinal orchidectomy, never scrotal biopsy.

**10.** After urethral catheterisation, the foreskin of a 60-year-old man is left retracted. Six hours later the glans is swollen and painful, and the foreskin cannot be pulled forward. What is the diagnosis?

A. Balanitis xerotica obliterans · B. Paraphimosis · C. Penile carcinoma · D. Peyronie's disease · E. Phimosis

**Answer: B.** Reduce urgently; dorsal slit if manual reduction fails.

*References: Bailey & Love's Short Practice of Surgery, 28th Ed.; Blecha, Surgery, 4th Ed.*

PART 13

# Paediatric and Neonatal Surgery

## Chapter 89: Principles of Neonatal Surgery, Oesophageal Atresia and Tracheo-oesophageal Fistula

### Principles of Neonatal Surgery

**Why neonates are different:** small circulating blood volume (**~80–85 ml/kg** — small losses matter), large surface area to weight ratio and little subcutaneous fat (**hypothermia**), immature liver (hypoglycaemia, jaundice, drug metabolism), immature kidneys (cannot concentrate urine or handle sodium loads), immature immunity (sepsis), high metabolic rate.

#### Key points of care

- **Thermoregulation:** incubator or radiant warmer, warm theatre, warmed fluids — hypothermia causes acidosis, coagulopathy and apnoea
- **Fluids (term neonate):** about 60 ml/kg/day on day 1, increasing by 20–30 ml/kg/day to 150 ml/kg/day; **10% dextrose** for maintenance; replace NG losses with 0.9% saline + KCl
- **Glucose monitoring:** risk of hypoglycaemia
- **Vitamin K** (prevent haemorrhagic disease of the newborn)
- **Antenatal diagnosis** on ultrasound allows planned delivery at a centre with neonatal surgery
- **Safe transfer:** warmth, airway, IV access, NG tube on free drainage, glucose
- Look for **associated anomalies** — many conditions occur together (e.g. VACTERL)

**Cardinal warning sign: bilious (green) vomiting in a neonate is a surgical emergency until proved otherwise** — exclude malrotation with volvulus.

### Oesophageal Atresia (OA) and Tracheo-oesophageal Fistula (TOF)

**Definition:** Failure of continuity of the oesophagus, usually with an abnormal connection between the oesophagus and trachea, due to abnormal separation of the foregut into trachea and oesophagus (4th–6th week). Incidence about 1 in 3,000–4,500.

#### Gross classification

| Type | Description | Frequency |
|---|---|---|
| **C** | **Proximal OA with distal TOF** | **~85% (commonest)** |
| A | Isolated OA, no fistula (gasless abdomen, long gap) | ~8% |
| E (H-type) | TOF without atresia | ~4% |
| B | Proximal TOF, distal atresia | ~1% |
| D | Proximal and distal TOF | ~1% |

**Associations — VACTERL: V**ertebral, **A**norectal, **C**ardiac (commonest, ~30%), **T**racheo-**E**sophageal, **R**enal, **L**imb (radial) anomalies; also chromosomal (trisomy 18, 21).

### Clinical features

- **Antenatal: polyhydramnios**, small or absent stomach bubble
- At birth: **excessive frothy saliva** (drooling), **choking, coughing and cyanosis with the first feed**
- **Inability to pass a nasogastric tube** — diagnostic
- Abdominal distension (air enters stomach via distal fistula) and **aspiration pneumonia** (gastric acid refluxing through fistula)
- H-type: recurrent chest infections, coughing with feeds — diagnosed later

### Investigations

- Pass a **10 Fr radio-opaque NG (Replogle) tube** — it stops at about 10 cm from the gums
- **Chest and abdominal X-ray (babygram):** tube **coiled in upper oesophageal pouch**; **gas in the stomach** = distal TOF; **gasless abdomen** = pure atresia; vertebral anomalies, "double bubble" (duodenal atresia)
- **Echocardiography** (cardiac defects; right-sided aortic arch changes surgical approach); renal ultrasound; spinal ultrasound
- Bronchoscopy at surgery; prone tube oesophagogram for H-type TOF

### Management

1. **Pre-operative:** nurse head up (or prone); **continuous suction of upper pouch** with a Replogle tube (prevents aspiration); nil by mouth; IV fluids and glucose; antibiotics if pneumonia; avoid bag-mask ventilation (gastric distension through fistula)
2. **Surgery (within 24–48 h): right posterolateral extrapleural thoracotomy** (or thoracoscopy) → **ligation and division of the TOF** and **primary end-to-end oesophageal anastomosis**
3. **Long-gap atresia (type A):** gastrostomy for feeding, delayed primary anastomosis at 2–3 months (upper pouch grows), or oesophageal replacement (gastric pull-up, colonic interposition)
4. H-type: division of fistula via a cervical approach

**Complications: anastomotic leak**, **anastomotic stricture** (commonest — dilatation), **gastro-oesophageal reflux** (common; may need fundoplication), **recurrent TOF**, **tracheomalacia** ("TOF cough" — barking cough, apnoeic spells), dysphagia and dysmotility (lifelong).

**Prognosis:** survival >90% in babies without major cardiac anomalies (Spitz classification uses birth weight >1500 g and major cardiac disease).

> **Exam Alert:** Frothy saliva, choking on first feed, and inability to pass an NG tube = oesophageal atresia. Commonest type: proximal atresia with distal fistula (gas in stomach). Always look for VACTERL anomalies, especially cardiac. Bilious vomiting in a neonate is a surgical emergency.

# Chapter 90: Congenital Diaphragmatic Hernia and Abdominal Wall Defects

## Congenital Diaphragmatic Hernia (CDH)

**Definition:** A developmental defect of the diaphragm through which abdominal viscera herniate into the chest during fetal life, causing **pulmonary hypoplasia** and **pulmonary hypertension**. Incidence about 1 in 3,000.

### Types

- **Bochdalek hernia (posterolateral) — commonest (~85–90%)**, **left-sided in ~85%** ("Bochdalek = back and left")
- Morgagni hernia (anterior, retrosternal) — small, often presents later with vague symptoms
- Eventration (thin, elevated diaphragm — not a true hernia)

**Pathophysiology:** bowel in the chest compresses the developing lung → **bilateral pulmonary hypoplasia** (worse on the affected side) with abnormal muscular pulmonary arteries → **persistent pulmonary hypertension of the newborn (PPHN)**, right-to-left shunting, hypoxia. **The lung problem, not the hernia, determines survival.**

### Clinical features

- **Antenatal ultrasound:** bowel or stomach in the chest, mediastinal shift, polyhydramnios; prognosis estimated by lung-to-head ratio (LHR) and liver herniation
- At birth: **respiratory distress and cyanosis**, **scaphoid (empty) abdomen**, **barrel chest**, displaced apex beat/heart sounds to the right, absent breath sounds on the left, bowel sounds in the chest

**Investigations:** chest X-ray — **bowel loops in the left hemithorax**, mediastinal shift to the right, NG tube tip in the chest; echocardiography (associated cardiac defects, pulmonary hypertension); karyotype.

### Management

1. **Immediate: endotracheal intubation at birth — avoid bag-and-mask ventilation** (distends the herniated bowel and worsens lung compression); **NG tube** on free drainage to decompress the stomach
2. **"Gentle ventilation"** (permissive hypercapnia, low pressures to avoid barotrauma), high-frequency oscillation, inhaled nitric oxide, surfactant (selectively), **ECMO** for refractory hypoxia
3. **Delayed surgery** once stable (usually after 24–72 h): reduce viscera through an abdominal (subcostal) or thoracoscopic approach, **repair the defect primarily or with a patch** (large defects)
4. Antenatal: **fetal endoscopic tracheal occlusion (FETO)** in severe cases at specialist centres

**Complications:** chronic lung disease, pulmonary hypertension, GORD, recurrence (especially after patch), neurodevelopmental delay, chest wall deformity. Survival ~70–80%.

## Abdominal Wall Defects

### Exomphalos (omphalocele) vs Gastroschisis

| Feature | Exomphalos (omphalocele) | Gastroschisis |
|---|---|---|
| Defect | **Through the umbilical ring**; persistence of physiological herniation | **Right of the umbilicus**; full-thickness defect, umbilical cord normal |
| Sac | **Covered by a membrane** (amnion + peritoneum); cord inserts into the sac | **No sac** — bowel exposed to amniotic fluid |
| Contents | Bowel ± **liver** | Small and large bowel (thickened, matted, inflamed); rarely liver |
| Maternal age | Older mothers | **Young mothers (<20)**, smoking, recreational drugs |
| **Associated anomalies** | **Common (50–70%)** — cardiac, chromosomal (**trisomy 13, 18, 21**), **Beckwith–Wiedemann** (macroglossia, hypoglycaemia), pentalogy of Cantrell | **Uncommon** — except **intestinal atresia** (~10%) |
| Prognosis | Depends on associated anomalies | Good (>90% survival); depends on bowel condition |

**Initial management (both):** delivery in a centre with neonatal surgery; **cover exposed bowel with cling film or a sterile bowel bag** (prevents heat and fluid loss, keeps it moist); position baby on the right side to avoid kinking of mesenteric vessels; **NG tube** decompression; IV fluids (high losses in gastroschisis), warmth, antibiotics, glucose.

### Surgical management

- **Gastroschisis:** primary reduction and closure if possible; otherwise **preformed silo** with gradual reduction over days, then delayed closure (sutureless closure using the cord is an option); prolonged TPN often needed (intestinal dysmotility)
- **Exomphalos minor (small):** primary closure
- **Exomphalos major (large, contains liver): conservative "paint and wait"** — topical antiseptic (e.g. silver sulfadiazine) to encourage epithelialisation of the sac, ventral hernia repair later; staged silo repair in selected cases

**Complications:** abdominal compartment syndrome (excessive reduction), bowel ischaemia, **short bowel syndrome**, necrotising enterocolitis, sepsis, prolonged feeding intolerance, ventral hernia.

> **Exam Alert:** CDH: scaphoid abdomen with respiratory distress — intubate, never bag-mask ventilate; pulmonary hypoplasia decides outcome; surgery is delayed. Exomphalos has a sac and many associated anomalies; gastroschisis has no sac, lies right of the cord, and is associated mainly with intestinal atresia.

# Chapter 91: Neonatal Intestinal Obstruction

**Cardinal signs:** (1) **bilious vomiting**, (2) **abdominal distension**, (3) **failure to pass meconium within 24–48 hours** (>90% of normal term babies pass meconium within 24 h), (4) polyhydramnios antenatally (high obstruction). **High obstruction** → early bilious vomiting, little distension; **low obstruction** → marked distension, later vomiting, delayed meconium.

### Causes at a glance

| Level | Causes |
|---|---|
| Duodenum | **Duodenal atresia/stenosis**, annular pancreas, **malrotation with Ladd's bands/volvulus** |
| Jejunum/ ileum | Jejunoileal atresia, **meconium ileus** (cystic fibrosis), volvulus |
| Colon/rectum | **Hirschsprung's disease**, **anorectal malformations**, meconium plug syndrome, small left colon syndrome |
| Functional | Sepsis, hypothyroidism, electrolyte imbalance, maternal drugs, necrotising enterocolitis |

## Duodenal Atresia

- Failure of recanalisation of the duodenum (usually **distal to the ampulla of Vater → bilious vomiting**)
- **~30% have Down syndrome (trisomy 21)**; associated cardiac and other anomalies
- Antenatal polyhydramnios and "double bubble"; **bilious vomiting within hours of birth**, epigastric fullness, no gross distension
- **AXR: "double bubble" sign** (gas in stomach and proximal duodenum) with **no distal gas** (atresia)
- **Treatment:** NG decompression, IV fluids; **duodenoduodenostomy (Kimura's diamond-shaped anastomosis)**

## Malrotation with Midgut Volvulus

- Failure of normal 270° counter-clockwise rotation and fixation of the midgut → **narrow mesenteric base** prone to volvulus; **Ladd's bands** across the duodenum
- **Sudden bilious vomiting in a previously well neonate** (most present in the first month); later abdominal distension, blood per rectum, shock = **gut ischaemia**
- **Upper GI contrast study — investigation of choice:** abnormal position of **duodenojejunal flexure** (to the right of the midline), **"corkscrew" duodenum**; USG — reversed SMA/SMV relationship, **"whirlpool sign"**
- **Surgical emergency — the entire midgut can infarct within hours**
- **Ladd's procedure:** counter-clockwise **derotation of volvulus**, division of Ladd's bands, **widening of the mesenteric base**, placement of small bowel on the right and colon on the left, **appendicectomy** (appendix will lie in an abnormal position)

## Hirschsprung's Disease (Congenital Aganglionic Megacolon)

- **Absence of ganglion cells** in the submucosal (Meissner's) and myenteric (Auerbach's) plexuses due to failure of **craniocaudal migration of neural crest cells** → tonically contracted aganglionic segment that fails to relax → functional obstruction; proximal bowel dilates
- Always starts at the **anus** and extends proximally a variable distance: **rectosigmoid in ~75–80%** (short segment), long segment, total colonic aganglionosis
- 1 in 5,000; **male:female 4:1**; **associated with Down syndrome** (~10%), RET gene
- **Clinical: delayed passage of meconium (>48 h)** in a term baby, abdominal distension, bilious vomiting; **explosive passage of stool and gas on rectal examination** ("blast sign"); older children — chronic severe constipation since birth, failure to thrive, **empty rectum**, no soiling (unlike functional constipation)
- **Hirschsprung's-associated enterocolitis:** fever, explosive foul diarrhoea, distension, sepsis — commonest cause of death; treat with rectal washouts, IV antibiotics, fluids
- **Investigations:** AXR (dilated loops, no rectal gas); **contrast enema** — **transition zone** (narrow distal, dilated proximal), delayed evacuation; anorectal manometry (absent rectoanal inhibitory reflex); **rectal suction biopsy — diagnostic (gold standard)**: absence of ganglion cells, **hypertrophied nerve trunks**, increased **acetylcholinesterase** staining, absent calretinin
- **Treatment:** initial **rectal washouts** (decompression); definitive **pull-through operation** — excision of aganglionic segment and anastomosis of normally innervated bowel to the anus: **transanal endorectal pull-through (Soave/De la Torre)**, Duhamel, Swenson; levelling colostomy for long segment, enterocolitis or late presentation
- Complications: enterocolitis (even after surgery), constipation, soiling, anastomotic stricture

## Anorectal Malformations (Imperforate Anus)

- 1 in 5,000; spectrum of defects where the rectum ends blindly or opens abnormally (fistula); **associated with VACTERL** (check spine, heart, kidneys, limbs)
- **Diagnosis by perineal inspection at birth** — always examine the anus in newborns; meconium in urine (rectourinary fistula in boys) or from vagina/perineum
- **Low (perineal fistula) vs high** (rectourethral, rectovesical in boys; cloaca in girls); **wait 24 hours** before deciding (meconium may appear on perineum); **invertogram / prone cross-table lateral X-ray** (distance of rectal pouch from skin)
- **Management: low** — primary **anoplasty** in neonatal period; **high/intermediate** — **divided colostomy** first, then **posterior sagittal anorectoplasty (PSARP, Peña)** at 2–6 months, then colostomy closure
- Outcome: continence depends on level, sacral development and associated spinal anomalies

### Meconium Ileus

- Obstruction of terminal ileum by thick inspissated meconium; **~90% have cystic fibrosis** (CFTR mutation)
- AXR: dilated small bowel loops, few air–fluid levels, **"soap-bubble" (ground-glass) appearance** in right lower quadrant; contrast enema — **microcolon**
- **Treatment: therapeutic Gastrografin enema** (hyperosmolar, draws fluid into bowel) for uncomplicated cases; surgery (enterotomy and washout, resection, stoma) if failed or complicated (volvulus, perforation, meconium peritonitis); sweat test and genetic testing; lifelong CF care

> **Exam Alert:** Bilious vomiting in a neonate = malrotation with volvulus until proved otherwise — upper GI contrast and urgent Ladd's procedure. Double bubble = duodenal atresia (think Down syndrome). Delayed meconium + explosive stool on PR = Hirschsprung's — confirm with rectal suction biopsy. Always examine the anus at birth.

## Chapter 92: Biliary Atresia and Choledochal Cyst

### Biliary Atresia

**Definition:** Progressive **inflammatory obliteration of the extrahepatic bile ducts** in infancy, leading to cholestasis, biliary cirrhosis and death by about 2 years if untreated. Incidence 1 in 10,000–20,000 (higher in East Asia). **The commonest indication for liver transplantation in children.**

**Types (by level of obstruction):** type I — common bile duct; type II — common hepatic duct; **type III — porta hepatis (commonest, ~90%)**. ~10% have associated anomalies (**biliary atresia splenic malformation syndrome** — polysplenia, situs inversus, preduodenal portal vein, cardiac defects).

#### Clinical features

- **Persistent jaundice beyond 2 weeks** of age (3 weeks in preterm) in an otherwise well-looking, feeding, thriving baby
- **Pale (acholic, clay-coloured) stools** and **dark urine** (stains the nappy) — **stool colour cards** aid early detection
- Hepatomegaly; later splenomegaly, ascites, failure to thrive, bleeding (vitamin K deficiency — may present with intracranial haemorrhage)

**Key principle: Any infant with jaundice beyond 2 weeks must have a split (conjugated) bilirubin measured.** Conjugated hyperbilirubinaemia (>20% of total or >1 mg/dl) is pathological and needs urgent investigation. Physiological and breast-milk jaundice are **unconjugated**.

#### Investigations

- Total and **conjugated bilirubin**, LFTs (raised GGT), coagulation (vitamin K)
- **Ultrasound** (after 4 h fasting): **small, contracted or absent gallbladder**, **"triangular cord sign"** (fibrous remnant at porta hepatis), excludes choledochal cyst
- **Hepatobiliary scintigraphy (HIDA):** good hepatic uptake but **no excretion into the bowel**
- **Liver biopsy:** bile ductular proliferation, bile plugs, portal fibrosis
- **Intraoperative cholangiography — definitive** (laparoscopic or open)
- Exclude other causes: alpha-1 antitrypsin deficiency, Alagille syndrome, TORCH infections, hypothyroidism, galactosaemia, cystic fibrosis

### Management

1. **Kasai portoenterostomy (hepatoportoenterostomy)** — excision of the fibrotic extrahepatic biliary remnant and anastomosis of a **Roux-en-Y jejunal loop to the porta hepatis**, where microscopic bile ductules drain bile
2. **Timing is critical: best results before 60 days of age** (bile drainage achieved in ~60–70%); results decline sharply after 90 days
3. Post-operative: ursodeoxycholic acid, fat-soluble vitamins (A, D, E, K), nutritional support (MCT milk), prophylactic antibiotics; steroids are controversial
4. **Liver transplantation** for failed Kasai, late presentation with cirrhosis, or progressive liver disease (~50% of patients need transplant eventually)

**Complications after Kasai: ascending cholangitis** (commonest — fever, recurrent jaundice; IV antibiotics), portal hypertension and variceal bleeding, progressive cirrhosis, hepatopulmonary syndrome, fat-soluble vitamin deficiencies.

## Choledochal Cyst

**Definition:** Congenital **cystic dilatation of the biliary tree**. Commoner in **females (4:1)** and in **Asian** populations. Associated with an **abnormal pancreaticobiliary junction (long common channel)** → reflux of pancreatic enzymes into the bile duct.

### Todani classification

| Type | Description |
|---|---|
| **I** | **Fusiform or saccular dilatation of the CBD — commonest (~80–90%)** |
| II | Diverticulum of the CBD |
| III | Choledochocele (intraduodenal dilatation of distal CBD) |
| IVa | Multiple cysts, intra- and extrahepatic |
| IVb | Multiple extrahepatic cysts |
| V | **Caroli's disease** — multiple intrahepatic cysts only |

**Clinical features:** classic triad (in only ~20%) — **abdominal pain, jaundice and a right upper quadrant mass**; infants present with obstructive jaundice and a mass; older children/adults with pain, **recurrent cholangitis**, **pancreatitis**; may be found on antenatal ultrasound.

**Investigations:** ultrasound; **MRCP — investigation of choice** (defines anatomy and common channel); LFTs, amylase; ERCP rarely.

**Management: complete excision of the cyst with Roux-en-Y hepaticojejunostomy** (open, laparoscopic or robotic). **Do not drain the cyst internally (cystenterostomy)** — leaves the cyst wall, with high risk of cholangitis, stones and **cholangiocarcinoma**. Type III: endoscopic sphincterotomy or transduodenal excision; type V (Caroli's) — hepatic resection if localised, transplantation if diffuse.

**Complications if untreated:** cholangitis, stones, pancreatitis, rupture, biliary cirrhosis, **cholangiocarcinoma** (risk 10–30%, rising with age).

> **Exam Alert:** Jaundice >2 weeks with pale stools = check conjugated bilirubin; suspect biliary atresia. Kasai portoenterostomy before 60 days gives the best outcome; biliary atresia is the commonest reason for paediatric liver transplant. Choledochal cyst: excise completely with hepaticojejunostomy — never drain internally (cancer risk).

# Chapter 93: Paediatric Urology — Hypospadias, Posterior Urethral Valves and Vesicoureteric Reflux

## Hypospadias

**Definition:** A congenital anomaly in which the **urethral meatus opens on the ventral (under) surface of the penis**, scrotum or perineum, due to incomplete fusion of the urethral folds. About 1 in 250–300 male births.

**Classic triad:** (1) **ectopic, ventrally placed meatus**, (2) **ventral curvature of the penis (chordee)**, (3) **dorsal hooded foreskin** (deficient ventrally).

**Classification by meatal position: distal/anterior (~70%: glanular, coronal, subcoronal)**, middle (penile shaft), **proximal/posterior** (penoscrotal, scrotal, perineal — severe).

**Associations:** undescended testis, inguinal hernia, upper tract anomalies (with proximal types). **Proximal hypospadias with an undescended or impalpable testis → investigate for a disorder of sex development (DSD)** — karyotype, hormones (e.g. congenital adrenal hyperplasia in a virilised girl).

### Management

- **Never circumcise** — the foreskin is needed for reconstruction (also told to families wanting religious circumcision; it can be done at the time of repair)
- **Surgical repair at 6–18 months** (single stage for distal; one or two stages for proximal), aims: straight penis (orthoplasty), meatus at the tip (urethroplasty), normal-looking glans and skin cover
- Techniques: **TIP (tubularised incised plate, Snodgrass) urethroplasty** — commonest; MAGPI for glanular; onlay flaps; two-stage repair with grafts for severe forms
- Pre-operative testosterone in a small penis (selected)

**Complications: urethrocutaneous fistula** (commonest), meatal stenosis, urethral stricture, wound dehiscence, residual chordee, urethral diverticulum.

## Posterior Urethral Valves (PUV)

**Definition:** Obstructing membranous folds in the **posterior (prostatic) urethra** in **boys only** — the **commonest cause of bladder outlet obstruction and of end-stage renal disease due to obstruction in male children**. About 1 in 5,000–8,000 male births.

**Pathophysiology:** obstruction from fetal life → thick-walled trabeculated bladder, bilateral hydroureteronephrosis, vesicoureteric reflux, **renal dysplasia**, and (severe) **oligohydramnios → pulmonary hypoplasia (Potter's sequence)**.

### Clinical features

- **Antenatal:** bilateral hydronephrosis, distended thick-walled bladder, dilated posterior urethra (**"keyhole sign"**), oligohydramnios
- **Newborn: poor urinary stream or dribbling**, palpable bladder, respiratory distress (pulmonary hypoplasia), abdominal (urinary) ascites
- Older boys: UTI, sepsis, failure to thrive, renal failure, daytime wetting

**Investigations:** renal and bladder ultrasound; **micturating cystourethrogram (MCUG) — diagnostic** (dilated, elongated posterior urethra, valve leaflets, thick bladder, reflux); creatinine and electrolytes (note: day-1 creatinine reflects maternal levels); DMSA for renal function.

**Management: immediate bladder drainage with a urethral catheter (feeding tube)**; correct fluids, electrolytes, acidosis; treat infection; then **endoscopic (cystoscopic) valve ablation**; vesicostomy if the

urethra is too small; long-term follow-up of renal function, bladder function ("valve bladder"); dialysis/ transplantation for end-stage renal disease (~30% develop CKD).

### Vesicoureteric Reflux (VUR)

**Definition: Retrograde flow of urine from the bladder into the ureters and kidneys**. **Primary VUR** — short intravesical (submucosal) tunnel of the ureter (inadequate flap-valve mechanism; tends to resolve with growth; familial). **Secondary VUR** — high bladder pressure (PUV, neurogenic bladder).

**Importance:** reflux of infected urine → **pyelonephritis** → **renal scarring (reflux nephropathy)** → hypertension and chronic kidney disease.

**International grading (on MCUG):** grade I — ureter only; II — ureter, pelvis, calyces without dilatation; III — mild dilatation; IV — moderate dilatation, blunting of calyces; **V — gross dilatation and tortuosity**.

**Presentation: febrile UTI** in infants and children (commonest), antenatal hydronephrosis, family screening.

**Investigations:** urine culture; renal ultrasound; **MCUG — gold standard for diagnosis and grading**; **DMSA scan — renal scarring** (done 4–6 months after infection).

**Management**

1. **Low grade (I–III):** most resolve spontaneously — **continuous antibiotic prophylaxis** (trimethoprim/ nitrofurantoin) in selected children, treat bladder and bowel dysfunction (constipation), prompt treatment of febrile UTIs, circumcision in boys with recurrent UTIs
2. **Indications for intervention:** breakthrough febrile UTIs on prophylaxis, new or progressive scarring, high-grade reflux (IV–V) persisting, non-compliance
3. **Endoscopic subureteric injection** of bulking agent (**Deflux**, dextranomer/hyaluronic acid — "STING"), or **ureteric reimplantation** (Cohen cross-trigonal, Politano–Leadbetter, Lich–Gregoir) — success >95%

> **Exam Alert:** Never circumcise a baby with hypospadias. Proximal hypospadias + impalpable testis = investigate for DSD. Posterior urethral valves occur only in boys — MCUG is diagnostic; catheterise first, then ablate. VUR is diagnosed by MCUG; DMSA shows scarring.

## Chapter 94: Neuroblastoma and Paediatric Trauma

### Neuroblastoma

**Definition:** A malignant embryonal tumour of **neural crest cells** of the sympathetic nervous system. The **commonest extracranial solid tumour of childhood** and the commonest malignancy in infants. Median age at diagnosis about **18 months**; ~90% diagnosed before 5 years.

**Sites: adrenal medulla (~40–50%)**, paravertebral sympathetic chain (abdomen, chest, neck, pelvis).

**Clinical features**

- **Abdominal mass** — hard, irregular, **crosses the midline**, often in an **unwell child** (fever, weight loss, irritability, pallor)
- Metastatic disease at diagnosis in ~50%: **bone pain, limp**, **periorbital ecchymoses ("raccoon/panda eyes")** and **proptosis** (orbital metastases), bone marrow failure, hepatomegaly, **"blueberry muffin" skin nodules** (infants)
- Paravertebral tumours: **spinal cord compression** ("dumbbell" tumours through foramina), Horner's syndrome (cervical/thoracic)
- Paraneoplastic: **opsoclonus-myoclonus syndrome** ("dancing eyes, dancing feet"), watery diarrhoea (VIP), hypertension, sweating (catecholamines)

### Neuroblastoma vs Wilms' tumour

| Feature | Neuroblastoma | Wilms' tumour |
|---|---|---|
| Age | Younger (<2 years) | 2–5 years |
| Child's condition | **Unwell** | Usually well |
| Mass | Irregular, hard, **crosses midline** | Smooth, **rarely crosses midline** |
| Calcification on imaging | **Common (~85–90%)** | Uncommon |
| Urinary catecholamines | **Raised VMA and HVA** | Normal |
| Kidney on imaging | Displaced downwards ("drooping lily") | Arises within kidney ("claw sign") |
| Metastases | Bone, marrow, liver, skin, orbit | Lungs |

**Investigations: urinary vanillylmandelic acid (VMA) and homovanillic acid (HVA)** (raised in ~90%); CBC, LDH, ferritin; **CT/MRI**; **MIBG scan** (metaiodobenzylguanidine — primary and metastases); bone marrow aspirate and trephine; **biopsy** for histology and biology — **MYCN amplification** (poor prognosis), ploidy, chromosomal changes.

### Risk stratification and treatment

- **Low risk:** surgery alone or observation (some infant tumours **regress spontaneously** — stage MS/4S in infants <18 months: liver, skin and limited marrow involvement with a good prognosis)
- **Intermediate risk:** chemotherapy + surgery
- **High risk** (MYCN amplified, age >18 months with metastases): intensive induction chemotherapy, surgical resection, **myeloablative chemotherapy with autologous stem cell rescue**, radiotherapy, **immunotherapy (anti-GD2 antibody — dinutuximab)** and isotretinoin (differentiation therapy); survival ~50%

## Paediatric Trauma

**Importance: Trauma is the leading cause of death in children over 1 year of age** — road traffic accidents, falls (from roofs, a common problem in Pakistan), burns, drowning, firearm injuries, and non-accidental injury.

### Anatomical and physiological differences

- **Airway:** large head and occiput (neck flexes when supine — place a pad under the shoulders), large tongue, floppy epiglottis, **narrowest at the cricoid** (in younger children), short trachea (right main bronchus intubation); **surgical cricothyroidotomy contraindicated under ~12 years** — use needle cricothyroidotomy
- **Breathing:** compliant chest wall — **serious lung contusion without rib fractures**; diaphragmatic breathing; gastric distension impairs ventilation (NG tube)
- **Circulation:** blood volume ~80 ml/kg; **children compensate well — tachycardia and poor perfusion come first; hypotension is a late, pre-arrest sign** (lost >30–45% of blood volume)
- **Fluid resuscitation: 10 ml/kg warmed crystalloid bolus**, then early **blood (10–20 ml/kg)**; **intraosseous access** (proximal tibia) if IV access fails within 60–90 seconds
- **Weight estimate:** (age in years + 4) × 2 kg (for 1–10 years)
- Large body surface area → **hypothermia**; large head → head injury common; **SCIWORA** (spinal cord injury without radiological abnormality)
- Abdominal organs relatively larger and less protected by ribs; **solid organ injuries (spleen, liver) are mostly managed non-operatively** in stable children
- Use **Paediatric Glasgow Coma Scale** (verbal score adapted for pre-verbal children); paediatric drug doses by weight; Broselow tape

**Non-accidental injury (child abuse) — suspect when:** delay in seeking help, inconsistent or changing history, injury not compatible with developmental age (e.g. fractures in non-walking infants), multiple bruises of different ages, bruises on ears, neck, buttocks or genitalia, **patterned injuries** (belt, hand, cigarette burns), **immersion scalds** (glove and stocking distribution), **posterior rib fractures, metaphyseal corner fractures**, subdural haematoma with retinal haemorrhages (shaken baby). Action: treat injuries, **admit the child to a place of safety**, document carefully, **skeletal survey**, involve senior paediatrician and **child protection services** — follow local safeguarding procedures.

> **Exam Alert:** Neuroblastoma crosses the midline, calcifies, raises urinary VMA/HVA, and occurs in an unwell child under 2. Hypotension in an injured child is a late, pre-arrest sign. Use intraosseous access if IV fails. Always consider non-accidental injury when the history does not fit the injury.

## Self-Assessment: Part 13 SBAs

**1.** A newborn has excessive frothy saliva and chokes and turns blue during his first feed. A nasogastric tube cannot be passed beyond 10 cm. X-ray shows the tube coiled in the upper chest and gas in the stomach. What is the most likely anatomy?

A. H-type fistula without atresia · B. Isolated oesophageal atresia without fistula · C. Proximal and distal fistulae · D. Proximal fistula with distal atresia · E. Proximal oesophageal atresia with distal tracheo-oesophageal fistula

**Answer: E.** The commonest type (~85%); gas in the stomach means a distal fistula.

**2.** A term baby has severe respiratory distress at birth, a scaphoid abdomen and heart sounds best heard on the right side of the chest. What is the most important immediate step?

A. Bag-and-mask ventilation · B. Emergency laparotomy · C. Endotracheal intubation and nasogastric decompression · D. Insert a left chest drain · E. Oral feeding

**Answer: C.** Congenital diaphragmatic hernia — bag-mask ventilation distends the bowel in the chest.

**3.** At birth, a baby of a 17-year-old mother has loops of small bowel protruding through a defect to the right of a normally inserted umbilical cord, with no covering membrane. Which associated anomaly is most likely?

A. Beckwith–Wiedemann syndrome · B. Congenital heart disease · C. Intestinal atresia · D. Trisomy 18 · E. Pentalogy of Cantrell

**Answer: C.** Gastroschisis; other options are associated with exomphalos.

**4.** A 4-day-old baby who had been feeding well suddenly develops green vomiting. The abdomen is not distended. What is the most appropriate next investigation?

A. Abdominal ultrasound for pyloric stenosis · B. Barium enema · C. Rectal suction biopsy · D. Sweat test · E. Upper gastrointestinal contrast study

**Answer: E.** Bilious vomiting = malrotation with volvulus until proved otherwise.

**5.** A baby with Down syndrome develops bilious vomiting a few hours after birth. Abdominal X-ray shows two large gas bubbles in the upper abdomen and no gas beyond. What is the operation of choice?

A. Duodenoduodenostomy · B. Ladd's procedure · C. Pyloromyotomy · D. Gastrojejunostomy · E. Pull-through procedure

**Answer: A.** Duodenal atresia ("double bubble").

**6.** A term baby has not passed meconium at 60 hours and has abdominal distension. On rectal examination there is explosive passage of gas and stool. Which investigation confirms the diagnosis?

A. Abdominal ultrasound · B. Anal manometry alone · C. Contrast enema alone · D. Plain abdominal X-ray · E. Rectal suction biopsy

**Answer: E.** Absence of ganglion cells confirms Hirschsprung's disease.

**7.** A 6-week-old baby has had jaundice since the second week of life, with pale stools and dark urine, but is feeding and gaining weight well. Conjugated bilirubin is raised. Ultrasound shows a small, contracted gallbladder. What is the best treatment?

A. Kasai portoenterostomy as soon as possible · B. Liver transplantation at 2 years · C. Phototherapy · D. Stop breastfeeding for 48 hours · E. Ursodeoxycholic acid alone

**Answer: A.** Biliary atresia — best results before 60 days.

**8.** A 9-month-old boy has a urethral opening on the underside of the penile shaft and a hooded foreskin. His parents request religious circumcision now. What is the most appropriate advice?

A. Circumcise now and repair later · B. Circumcise only if UTI occurs · C. Defer circumcision; the foreskin is needed for hypospadias repair · D. Hypospadias needs no treatment · E. Perform circumcision with meatal dilatation

**Answer: C.** Circumcision can be done at the time of hypospadias repair.

**9.** A newborn boy has a weak urinary stream, a palpable bladder and bilateral hydronephrosis on ultrasound. Which investigation is diagnostic?

A. CT urogram · B. DMSA scan · C. Intravenous urogram · D. Micturating cystourethrogram · E. Renal biopsy

**Answer: D.** Posterior urethral valves are shown as a dilated posterior urethra.

**10.** A 15-month-old girl is irritable, pale and limping, with bruising around both eyes and a hard, irregular abdominal mass that crosses the midline. Which test is most useful for diagnosis?

A. Serum alpha-fetoprotein · B. Serum calcium · C. Urinary VMA and HVA · D. Urine culture · E. β-hCG

**Answer: C.** Neuroblastoma with orbital and bone metastases.

*References: Bailey & Love's Short Practice of Surgery, 28th Ed.; Blecha, Surgery, 4th Ed.; ATLS, 10th Ed.*

PART 14

# Transplantation

## Chapter 95: Transplant Immunology, Rejection and Immunosuppression

### Definitions

- **Autograft:** tissue moved within the same person (skin graft, saphenous vein bypass) — no rejection
- **Isograft (syngeneic):** between genetically identical twins — no rejection
- **Allograft:** between genetically different members of the same species — the usual organ transplant; needs immunosuppression
- **Xenograft:** between species (e.g. pig heart valves, experimental pig organs)
- **Orthotopic:** placed in the normal anatomical position (liver, heart); **heterotopic:** placed elsewhere (kidney in iliac fossa)

### Key antigens

- **ABO blood group antigens** — expressed on endothelium; **ABO incompatibility causes hyperacute rejection** (donor and recipient must be ABO compatible, except in special desensitisation programmes)
- **Human leucocyte antigens (HLA) — the major histocompatibility complex (MHC) on chromosome 6.** Class I (HLA-A, B, C) on all nucleated cells; class II (HLA-DR, DQ, DP) on antigen-presenting cells. **HLA-DR matching is most important** for kidney graft survival

### Pre-transplant immunological tests

- ABO blood grouping
- **HLA tissue typing** of donor and recipient
- **HLA antibody screening** of the recipient (sensitisation from previous transplants, pregnancy, blood transfusion) — panel reactive antibodies, donor-specific antibodies
- **Crossmatch** (recipient serum against donor lymphocytes — complement-dependent cytotoxicity or flow cytometry): **a positive T-cell crossmatch is a contraindication** (hyperacute rejection)

### Types of rejection

| Type | Timing | Mechanism | Features | Treatment |
|---|---|---|---|---|
| **Hyperacute** | **Minutes to hours** (on the operating table) | **Pre-formed antibodies** (ABO or anti-HLA) → complement activation, thrombosis | Graft turns blue, mottled, soft; no function | **Irreversible — remove graft**; prevented by ABO matching and crossmatch |

| Type | Timing | Mechanism | Features | Treatment |
|---|---|---|---|---|
| **Acute cellular (T-cell mediated)** | Days to months (commonest in first 3 months) | **T lymphocytes** attack graft | Fever, graft tenderness, **rising creatinine** (kidney), raised LFTs (liver); confirm by **biopsy** (tubulitis, interstitial infiltrate) | **High-dose IV methylprednisolone pulses**; ATG for steroid-resistant rejection — usually reversible |
| **Acute antibody-mediated** | Days to months | Donor-specific antibodies | C4d staining on biopsy | Plasmapheresis, IVIG, rituximab |
| **Chronic** | Months to years | Immune + non-immune (ischaemia, drug toxicity, hypertension) | Slow progressive loss of function; **obliterative arteriopathy**, interstitial fibrosis, tubular atrophy | **No effective treatment** — commonest cause of late graft loss; retransplant |

**Graft-versus-host disease (GVHD):** donor lymphocytes attack the recipient — mainly after **bone marrow** and **small bowel** transplants (lymphoid-rich grafts); rash, diarrhoea, liver dysfunction.

### Immunosuppressive drugs

| Group | Drugs | Mechanism | Key side effects |
|---|---|---|---|
| **Calcineurin inhibitors (CNI) — backbone** | **Tacrolimus** (commonest), ciclosporin | Inhibit calcineurin → block IL-2 production and T-cell activation | **Nephrotoxicity**, hypertension, **new-onset diabetes (tacrolimus)**, tremor, hyperkalaemia; ciclosporin — **gum hypertrophy, hirsutism**; drug interactions (monitor blood levels) |
| **Antiproliferative agents** | **Mycophenolate mofetil (MMF)**, azathioprine | Block purine synthesis → inhibit lymphocyte proliferation | MMF — diarrhoea, leucopenia, teratogenic; azathioprine — marrow suppression (check TPMT), pancreatitis |
| **Corticosteroids** | Prednisolone, methylprednisolone | Broad anti-inflammatory, block cytokines | Diabetes, osteoporosis, infection, poor wound healing, Cushingoid features |
| **mTOR inhibitors** | Sirolimus, everolimus | Block T-cell proliferation in response to IL-2 | **Poor wound healing**, lymphocele, hyperlipidaemia, mouth ulcers; **anti-cancer effect** (used in skin cancer, Kaposi sarcoma) |
| **Induction agents** | **Basiliximab** (anti-IL-2 receptor), **anti-thymocyte globulin (ATG)**, alemtuzumab | Deplete or block T cells at transplantation | Cytokine release, infection, PTLD |
| Co-stimulation blocker | Belatacept | Blocks CD28 co-stimulation | Avoids CNI nephrotoxicity; PTLD risk if EBV-negative |

**Typical regimen:** induction (basiliximab or ATG) + **triple maintenance therapy — tacrolimus + mycophenolate + prednisolone** (steroids tapered or withdrawn in selected patients).

> **Exam Alert:** Hyperacute rejection is due to pre-formed antibodies and is irreversible — prevent it by ABO matching and a negative crossmatch. Acute rejection is T-cell mediated and treated with pulsed steroids. Chronic rejection is the commonest cause of late graft loss. Tacrolimus is nephrotoxic and diabetogenic.

# Chapter 96: Organ Donation — Brain Death, Deceased and Living Donation, Ethics and Law

### Sources of organs

| Type | Description | Organs |
|---|---|---|
| **Donation after brain death (DBD)** | Heart-beating donor on a ventilator with irreversible loss of brainstem function | Kidneys, liver, heart, lungs, pancreas, intestine, corneas, tissues |
| **Donation after circulatory death (DCD)** | Organs retrieved after cardiac arrest (usually after planned withdrawal of life support); longer warm ischaemia | Kidneys, liver, pancreas, lungs |
| **Living donation** | Healthy person donates a kidney or part of the liver | **Kidney (commonest in Pakistan)**, liver lobe/segments |

## Brain Death (Brainstem Death)

**Definition:** Irreversible loss of the capacity for consciousness combined with irreversible loss of the capacity to breathe — legally and medically equivalent to death.

**Preconditions** (all must be met before testing)

- Known cause of irreversible brain damage (e.g. severe head injury, intracranial haemorrhage)
- Patient in apnoeic coma on a ventilator
- **Exclude reversible causes:** sedative or neuromuscular blocking drugs, **hypothermia** (core temperature >34 °C), severe metabolic or endocrine disturbance (sodium, glucose, thyroid), hypotension

**Brainstem tests** (performed by two experienced senior doctors, on two occasions)

- **Fixed pupils**, no response to light
- **Absent corneal reflex**
- **Absent oculovestibular (caloric) reflex** — no eye movement on ice-cold water in the ears
- No motor response in the cranial nerve distribution to painful stimuli
- **Absent gag and cough reflexes**
- **Apnoea test:** no respiratory effort when $PaCO_2$ rises above 6.0 kPa (with pH <7.40) while oxygenation is maintained

Spinal reflexes may persist and do not exclude brain death. Ancillary tests (EEG, cerebral angiography, CT perfusion) are used when clinical tests cannot be completed.

**Donor management ("care of the potential donor"):** maintain BP (vasopressors), fluids, treat diabetes insipidus (desmopressin), hormone replacement (thyroxine, steroids), normothermia, ventilation — preserves organ function.

**Contraindications to donation:** active malignancy (except some primary brain tumours and treated skin cancers), uncontrolled sepsis, **HIV** (with exceptions in HIV-to-HIV programmes), prion disease (CJD); organ-specific dysfunction. Hepatitis B/C-positive organs may be used in selected recipients.

## Organ Preservation

- **Static cold storage** in preservation solution (University of Wisconsin, HTK) at **4 °C** — slows metabolism
- **Machine perfusion** — hypothermic or **normothermic** (warm, oxygenated) perfusion; allows assessment and "reconditioning" of marginal organs

- **Cold ischaemia time limits (approximate): heart 4–6 h**, lungs 6–8 h, **liver 8–12 h**, pancreas 12 h, **kidney 24–36 h**
- **Warm ischaemia** (from circulatory arrest to cold perfusion) is far more damaging

### Living Donation

**Advantages:** better graft survival, planned surgery, **shorter waiting time**, pre-emptive transplantation before dialysis.

**Donor evaluation:** voluntary informed consent free from coercion, independent assessment, blood group and crossmatch, normal renal function and anatomy (CT angiography), no diabetes, uncontrolled hypertension, significant obesity, active infection or malignancy; psychological assessment.

**Donor risks:** surgical mortality about **1 in 3,000** for nephrectomy (higher for liver donation); small increased lifetime risk of hypertension, proteinuria and end-stage renal disease. **Laparoscopic donor nephrectomy** is standard (left kidney preferred — longer renal vein).

**Paired ("swap") exchange:** incompatible donor–recipient pairs exchange donors with another pair to achieve compatible transplants.

### Ethics and Law

**Core ethical principles:** voluntary, informed consent; no coercion; **no financial reward or commercial dealing**; fair and transparent allocation of deceased-donor organs; protection of vulnerable donors; confidentiality.

**Declaration of Istanbul (2008):** condemns **organ trafficking and transplant tourism**, and promotes self-sufficiency in organ donation within each country.

**Pakistan:** the **Transplantation of Human Organs and Tissues Act (2010)**, following the 2007 Ordinance, **prohibits commercial dealing in human organs** with criminal penalties, permits living donation from close relatives and, in other cases, only with approval of an evaluation committee, permits deceased donation, and requires transplantation to take place at authorised centres under the **Human Organ Transplant Authority (HOTA)** and provincial authorities. The law followed a period when Pakistan was a recognised centre of commercial kidney trade. Deceased donation in Pakistan remains very limited; public awareness, family consent and religious guidance (scholars have supported donation as an act of saving life) are key to increasing it.

> **Exam Alert:** Brainstem death testing requires exclusion of reversible causes (drugs, hypothermia, metabolic) and includes the apnoea test. Kidneys tolerate the longest cold ischaemia; the heart the shortest. Organ sale is illegal in Pakistan and condemned by the Declaration of Istanbul.

## Chapter 97: Kidney Transplantation

**Overview:** Kidney transplantation is the **treatment of choice for end-stage renal disease (ESRD)** — better survival, quality of life and lower long-term cost than dialysis. It is the **commonest solid organ transplant** worldwide and in Pakistan (mostly living-related donors; SIUT Karachi is a leading public centre).

**Common causes of ESRD in recipients: diabetic nephropathy** (commonest), hypertension, chronic glomerulonephritis, polycystic kidney disease, chronic pyelonephritis/reflux, obstructive uropathy (stones — common in Pakistan), unknown cause.

**Recipient evaluation:** cardiovascular fitness (coronary disease is the main cause of death), infection screening (hepatitis B/C, HIV, TB — latent TB treatment in Pakistan, CMV, EBV), malignancy screening,

urological assessment (bladder function, iliac vessels — calcification), dental review, psychosocial assessment, ABO and HLA typing and antibodies.

**Contraindications:** active malignancy, active uncontrolled infection, severe uncorrectable cardiac or pulmonary disease, limited life expectancy, active substance misuse, non-adherence; positive crossmatch.

### Operation

- **Heterotopic placement in the iliac fossa** (usually the right — external iliac vessels are more superficial), **extraperitoneal** approach via a curved (Rutherford–Morison) incision
- **Renal artery → external iliac artery** (end-to-side); **renal vein → external iliac vein** (end-to-side)
- **Ureter → bladder** (extravesical ureteroneocystostomy, Lich–Gregoir) over a temporary **double-J stent**
- **Native kidneys are usually left in place** (remove only for recurrent infection, large polycystic kidneys, uncontrolled hypertension or malignancy)

**Post-operative care:** fluid balance (high urine output in living-donor grafts), monitor creatinine, urine output, immunosuppressant levels; Doppler ultrasound of the graft; prophylaxis — **co-trimoxazole (Pneumocystis)**, **valganciclovir (CMV)**, antifungal; DVT prophylaxis; remove stent at 4–6 weeks.

**Delayed graft function (DGF):** need for dialysis in the first week — commoner with deceased (especially DCD) donors because of ischaemia–reperfusion injury (acute tubular necrosis).

### Complications

| Category | Complications |
|---|---|
| **Vascular** | **Renal artery thrombosis** or **renal vein thrombosis** (early, sudden anuria — graft loss; urgent Doppler and exploration), **transplant renal artery stenosis** (late — hypertension, rising creatinine; angioplasty), haemorrhage |
| **Urological** | **Urine leak** (anastomotic — early), **ureteric stenosis/obstruction** (hydronephrosis on USG — nephrostomy, stent, reimplantation), **lymphocele** (perigraft collection — commonest fluid collection; drain or laparoscopic peritoneal fenestration), haematuria |
| **Immunological** | Hyperacute, acute (rising creatinine — **graft biopsy**), chronic rejection |
| **Infection** | Wound infection, **UTI (commonest infection)**, CMV, BK polyomavirus nephropathy, Pneumocystis, TB reactivation |
| **Drug-related** | **CNI nephrotoxicity** (high tacrolimus levels — biopsy distinguishes from rejection), new-onset diabetes after transplant, hypertension, dyslipidaemia |
| **Malignancy** | Skin cancer (**SCC commonest**), **PTLD**, Kaposi sarcoma |
| **Recurrence** | Original disease recurring in the graft (FSGS, IgA nephropathy, diabetes) |

**Approach to rising creatinine after transplant:** check volume status and drug levels, urine culture, **ultrasound with Doppler** (obstruction, collection, perfusion), then **graft biopsy** (rejection vs CNI toxicity vs BK virus vs ATN).

**Outcomes:** living donor kidney graft survival ~95% at 1 year and ~80% at 10 years (half-life ~15–20 years); deceased donor ~90% at 1 year. **Death with a functioning graft** (cardiovascular disease, infection, cancer) is the commonest cause of graft loss in the long term.

> **Exam Alert:** Kidney transplant is placed extraperitoneally in the iliac fossa, joined to the external iliac vessels and the bladder; native kidneys are left in place. Sudden anuria early after transplant = vascular thrombosis — urgent Doppler. Lymphocele is the commonest perigraft collection. A rising creatinine needs ultrasound and biopsy.

# Chapter 98: Liver Transplantation

**Overview:** The only curative treatment for end-stage liver disease, acute liver failure and selected liver cancers. In Pakistan, most liver transplants are **living-donor liver transplants (LDLT)** using the donor's right or left lobe; centres include PKLI (Lahore) and others. The burden of **hepatitis B and C cirrhosis** in Pakistan makes this an important topic.

### Indications

| Category | Examples |
|---|---|
| **Chronic liver disease (cirrhosis)** | **Hepatitis C and B** (commonest in Pakistan), alcohol-related liver disease, **metabolic dysfunction-associated steatotic liver disease (MASLD/NASH)** — rising worldwide, autoimmune hepatitis, PBC, PSC, Wilson's disease, haemochromatosis |
| **Acute liver failure** | **Paracetamol overdose**, viral hepatitis (A, B, E — hepatitis E in pregnancy), drug-induced, Wilson's disease, Budd–Chiari |
| **Liver cancer** | **Hepatocellular carcinoma (HCC)** within the **Milan criteria**: single tumour ≤5 cm, or up to 3 tumours each ≤3 cm, with no vascular invasion or extrahepatic spread |
| **Children** | **Biliary atresia (commonest)**, metabolic disorders (alpha-1 antitrypsin deficiency, tyrosinaemia), Alagille syndrome, hepatoblastoma |
| Others | Polycystic liver disease, metabolic disorders with normal liver function (familial amyloid polyneuropathy, primary hyperoxaluria) |

**Timing and allocation:** severity of liver disease is scored with the **MELD score** (bilirubin, INR, creatinine, ± sodium) in adults and **PELD** in children; **Child–Pugh score** is also used clinically. Refer for assessment when complications develop: **ascites, variceal bleeding, hepatic encephalopathy, hepatorenal syndrome, spontaneous bacterial peritonitis, jaundice**, or HCC.

**Acute liver failure — King's College criteria (paracetamol):** arterial **pH <7.30** after resuscitation, **or** all three of INR >6.5, creatinine >300 µmol/L, and grade III–IV encephalopathy → urgent listing ("super-urgent").

**Contraindications:** active extrahepatic malignancy, HCC outside criteria, uncontrolled sepsis, severe cardiopulmonary disease (severe portopulmonary hypertension), **active alcohol or drug misuse** (most programmes require abstinence and support), inadequate social support, irreversible brain damage.

### Operation

- **Recipient hepatectomy** (often the most difficult part — portal hypertension, coagulopathy, adhesions)
- **Orthotopic implantation** — anastomoses: **hepatic veins/IVC** (caval replacement or **piggyback** technique preserving the recipient IVC), **portal vein**, **hepatic artery**, and **bile duct** (duct-to-duct, or Roux-en-Y hepaticojejunostomy in children and PSC)
- **Graft types:** whole liver (deceased donor), **split liver** (one deceased liver shared between an adult and a child), **reduced-size**, **living donor right or left lobe** (the liver regenerates in donor and recipient within weeks)

### Complications

| Timing | Complications |
|---|---|
| **Early** | **Primary non-function** (graft never works — urgent retransplant), haemorrhage, **hepatic artery thrombosis** (most serious vascular complication — graft necrosis, bile duct ischaemia; urgent Doppler, revascularisation or retransplant), portal vein thrombosis, **bile leak**, acute rejection, infection, renal failure |

| Timing | Complications |
|---|---|
| **Late** | **Biliary strictures** (anastomotic or ischaemic — ERCP dilatation/stenting), chronic rejection (ductopenic), **recurrence of original disease** (hepatitis B — prevented with antivirals ± HBIG; hepatitis C — now cured with direct-acting antivirals; HCC recurrence; PSC, autoimmune), CNI nephrotoxicity, diabetes, cardiovascular disease, de novo cancers, PTLD |

**Living donor risks:** major operation (right lobe donation ~0.1–0.5% mortality), bile leak, liver insufficiency — careful donor selection and **remnant liver volume of at least ~30%** of the original.

**Outcomes:** 1-year survival ~90% and 5-year survival ~75–80%. The liver is relatively **immunologically privileged** — lower rates of rejection than other organs; HLA matching is not used.

> **Exam Alert:** Milan criteria select HCC patients for transplant. King's College criteria (pH <7.3 after paracetamol overdose) identify acute liver failure needing urgent transplant. Hepatic artery thrombosis is the most serious vascular complication. In Pakistan most liver transplants are from living donors.

# Chapter 99: Pancreas, Heart, Lung and Intestinal Transplantation; Long-term Complications

## Other Organ Transplants (Brief)

| Transplant | Main indications | Key points |
|---|---|---|
| **Pancreas** | **Type 1 diabetes** with ESRD — **simultaneous pancreas–kidney (SPK)** (commonest); pancreas after kidney; pancreas alone for life-threatening hypoglycaemia unawareness | Graft placed in the iliac fossa; exocrine drainage into **small bowel (enteric)** or bladder; complications — **graft thrombosis** (commonest cause of early loss), pancreatitis, leak; achieves insulin independence and stabilises diabetic complications |
| **Islet cell** | Type 1 diabetes with severe hypoglycaemia | Islets infused into the **portal vein** percutaneously; minimally invasive; often several infusions needed |
| **Heart** | End-stage heart failure (cardiomyopathy, ischaemic heart disease) despite optimal therapy | **Cardiac allograft vasculopathy** (accelerated coronary disease — chronic rejection); **denervated heart** — no angina, resting tachycardia; ventricular assist devices as bridge |
| **Lung** | COPD, **pulmonary fibrosis**, **cystic fibrosis** (bilateral), pulmonary hypertension | **Bronchiolitis obliterans syndrome** (chronic rejection) limits survival; highest rejection and infection rates of solid organs |
| **Intestinal / multivisceral** | **Intestinal failure** (short bowel syndrome) with TPN complications — liver failure, loss of venous access, recurrent line sepsis | Highly immunogenic (lymphoid-rich) — high rejection, GVHD and infection rates |
| **Cornea, skin, bone, heart valves** | Tissue transplants | Cornea is avascular — immunologically privileged |
| Vascularised composite allografts | Hand, face, uterus | Highly specialised; lifelong immunosuppression for non-life-saving grafts raises ethical issues |

## Long-term Complications of Transplantation (all organs)

**1. Infection** — the commonest complication; timing follows the degree of immunosuppression:

| Period | Typical infections |
|---|---|
| **First month** | Surgical and hospital-acquired: wound infection, **UTI**, pneumonia, line sepsis, *C. difficile* |
| **1–6 months** (peak immunosuppression) | **Opportunistic**: **cytomegalovirus (CMV)** — commonest viral (fever, leucopenia, hepatitis, colitis, pneumonitis; prophylaxis with valganciclovir), *Pneumocystis jirovecii* pneumonia (**co-trimoxazole prophylaxis**), fungal (*Aspergillus*, *Candida*), **TB reactivation** (important in Pakistan), BK virus, EBV |
| **>6 months** | Community-acquired infections; late viral (CMV, varicella-zoster, hepatitis recurrence) |

Vaccinate before transplant; **avoid live vaccines** after transplant.

**2. Malignancy** — risk 2–4 times the general population:

- **Non-melanoma skin cancer** — **commonest; squamous cell carcinoma more common than BCC** (reversal of the usual ratio); sun protection and regular skin checks; switch to mTOR inhibitors
- **Post-transplant lymphoproliferative disorder (PTLD)** — **EBV-driven** B-cell proliferation; highest risk in EBV-negative recipients (children) of EBV-positive grafts; treat by **reducing immunosuppression**, **rituximab**, chemotherapy
- **Kaposi sarcoma** (HHV-8), cervical and anal cancer (HPV), renal cell carcinoma (native kidneys)

**3. Cardiovascular disease** — leading cause of death with a functioning graft: hypertension, **new-onset diabetes after transplant (tacrolimus, steroids)**, dyslipidaemia, obesity.

**4. Drug toxicity** — CNI nephrotoxicity (chronic kidney disease after non-renal transplants), bone disease (steroids — osteoporosis, avascular necrosis of hip), gout, gum hypertrophy, cosmetic effects.

**5. Chronic rejection** and **non-adherence** to immunosuppression (a major cause of graft loss, especially in adolescents).

**Surgery in a transplant patient:** continue immunosuppression (IV if nil by mouth), consider **stress-dose steroids**, avoid nephrotoxins (NSAIDs, aminoglycosides, contrast), check drug interactions (e.g. macrolides and azoles raise tacrolimus levels), impaired wound healing (sirolimus), atypical presentation of sepsis and peritonitis (steroids mask signs).

> **Exam Alert:** SPK transplant is for type 1 diabetes with renal failure. CMV is the commonest opportunistic infection, peaking at 1–6 months. Squamous cell carcinoma is the commonest cancer after transplantation; PTLD is EBV-driven and treated by reducing immunosuppression. Steroids mask peritonitis in transplant patients.

## Self-Assessment: Part 14 SBAs

**1.** Minutes after the vascular clamps are released during a kidney transplant, the graft becomes mottled, blue and flaccid. What is the mechanism?

A. Calcineurin inhibitor toxicity · B. Graft-versus-host disease · C. Pre-formed recipient antibodies against donor antigens · D. T-cell mediated acute rejection · E. Ureteric obstruction

**Answer: C.** Hyperacute rejection — irreversible; prevented by ABO matching and crossmatch.

**2.** Six weeks after a living-related kidney transplant, a 30-year-old man has a rising creatinine, low-grade fever and graft tenderness. Tacrolimus level is in range and Doppler ultrasound is normal. What is the most appropriate next step?

A. Graft biopsy · B. Graft nephrectomy · C. Increase tacrolimus dose · D. Observe for 2 weeks · E. Start haemodialysis

**Answer: A.** Biopsy confirms acute rejection, then pulsed IV methylprednisolone.

**3.** Which drug used after transplantation commonly causes new-onset diabetes and nephrotoxicity?

A. Basiliximab · B. Co-trimoxazole · C. Mycophenolate mofetil · D. Tacrolimus · E. Valganciclovir

**Answer: D.** A calcineurin inhibitor.

**4.** A 25-year-old man on a ventilator after a severe head injury has fixed dilated pupils. Brainstem death testing is planned. Which finding must be excluded before testing?

A. Absent corneal reflexes · B. Absent gag reflex · C. Core temperature of 32 °C · D. Preserved spinal reflexes · E. Raised intracranial pressure

**Answer: C.** Hypothermia is a reversible cause of coma and must be corrected first.

**5.** Which organ tolerates the longest period of cold ischaemia during preservation?

A. Heart · B. Kidney · C. Liver · D. Lung · E. Pancreas

**Answer: B.** Up to 24–36 hours.

**6.** On the first day after a deceased-donor kidney transplant, a patient who had been passing 200 ml/h of urine suddenly becomes anuric. The catheter is patent. What is the most urgent investigation?

A. DMSA scan · B. Doppler ultrasound of the graft · C. Graft biopsy · D. Micturating cystourethrogram · E. Serum tacrolimus level

**Answer: B.** Exclude renal artery or vein thrombosis.

**7.** Four weeks after a kidney transplant, a patient develops a painless swelling over the graft and mild hydronephrosis. Ultrasound shows a clear fluid collection; aspirate creatinine equals serum creatinine. What is the most likely diagnosis?

A. Abscess · B. Haematoma · C. Lymphocele · D. Seroma from wound · E. Urine leak

**Answer: C.** A urine leak would have a much higher fluid creatinine than serum.

**8.** A 19-year-old woman presents 30 hours after a large paracetamol overdose. After resuscitation, her arterial pH is 7.22 and she is confused. What is the most appropriate management?

A. Activated charcoal only · B. Discharge after psychiatric review · C. Haemodialysis alone · D. N-acetylcysteine and urgent referral to a liver transplant unit · E. Oral steroids

**Answer: D.** Meets King's College criteria for transplant listing.

**9.** A 55-year-old man with hepatitis C cirrhosis has a single 4 cm hepatocellular carcinoma without vascular invasion or extrahepatic spread. Which statement is correct?

A. He is outside the Milan criteria · B. He meets the Milan criteria for liver transplantation · C. Liver transplantation is contraindicated in hepatitis C · D. Only chemotherapy is suitable · E. Tumour must be <2 cm

**Answer: B.** Single tumour ≤5 cm.

**10.** Three months after a kidney transplant, a patient has fever, leucopenia, raised liver enzymes and diarrhoea. Which infection is most likely?

A. Cytomegalovirus · B. Hepatitis A · C. Malaria · D. Staphylococcal wound infection · E. Typhoid

**Answer: A.** CMV peaks at 1–6 months of peak immunosuppression.

*References: Bailey & Love's Short Practice of Surgery, 28th Ed.; Blecha, Surgery, 4th Ed.*

PART 15

# Bariatric and Metabolic Surgery

## Chapter 100: Obesity — Assessment and Indications for Bariatric Surgery

**Definition:** Obesity is a chronic, relapsing disease of excess body fat that impairs health. It is measured by the **body mass index (BMI) = weight (kg) ÷ height (m)²**. Pakistan has one of the highest rates of obesity and diabetes in South Asia, especially among women and urban populations.

**WHO classification of BMI (kg/m²)**

| Category | General (WHO) | Asian populations (lower cut-offs) |
|---|---|---|
| Normal | 18.5–24.9 | 18.5–22.9 |
| Overweight | 25–29.9 | 23–27.4 |
| Obesity class I | 30–34.9 | ≥27.5 |
| Obesity class II | 35–39.9 | — |
| Obesity class III (severe) | **≥40** | — |

**South Asians develop diabetes and cardiovascular disease at lower BMIs** (more visceral fat) — hence lower thresholds. **Waist circumference** (central obesity) adds information: increased risk at >90 cm in South Asian men and >80 cm in women.

**Causes and contributing factors:** high-calorie diet and sedentary lifestyle (commonest), genetic predisposition, psychological factors (binge eating), sleep deprivation, medications (steroids, antipsychotics, insulin, sodium valproate), endocrine disorders (**hypothyroidism, Cushing's syndrome**, polycystic ovary syndrome), hypothalamic damage, genetic syndromes (Prader–Willi).

**Obesity-related diseases: type 2 diabetes**, hypertension, dyslipidaemia, coronary heart disease, stroke, **obstructive sleep apnoea (OSA)**, **metabolic dysfunction-associated steatotic liver disease (MASLD/NAFLD)**, GORD, gallstones, osteoarthritis (knees, hips), PCOS and infertility, venous thromboembolism, depression, idiopathic intracranial hypertension, and cancers (breast, endometrium, colon, oesophageal adenocarcinoma, kidney, liver).

**Assessment of the patient with obesity**

- Weight history, previous diet and drug attempts, eating behaviour (binge eating), psychological assessment
- Comorbidities: HbA1c, lipids, LFTs, renal function, thyroid function, **sleep study (STOP-BANG score)**, ECG/echocardiography if indicated
- Nutritional baseline: iron, ferritin, vitamin B12, folate, vitamin D, calcium
- Upper GI endoscopy (selected — GORD, *H. pylori*, hiatus hernia)
- Exclude secondary causes (thyroid, Cushing's)

### Management ladder

1. **Lifestyle:** dietary change (calorie deficit), physical activity, behavioural therapy — expected loss 5–10%
2. **Pharmacotherapy: GLP-1 receptor agonists (semaglutide, liraglutide)** and dual GIP/GLP-1 agonist (**tirzepatide**) — weight loss of ~15–20%; orlistat (lipase inhibitor); weight usually returns on stopping
3. **Endoscopic therapies:** intragastric balloon, endoscopic sleeve gastroplasty — modest, temporary
4. **Bariatric (metabolic) surgery: most effective and durable treatment** for severe obesity — sustained loss of 25–35% of total body weight, remission of diabetes, and reduced mortality

### Indications for bariatric/metabolic surgery (current international guidance, ASMBS/IFSO 2022)

- **BMI ≥35 kg/m²**, regardless of the presence or severity of comorbidities
- **BMI 30–34.9 kg/m² with metabolic disease** (especially type 2 diabetes) not controlled by non-surgical means
- **Lower thresholds for Asians: consider surgery from BMI ≥27.5 kg/m²**
- Adolescents with severe obesity in specialist centres
- Previous guidance (NIH 1991): BMI ≥40, or ≥35 with comorbidities — still quoted in examinations

**Contraindications:** untreated major psychiatric illness or eating disorder, active substance or alcohol misuse, inability to comply with lifelong follow-up and supplements, unacceptable anaesthetic risk, untreated endocrine cause, pregnancy (or planned pregnancy within 12–18 months).

**Multidisciplinary team:** bariatric surgeon, physician/endocrinologist, anaesthetist, dietitian, psychologist, specialist nurse.

> **Exam Alert:** BMI = kg/m²; Asians have lower cut-offs (obesity ≥27.5). Bariatric surgery is the most effective long-term treatment for severe obesity. Current indications: BMI ≥35, or 30–34.9 with metabolic disease (≥27.5 in Asians). Always assess for obstructive sleep apnoea.

## Chapter 101: Bariatric Operations — Sleeve Gastrectomy, Gastric Bypass and Others

**Mechanisms of action:** bariatric operations were classically described as **restrictive** (reduce stomach capacity) or **malabsorptive** (bypass absorptive intestine). We now know the main effect is **metabolic and hormonal**: reduced **ghrelin** (hunger hormone, from the gastric fundus), increased **GLP-1 and peptide YY** (satiety, insulin secretion) from rapid delivery of food to the distal gut, altered bile acids and gut microbiota. All operations are performed **laparoscopically** (robotic in some centres).

### Comparison of the main operations

| Operation | Description | Expected excess weight loss | Advantages | Disadvantages |
|---|---|---|---|---|
| **Sleeve gastrectomy (SG)** | **Longitudinal resection of ~75–80% of the stomach** (greater curvature and fundus) over a 36–40 Fr bougie, leaving a tube-shaped stomach | ~60–70% | **Commonest bariatric operation worldwide** (and in Pakistan); technically simpler; no anastomosis; no bowel bypass — fewer deficiencies; removes ghrelin-producing fundus | Irreversible; **new or worse GORD** (and Barrett's); **staple-line leak** (usually near the angle of His); weight regain |

| Operation | Description | Expected excess weight loss | Advantages | Disadvantages |
|---|---|---|---|---|
| **Roux-en-Y gastric bypass (RYGB)** | Small **gastric pouch (~30 ml)** joined to a **Roux limb of jejunum** (~100–150 cm); biliopancreatic limb joined further down (jejunojejunostomy) | ~65–75% | **"Gold standard"**; excellent for **diabetes** and **GORD** (treats reflux) | Marginal ulcer, **internal hernia**, dumping, iron/ B12/calcium deficiency; technically more complex |
| **One-anastomosis gastric bypass (OAGB / mini-gastric bypass)** | Long, narrow gastric pouch with a **single loop gastrojejunostomy** ~150–200 cm from the duodenojejunal flexure | ~70–80% | One anastomosis; shorter operation; strong diabetes remission; popular in South Asia | **Bile reflux** gastritis/ oesophagitis; malnutrition if limb too long |
| **Adjustable gastric band (AGB)** | Inflatable silicone band around the upper stomach, adjusted via a subcutaneous port | ~40–50% | Reversible, no stapling | **Largely abandoned** — poor long-term results; slippage, erosion, port problems, re-operation |
| **Biliopancreatic diversion with duodenal switch (BPD-DS) / SADI-S** | Sleeve gastrectomy + duodeno-ileal anastomosis with a short common channel | ~75–85% | Most weight loss; for **super obesity** (BMI >50) | **Severe malabsorption** — protein, fat-soluble vitamins; diarrhoea; specialist centres only |

**Choice of operation (common practice):**

- **Sleeve gastrectomy:** most patients; high-risk or super-obese patients (sometimes as first stage)
- **RYGB:** patients with **significant GORD/Barrett's**, **type 2 diabetes**, or weight regain/reflux after sleeve (revision)
- **OAGB:** alternative to RYGB, especially in diabetes
- **BPD-DS/SADI-S:** BMI >50, specialist centres

**Expected outcomes:** loss of ~25–35% of total body weight; **remission of type 2 diabetes in ~60–80%** (higher after bypass, shorter diabetes duration); improvement in hypertension, sleep apnoea, fatty liver, PCOS, joint pain, quality of life; **reduced overall mortality and cancer incidence**. Some weight regain (~10–20%) after 2–5 years is common.

**Revisional surgery:** for inadequate weight loss, weight regain or complications (e.g. sleeve to RYGB for severe reflux; band removal and conversion).

> **Exam Alert:** Sleeve gastrectomy is the commonest bariatric operation; it can cause new reflux. Roux-en-Y gastric bypass is the gold standard and is preferred in patients with GORD and diabetes. Bariatric surgery works mainly through hormonal changes (↓ ghrelin, ↑ GLP-1). Gastric banding is largely abandoned.

## Chapter 102: Complications of Bariatric Surgery

**Key principle:** Signs of peritonitis are **masked in obese patients** — abdominal examination is unreliable. **Persistent tachycardia (>120/min) after bariatric surgery is an anastomotic or staple-line leak until proved otherwise.** Have a low threshold for CT or **diagnostic laparoscopy**.

## Early Complications (first 30 days)

| Complication | Key features | Management |
|---|---|---|
| **Leak** (staple line or anastomosis) | ~1–2%; **tachycardia** (earliest sign), fever, tachypnoea, abdominal or left shoulder pain, sense of doom; after sleeve — typically at the **angle of His (upper staple line)** | CT with oral contrast; resuscitation, antibiotics, NPO; **re-laparoscopy, washout and drainage** if unstable; **endoscopic stent or internal drainage** for contained leaks; nutritional support |
| **Haemorrhage** | Intraluminal (haematemesis, melaena) or intra-abdominal (from staple line) | Resuscitation, endoscopy, re-laparoscopy |
| **Venous thromboembolism** | DVT/PE — a leading cause of death | **Prophylaxis:** early mobilisation, compression devices, weight-adjusted LMWH (extended in high-risk) |
| Respiratory | Atelectasis, pneumonia; OSA worsened by opioids | CPAP, physiotherapy, opioid-sparing analgesia |
| Others | Wound/port-site infection, rhabdomyolysis (long surgery), portomesenteric vein thrombosis (after sleeve), dehydration, AKI | — |

## Late Complications

| Complication | Operation | Key features and management |
|---|---|---|
| **Internal hernia** | **RYGB** (and OAGB) | Bowel herniates through mesenteric defects (**Petersen's space**, jejunojejunostomy defect) — risk increases with weight loss; **intermittent colicky abdominal pain** with normal tests; CT — **"mesenteric swirl" sign**; **urgent laparoscopy** (risk of strangulation, even if CT normal); prevented by closing defects |
| **Marginal (anastomotic) ulcer** | RYGB, OAGB | At gastrojejunostomy; **smoking, NSAIDs, *H. pylori***; pain, bleeding, perforation, stricture; PPI, stop smoking/NSAIDs |
| **Anastomotic stricture** | RYGB | Vomiting, dysphagia at 4–8 weeks; endoscopic balloon dilatation |
| **GORD and Barrett's** | **Sleeve** | New or worse reflux in up to 20–30%; PPI; conversion to RYGB if severe |
| **Sleeve stenosis / twist** | Sleeve | Dysphagia, vomiting; dilatation, seromyotomy or conversion |
| **Bile reflux** | OAGB | Bilious vomiting, oesophagitis; conversion to Roux-en-Y |
| **Dumping syndrome** | RYGB (also sleeve) | **Early dumping** (15–30 min after meals — osmotic fluid shift: palpitations, sweating, faintness, bloating, diarrhoea); **late dumping** (1–3 h — **reactive hypoglycaemia** from insulin surge); small frequent meals, avoid simple sugars, separate liquids from solids; acarbose, octreotide |
| **Gallstones** | All (rapid weight loss) | Ursodeoxycholic acid for 6 months reduces risk; cholecystectomy if symptomatic |
| **Weight regain** | All | Dietary and behavioural support, GLP-1 agonists, revisional surgery |
| Band complications | Band | Slippage, **erosion into stomach**, port infection — band removal |
| Psychological | All | Depression, **alcohol misuse** (faster absorption after bypass), increased self-harm risk — long-term follow-up |

### Nutritional Deficiencies (lifelong supplementation required)

| Deficiency | Cause | Consequence | Prevention |
|---|---|---|---|
| **Iron** | Duodenal bypass, low acid | **Microcytic anaemia** (commonest deficiency) | Oral iron; IV iron if needed |
| **Vitamin B12** | Loss of intrinsic factor and acid | Macrocytic anaemia, **neuropathy** | **IM B12 every 3 months** or high-dose oral |
| **Calcium and vitamin D** | Duodenal bypass | Secondary hyperparathyroidism, **osteoporosis** | Calcium citrate + vitamin D |
| Folate | Reduced intake/absorption | Anaemia; neural tube defects in pregnancy | Multivitamin; folic acid before pregnancy |
| **Thiamine (B1)** | **Persistent vomiting** in the early post-operative period | **Wernicke's encephalopathy** (confusion, ataxia, ophthalmoplegia), beriberi | **IV thiamine before any glucose** in a vomiting patient |
| Protein | Malabsorptive procedures (BPD-DS) | Oedema, hair loss, hypoalbuminaemia | Protein supplements |
| Fat-soluble vitamins (A, D, E, K) | Malabsorptive procedures | Night blindness, coagulopathy | Supplements |

**Pregnancy after bariatric surgery:** delay for **12–18 months** (rapid weight-loss phase); fertility often improves (effective contraception needed — oral contraceptive absorption may be reduced); continue supplements.

> **Exam Alert:** Persistent tachycardia after bariatric surgery = leak until proved otherwise. Intermittent pain after gastric bypass = internal hernia → laparoscopy. Iron deficiency is the commonest deficiency; vomiting after surgery needs IV thiamine to prevent Wernicke's. Sleeve worsens reflux; bypass improves it.

## Chapter 103: Metabolic Surgery for Type 2 Diabetes and Perioperative Care of the Obese Patient

### Metabolic Surgery for Type 2 Diabetes

**Concept:** Bariatric operations improve glucose control **within days, before significant weight loss**, through hormonal effects (**incretin effect** — increased GLP-1 secretion from rapid nutrient delivery to the distal ileum; foregut exclusion; bile acid changes; reduced hepatic insulin resistance). Hence the term **metabolic surgery**.

**Evidence:** randomised trials (e.g. STAMPEDE) show that surgery achieves **better glycaemic control and higher remission rates than intensive medical therapy** in obese patients with type 2 diabetes. International diabetes organisations (including the 2nd Diabetes Surgery Summit, 2016) endorse metabolic surgery as a standard treatment option.

**Indications:** type 2 diabetes with **BMI ≥35**, or **BMI 30–34.9 with inadequately controlled diabetes** despite optimal medical treatment — **lower thresholds (≥27.5) in Asians**, which is very relevant in Pakistan.

**Predictors of diabetes remission: shorter duration of diabetes** (<8 years), **not on insulin**, good residual beta-cell function (**C-peptide**), younger age, greater weight loss (scores such as ABCD and DiaRem). **Bypass operations** give higher remission rates than sleeve gastrectomy.

**Other metabolic benefits:** improvement or resolution of hypertension, dyslipidaemia, **MASLD/NASH** (including fibrosis), sleep apnoea, PCOS; reduced cardiovascular events and mortality.

**Diabetes medication after surgery:** stop or reduce **sulphonylureas and insulin** immediately after surgery (risk of **hypoglycaemia**); continue metformin if needed; monitor glucose closely. Some patients relapse years later — continue annual HbA1c and retinal screening.

**Surgery and GLP-1 medicines together:** GLP-1/GIP agonists (semaglutide, tirzepatide) are now strong alternatives and complements — used before surgery (pre-operative weight loss) or after surgery for weight regain or diabetes relapse.

## Perioperative Care of the Obese Patient (any operation)

### Pre-operative

- **Obstructive sleep apnoea:** screen with **STOP-BANG**; sleep study; **CPAP** before and after surgery
- Cardiovascular and respiratory assessment; ECG, echocardiography if indicated
- **Glycaemic control** (HbA1c), stop smoking
- **Pre-operative low-calorie liver-shrinking diet** for 2 weeks before bariatric surgery — reduces liver size (left lobe) and improves access
- Equipment: bariatric operating table, large BP cuffs, transfer devices, long instruments and trocars

### Anaesthesia

- **Difficult airway and rapid desaturation** (reduced functional residual capacity) — preoxygenation in the **"ramped" (head-up) position**, video laryngoscopy
- Higher aspiration risk (GORD, hiatus hernia) — rapid sequence induction where indicated
- Drug dosing by **ideal or lean body weight** for most drugs
- **Opioid-sparing multimodal analgesia** (paracetamol, local anaesthetic infiltration, TAP blocks) — avoid respiratory depression in OSA
- Careful positioning and padding — pressure injury, rhabdomyolysis, nerve injury

### Post-operative

- **Early mobilisation** and **enhanced recovery (ERAS)** pathways
- **VTE prophylaxis:** mechanical + **weight-adjusted LMWH** (higher dose, e.g. enoxaparin 40 mg twice daily if BMI >40), extended prophylaxis in high-risk patients
- Sit up at 30–45°; CPAP; incentive spirometry; continuous oxygen saturation monitoring
- **Monitor for leak:** heart rate, temperature, respiratory rate
- Higher risk of **wound infection, seroma and dehiscence** (thick subcutaneous fat)

**Long-term follow-up after bariatric surgery:** lifelong supplements (multivitamin, iron, calcium/vitamin D, B12), regular blood tests (CBC, ferritin, B12, folate, vitamin D, calcium, PTH, albumin), dietary and psychological support, contraception advice; body-contouring surgery for excess skin after massive weight loss.

> **Exam Alert:** Metabolic surgery improves diabetes before weight loss through incretin (GLP-1) effects. Short diabetes duration and no insulin use predict remission. Reduce sulphonylureas and insulin after surgery to avoid hypoglycaemia. Screen for sleep apnoea (STOP-BANG), preoxygenate in the ramped position, and give weight-adjusted VTE prophylaxis.

## Self-Assessment: Part 15 SBAs

**1.** A 40-year-old Pakistani man weighs 82 kg and is 1.70 m tall. He has type 2 diabetes for 4 years, poorly controlled on metformin and gliclazide. What is the best description of his eligibility for metabolic surgery?

A. Eligible, because Asian thresholds are lower and his diabetes is uncontrolled · B. Ineligible, BMI must exceed 40 · C. Ineligible, diabetes is a contraindication · D. Ineligible until he starts insulin · E. Eligible only for gastric banding

**Answer: A.** BMI ≈28.4 kg/m²; surgery can be considered from BMI ≥27.5 in Asians with uncontrolled diabetes.

**2.** A 38-year-old woman with BMI 44 and severe reflux symptoms with Barrett's oesophagus on endoscopy is planning bariatric surgery. Which operation is most appropriate?

A. Adjustable gastric band · B. Intragastric balloon · C. Roux-en-Y gastric bypass · D. Sleeve gastrectomy · E. Biliopancreatic diversion

**Answer: C.** Bypass treats reflux; sleeve gastrectomy can worsen it.

**3.** Which hormone, produced mainly in the gastric fundus, falls after sleeve gastrectomy and reduces hunger?

A. Cholecystokinin · B. Gastrin · C. Ghrelin · D. Insulin · E. Peptide YY

**Answer: C.**

**4.** On the second day after laparoscopic sleeve gastrectomy, a patient has a pulse of 128/min, temperature 37.9 °C and a respiratory rate of 26, but the abdomen is soft. What is the most likely diagnosis?

A. Anxiety · B. Atelectasis only · C. Dumping syndrome · D. Staple-line leak · E. Wound infection

**Answer: D.** Persistent tachycardia is a leak until proved otherwise; abdominal signs are unreliable in obesity.

**5.** Two years after Roux-en-Y gastric bypass and 40 kg of weight loss, a woman has recurrent episodes of colicky upper abdominal pain. Blood tests are normal; CT shows a swirl of mesenteric vessels. What is the next step?

A. Diagnostic laparoscopy · B. Oral PPI and review · C. Ultrasound for gallstones · D. Upper GI endoscopy only · E. Reassurance

**Answer: A.** Internal hernia — risk of strangulation.

**6.** A smoker who had gastric bypass 1 year ago and takes ibuprofen for knee pain presents with epigastric pain and melaena. What is the most likely cause?

A. Duodenal ulcer in the excluded duodenum · B. Gastric cancer · C. Internal hernia · D. Marginal ulcer at the gastrojejunostomy · E. Oesophageal varices

**Answer: D.** Smoking and NSAIDs are the main risk factors.

**7.** Twenty minutes after a sweet meal, a patient who had gastric bypass develops palpitations, sweating, faintness, abdominal cramps and diarrhoea. What is the mechanism?

A. Bile reflux · B. Internal hernia · C. Reactive hypoglycaemia · D. Rapid entry of hyperosmolar food into the small bowel · E. Thiamine deficiency

**Answer: D.** Early dumping; reactive hypoglycaemia causes late dumping at 1–3 hours.

**8.** Six weeks after sleeve gastrectomy, a woman with persistent vomiting becomes confused, unsteady, with nystagmus. Before giving IV dextrose, which treatment is essential?

A. IV calcium · B. IV iron · C. IV thiamine · D. IM vitamin B12 · E. Oral vitamin D

**Answer: C.** Wernicke's encephalopathy.

**9.** Which nutritional deficiency is commonest after Roux-en-Y gastric bypass?

A. Iron · B. Thiamine · C. Vitamin A · D. Vitamin K · E. Zinc

**Answer: A.** Lifelong supplementation and monitoring are needed.

**10.** Which factor best predicts remission of type 2 diabetes after metabolic surgery?

A. Diabetes duration of 15 years · B. Insulin therapy for many years · C. Low C-peptide · D. Older age · E. Short duration of diabetes without insulin use

**Answer: E.** Preserved beta-cell function predicts remission.

*References: Bailey & Love's Short Practice of Surgery, 28th Ed.; Blecha, Surgery, 4th Ed.; ASMBS/IFSO Guidelines (2022).*

PART 16

# Plastic and Reconstructive Surgery

## Chapter 104: Principles of Reconstruction and Skin Grafts

**Aim of reconstructive surgery:** restore **function first**, then form (appearance), by replacing **"like with like"** tissue where possible.

**The reconstructive ladder** (simplest to most complex) — choose the simplest method that gives a good result:

1. Healing by **secondary intention**
2. **Primary closure** (direct suture)
3. Delayed primary closure
4. **Split-thickness skin graft**
5. **Full-thickness skin graft**
6. Tissue expansion
7. **Local flap**
8. Regional (pedicled) flap
9. **Free flap** (microvascular)

Modern practice uses the **"reconstructive elevator"** — going straight to the most appropriate rung (e.g. a free flap) when it gives the best function, rather than climbing step by step. **Negative pressure wound therapy (VAC)** is a useful adjunct to prepare or close wounds.

### Skin Grafts

**Definition:** A graft is tissue transferred **without its own blood supply**; it survives by obtaining nutrition from the recipient bed. (A **flap** carries its own blood supply.)

**Split-thickness vs full-thickness skin grafts**

| Feature | Split-thickness skin graft (SSG/STSG) | Full-thickness skin graft (FTSG) |
|---|---|---|
| Layers | Epidermis + **part of the dermis** | Epidermis + **whole dermis** |
| Donor sites | **Thigh** (commonest), buttock, arm, scalp | **Post-auricular**, pre-auricular, supraclavicular, upper eyelid, groin, inner arm |
| Donor site healing | **Heals spontaneously** by re-epithelialisation from adnexa (10–14 days); can be re-harvested | Must be **closed directly** (limited size) |
| Take | **Takes more easily** (thinner) | Needs an excellent, well-vascularised bed |
| Size | Large areas; can be **meshed** (expanded 1.5:1 to 3:1) to cover more area and let fluid drain | Small areas only |

| Feature | Split-thickness skin graft (SSG/STSG) | Full-thickness skin graft (FTSG) |
|---|---|---|
| **Secondary contraction** | **Marked** — contracts after healing | **Minimal** |
| Appearance | Poorer colour/texture match; shiny | **Better cosmetic match**; can grow with child |
| Uses | **Burns**, large wounds, leg ulcers, muscle beds, after excision of large lesions | **Face** (eyelids, nose), **hands and fingers** (flexor surfaces), over joints |

**Instruments:** split-skin grafts are harvested with a **dermatome** (electric/air-powered) or Humby/Watson knife; mesh grafter.

**Phases of graft "take"**

1. **Plasmatic imbibition** (0–48 h) — graft absorbs nutrients from plasma in the bed by diffusion
2. **Inosculation** (48–72 h) — graft and bed capillaries link up
3. **Revascularisation** (from day 3–5) — new vessels grow into the graft; lymphatic and nerve regrowth later (sensation partial)

**Requirements for successful take:** a **well-vascularised bed** (granulation tissue, muscle, fascia, periosteum, paratenon) and close contact. **Grafts will not take on bare bone without periosteum, bare tendon without paratenon, cartilage without perichondrium, or irradiated tissue** — these need a flap.

**Causes of graft failure (commonest first)**

- **Haematoma** or **seroma** (separates graft from bed) — commonest
- **Infection** — especially **β-haemolytic Streptococcus (Group A)**, which destroys grafts (check swab before grafting; > $10^5$ organisms/g)
- **Shearing** (movement) — prevented by tie-over (bolster) dressing, splintage, NPWT
- Poor bed (avascular, irradiated), smoking, malnutrition, steroids

**Other grafts:** composite grafts (skin + cartilage from ear for nasal alar defects), dermal substitutes (Integra), cultured epithelial autografts (major burns), fat grafting (lipofilling), bone, nerve and tendon grafts.

> **Exam Alert:** A graft has no blood supply; a flap does. Split-thickness grafts take easily but contract; full-thickness grafts contract little and look better (face, hands). Haematoma is the commonest cause of graft failure; Group A Streptococcus destroys grafts. Grafts do not take on bare bone, tendon or cartilage.

## Chapter 105: Flaps, Microsurgery and Tissue Expansion

**Definition:** A **flap** is a unit of tissue transferred from a donor site to a recipient site **with its own blood supply**. Flaps are needed where a graft will not take (bare bone, tendon, cartilage, implants, irradiated tissue), for **padding over pressure areas**, for bulk, and for better function and appearance.

**Classification of flaps**

| Basis | Types |
|---|---|
| **Blood supply** | **Random pattern** (no named vessel — supplied by the subdermal plexus; length:breadth ratio about 1:1 to 3:1 on the face) vs **axial pattern** (based on a **named artery** — can be longer) |
| **Tissue content** | Cutaneous, fasciocutaneous, **musculocutaneous (myocutaneous)**, muscle, osseous/ osteocutaneous, composite, **perforator flaps** (skin and fat on a single perforating vessel, sparing muscle) |
| **Method of movement (local flaps)** | **Advancement** (V–Y, rectangular), **rotation**, **transposition** (rhomboid/Limberg, **Z-plasty**, bilobed), interpolation |

| Basis | Types |
|---|---|
| **Distance** | **Local** (adjacent), **regional/pedicled** (moved on its vascular pedicle — e.g. pectoralis major), **distant**, **free** (vessels divided and re-connected by microsurgery) |

**Z-plasty:** two transposed triangular flaps (commonly 60° angles) — **lengthens a scar (by ~75% at 60°) and changes its direction** — used to release **linear contractures** (e.g. burns across flexor creases) and to realign scars along relaxed skin tension lines.

### Commonly used pedicled flaps (examples)

| Flap | Blood supply | Common uses |
|---|---|---|
| **Pectoralis major myocutaneous** | Thoracoacromial artery | **Head and neck reconstruction** (after oral cancer surgery) — the "workhorse" in Pakistan |
| **Latissimus dorsi** | Thoracodorsal artery | **Breast reconstruction**, chest wall, shoulder |
| **TRAM** (transverse rectus abdominis myocutaneous) | Superior epigastric (pedicled) | Breast reconstruction |
| Forehead (paramedian) flap | Supratrochlear artery | **Nasal reconstruction** |
| **Gastrocnemius** muscle flap | Sural arteries | Cover of the **knee and upper third of tibia** |
| Soleus flap | Posterior tibial / peroneal | Middle third of tibia |
| Groin flap | Superficial circumflex iliac artery | Hand cover |
| Cross-finger flap | Random | Finger pulp/volar defects |

**Free flaps (microvascular surgery):** the flap's artery and vein are anastomosed to recipient vessels under the **operating microscope** — e.g. **radial forearm flap** (oral/pharyngeal lining), **anterolateral thigh (ALT) flap** (versatile perforator flap), **free fibula flap** (**mandible reconstruction**), **DIEP flap** (deep inferior epigastric perforator — breast reconstruction sparing rectus muscle), free latissimus dorsi, gracilis (functional muscle transfer). Success rate ~95%.

**Lower limb (open tibial fractures):** soft tissue cover according to level — **proximal third: gastrocnemius; middle third: soleus; distal third: free flap** (few local options); early combined orthoplastic management.

### Flap monitoring (especially free flaps, first 48–72 h)

| Sign | Normal | Arterial insufficiency | Venous congestion (commoner) |
|---|---|---|---|
| Colour | Pink | **Pale, white** | **Blue, purple, dusky** |
| Temperature | Warm | Cold | Warm initially |
| Capillary refill | 2–3 s | **Slow or absent** | **Very brisk** (<1 s) |
| Turgor | Soft | Flat, prune-like | **Swollen, tense** |
| Pin-prick bleeding | Bright red | Absent | **Dark, rapid** |

Use a handheld Doppler; **a failing free flap needs urgent re-exploration** (thrombosis of the anastomosis). Medicinal **leeches** help venous congestion (risk of *Aeromonas* infection — give prophylaxis). Avoid tight dressings, hypothermia, hypotension and vasoconstrictors; keep the patient warm and well-filled.

## Tissue Expansion

- A silicone balloon placed under normal skin next to a defect is **gradually inflated with saline** over weeks via a port → skin grows (mechanical creep and biological growth)

- Provides **extra skin of matching colour, texture and hair** (e.g. **scalp reconstruction** after burns or excision of giant naevi, breast reconstruction)
- Disadvantages: multiple visits, temporary deformity, **infection, extrusion**, implant failure

> **Exam Alert:** A flap has its own blood supply — needed over bone, tendon, cartilage or implants. Z-plasty lengthens and reorients scars to release contractures. A congested free flap is blue, swollen with brisk refill; a pale cold flap has arterial failure — both need urgent re-exploration. Free fibula for mandible; pectoralis major for head and neck.

# Chapter 106: Hand Injuries and Hand Infections

**Importance:** The hand is essential for work and daily life; hand injuries are common in Pakistan (fodder-cutting machines, industrial machinery, glass, knife injuries, firecrackers). **Every hand wound must be examined for nerve, tendon and vessel injury before anaesthesia is given.**

## Examination of the Injured Hand

- **Posture (cascade):** at rest the fingers are progressively more flexed from index to little finger; **a finger lying straight out of the cascade suggests a flexor tendon cut**
- **Flexor digitorum profundus (FDP):** hold the middle phalanx straight — patient flexes the **DIP joint**
- **Flexor digitorum superficialis (FDS):** hold the other fingers straight (blocks FDP) — patient flexes the **PIP joint**
- Extensors: extend fingers against resistance; mallet finger (terminal extensor), boutonnière (central slip)
- **Nerves:** test sensation of each **digital nerve** (two-point discrimination) and motor function — **median** (thenar muscles: abductor pollicis brevis; sensation index pulp), **ulnar** (finger abduction/adduction, Froment's sign; little finger pulp), **radial** (wrist and finger extension; first dorsal web space sensation)
- **Vascularity:** colour, capillary refill, Allen's test
- X-ray for fractures and foreign bodies (glass)

## Flexor Tendon Injuries

### Verdan's zones of the flexor tendons

| Zone | Region | Comment |
|---|---|---|
| I | Distal to FDS insertion (FDP only) | Jersey finger (FDP avulsion) |
| **II** | From the distal palmar crease to the FDS insertion — **both FDS and FDP within the tight fibro-osseous sheath** | **"No man's land"** (Bunnell) — adhesions common, results historically poor; now repaired primarily by experts |
| III | Palm | Lumbrical origins |
| IV | Carpal tunnel | Median nerve injury common |
| V | Forearm/wrist | "Spaghetti wrist" — multiple tendons, nerves and arteries |

**Management:** primary repair in theatre (within days) by a hand surgeon — core suture with epitendinous repair, preserve the A2 and A4 **pulleys** (prevent bowstringing); repair nerves microsurgically; **early protected active mobilisation** with a dorsal blocking splint and hand therapy. Complications: **adhesions** (commonest), rupture of repair, joint stiffness.

**Extensor injuries: mallet finger** (loss of active DIP extension after forced flexion) — **splint the DIP in extension for 6–8 weeks**; **boutonnière** (central slip — PIP flexed, DIP hyperextended) — splint PIP in extension.

**Other key injuries: fingertip injuries** (dressings, healing by secondary intention or local flaps), **nail bed injuries** (repair), **high-pressure injection injuries** (paint, grease — small entry wound but extensive damage: **surgical emergency, urgent debridement**), **amputated digits** (wrap in saline-moistened gauze in a sealed plastic bag placed on ice — not directly on ice — for possible **replantation**, especially thumb, multiple fingers, children), **human bite ("fight bite")** over the knuckle (MCP joint) — explore, wash out, co-amoxiclav.

## Hand Infections

| Infection | Features | Management |
|---|---|---|
| **Paronychia** | Nail fold infection (*Staph. aureus*) | See Chapter 28 |
| **Felon (pulp space infection)** | Tense, throbbing fingertip pulp | Early incision and drainage (lateral or volar incision); risk of osteomyelitis of terminal phalanx |
| **Acute suppurative flexor tenosynovitis** | Infection within the flexor sheath after a penetrating wound — **Kanavel's four cardinal signs:** (1) **finger held in slight flexion**, (2) **fusiform (sausage) swelling**, (3) **tenderness along the flexor sheath**, (4) **severe pain on passive extension** (most important) | **Surgical emergency** — IV antibiotics, elevation; **urgent drainage and catheter irrigation of the sheath**; risk of tendon necrosis and spread to palm/forearm (**horseshoe abscess** between thumb and little finger sheaths) |
| **Deep palmar space infections** | Thenar or midpalmar space; ballooning of palm, loss of palmar concavity | Incision and drainage, IV antibiotics |
| **Web space infection (collar-stud abscess)** | Swelling of the web, fingers spread apart | Drainage via dorsal and volar incisions |
| **Septic arthritis / bite injuries** | After human or animal bites | Washout, co-amoxiclav (*Pasteurella* in cat/dog bites, *Eikenella* in human bites) |
| **Necrotising fasciitis** | Diabetics, IV drug users | Radical debridement |

**Principles of treating hand infections: rest, elevation** (high arm sling), antibiotics, **early surgical drainage** of pus under tourniquet (incisions avoid crossing flexion creases at right angles), splint in the **safe position** — **wrist slightly extended, MCP joints flexed 70–90°, IP joints extended ("position of safe immobilisation")** to prevent stiffness, followed by early mobilisation and hand therapy. Check blood sugar.

> **Exam Alert:** Always test nerves and tendons before giving local anaesthetic. Zone II is "no man's land". Kanavel's signs mean flexor sheath infection — urgent drainage. High-pressure injection injury is an emergency despite a tiny wound. Splint the hand in the position of safe immobilisation (MCPs flexed, IPs extended).

# Chapter 107: Pressure Ulcers and Vascular Anomalies

## Pressure Ulcers (Bed Sores, Decubitus Ulcers)

**Definition:** Localised damage to skin and underlying tissue, usually over a **bony prominence**, from **sustained pressure**, alone or combined with shear and friction. Capillary closing pressure is about **32 mmHg**; pressure above this for **2 hours** can cause ischaemic necrosis. **Muscle is more sensitive than skin** — damage is often larger in depth than the skin opening suggests ("tip of the iceberg").

**Risk factors: immobility** (spinal cord injury, stroke, coma, sedation, fractures, elderly), **sensory loss** (paraplegia, diabetic neuropathy), **incontinence and moisture**, malnutrition and low albumin, anaemia, poor perfusion, old age.

**Common sites: sacrum (commonest)**, **ischial tuberosities** (sitting — wheelchair users), **greater trochanters**, **heels**, occiput (children), elbows, malleoli.

**Risk assessment: Braden** or **Waterlow** scales on admission and regularly.

**Staging (EPUAP/NPIAP)**

| Stage | Description |
|---|---|
| 1 | **Non-blanchable erythema** of intact skin |
| 2 | Partial-thickness skin loss (shallow ulcer or blister) |
| 3 | Full-thickness skin loss — subcutaneous fat visible, no bone/tendon/muscle |
| 4 | **Full-thickness tissue loss with exposed bone, tendon or muscle** |
| Unstageable | Base covered by slough or eschar |
| Deep tissue injury | Purple/maroon intact skin — deep damage |

**Prevention (most important): 2-hourly turning and repositioning**, pressure-relieving **air mattresses** and cushions, keep skin clean and dry, manage incontinence, nutrition, early mobilisation, education of carers.

**Management:** relieve pressure; treat infection (osteomyelitis — MRI, bone biopsy); **debridement** of necrotic tissue; dressings and **negative pressure wound therapy**; nutrition (protein, vitamin C, zinc), correct anaemia; manage spasticity and contractures; **surgical reconstruction** for stage 3–4 ulcers in suitable patients — excision of ulcer and bursa, ostectomy of the bony prominence, closure with **musculocutaneous or fasciocutaneous flaps** (e.g. gluteus maximus flap for sacral sores, hamstring/tensor fascia lata flaps for ischial/trochanteric sores). Recurrence is high unless the cause is controlled.

**Complications:** infection, **osteomyelitis**, septicaemia, sinus/fistula formation, anaemia, protein loss, amyloidosis, **Marjolin's ulcer** (chronic ulcer).

## Vascular Anomalies (ISSVA Classification)

Vascular anomalies are divided into two groups: **vascular tumours** (cellular proliferation — e.g. **infantile haemangioma**) and **vascular malformations** (structural errors of vessel development — present at birth and grow with the child).

| Feature | Infantile haemangioma | Vascular malformation |
|---|---|---|
| At birth | Often absent or a faint mark | **Always present** (may not be obvious) |
| Natural history | **Rapid proliferation** in first months → plateau → **spontaneous involution** (most by 5–10 years) | **Grows proportionately with the child; never involutes**; may enlarge with trauma, puberty, pregnancy |

| Feature | Infantile haemangioma | Vascular malformation |
|---|---|---|
| Sex | Female > male (3:1) | Equal |
| Cellular | Endothelial proliferation; **GLUT-1 positive** | Normal turnover; GLUT-1 negative |
| Examples | Superficial ("strawberry"), deep, mixed | Capillary (**port-wine stain**), venous, lymphatic (**cystic hygroma**), arteriovenous (high-flow) |

**Infantile haemangioma — management:** most need only **observation and reassurance** ("active non-intervention"). **Treat** if complicated: **ulceration**, bleeding, **threatens vision (periorbital — amblyopia)**, airway (beard distribution — subglottic), large facial lesions, heart failure (large/multiple), **PHACE syndrome**. **Oral propranolol is first-line** (cardiac and glucose monitoring); topical timolol for small lesions; surgery/laser for residual changes. Multiple cutaneous haemangiomas → ultrasound liver.

### Vascular malformations — key types

- **Capillary malformation (port-wine stain):** flat red/purple patch, darkens and thickens with age; **Sturge–Weber syndrome** (ophthalmic division of trigeminal nerve area — seizures, glaucoma); treat with **pulsed dye laser**
- **Venous malformation:** soft, compressible, bluish, swells on dependency or crying; phleboliths on X-ray; **sclerotherapy**, excision
- **Lymphatic malformation:** macrocystic (cystic hygroma) or microcystic; sclerotherapy (OK-432, doxycycline), excision; sirolimus for complex disease
- **Arteriovenous malformation (high-flow):** warm, pulsatile, thrill and bruit; may cause bleeding, ulceration, heart failure; **embolisation followed by surgical resection**; partial treatment can stimulate growth
- **Investigations:** Doppler ultrasound (flow type), MRI (extent); angiography for AVMs

> **Exam Alert:** Pressure ulcers arise over bony prominences — sacrum commonest; prevention by 2-hourly turning. Stage 4 has exposed bone, tendon or muscle; reconstruction uses flaps. Infantile haemangioma appears after birth, grows, then involutes — propranolol if complicated; vascular malformations are present at birth and never involute. Port-wine stain in the trigeminal area suggests Sturge–Weber syndrome.

## Self-Assessment: Part 16 SBAs

**1.** After excision of a 2 cm basal cell carcinoma from the lower eyelid, the defect cannot be closed directly. Which reconstruction gives the best cosmetic result with least contraction?

A. Healing by secondary intention · B. Meshed split-thickness skin graft from the thigh · C. Full-thickness skin graft from the post-auricular area · D. Free radial forearm flap · E. Tissue expansion

**Answer: C.** Full-thickness grafts contract less and match facial skin well.

**2.** Five days after a split-thickness skin graft to a leg wound, most of the graft has failed. On removal of the dressing, there is a collection of blood beneath it. What is the commonest cause of graft failure?

A. Graft rejection · B. Haematoma · C. Infection with Pseudomonas · D. Shearing · E. Thick graft

**Answer: B.**

**3.** A motorcyclist has an open fracture of the middle third of the tibia with exposed bone lacking periosteum. Which statement about soft tissue cover is correct?

A. A split-skin graft directly on the bone will take well · B. A flap is needed, such as a soleus muscle flap · C. Healing by secondary intention is best · D. Primary closure under tension is preferred · E. Cover is unnecessary

**Answer: B.** Grafts do not take on bare bone; the soleus covers the middle third.

**4.** Six hours after free flap reconstruction, the flap is swollen, dark purple, with very rapid capillary refill and dark blood on pin-prick. What is the most likely problem?

A. Arterial thrombosis · B. Haematoma under the donor site · C. Infection · D. Normal flap appearance · E. Venous congestion

**Answer: E.** Needs urgent re-exploration of the venous anastomosis.

**5.** A burns patient has a tight linear scar contracture across the front of the elbow limiting extension. Which procedure lengthens the scar and changes its direction?

A. Full-thickness graft · B. Rotation flap · C. Serial dressings · D. Tissue expansion · E. Z-plasty

**Answer: E.**

**6.** A man cuts his palm on glass. His index finger lies extended at rest; he cannot flex the DIP joint when the middle phalanx is held, and cannot flex the PIP joint when the other fingers are held straight. Which structures are divided?

A. Extensor digitorum only · B. FDP only · C. FDS only · D. Both FDP and FDS · E. Median nerve only

**Answer: D.**

**7.** Three days after a thorn prick, a woman's middle finger is held in slight flexion, is uniformly swollen, tender along the palm side, and extremely painful on passive extension. What is the correct management?

A. Oral antibiotics and review in a week · B. Hot soaks only · C. IV antibiotics and urgent surgical drainage of the flexor sheath · D. Physiotherapy · E. Topical antibiotic cream

**Answer: C.** Kanavel's signs — flexor tenosynovitis.

**8.** A factory worker has a tiny puncture wound on his index finger from a high-pressure paint gun. The finger is mildly swollen and painful. What is the correct management?

A. Clean and dress, discharge · B. Oral antibiotics only · C. Urgent surgical exploration and debridement · D. Elevation and review in 48 hours · E. X-ray only

**Answer: C.** Small entry, extensive deep damage.

**9.** A paraplegic patient has a sacral ulcer with exposed bone. What is its stage?

A. Stage 1 · B. Stage 2 · C. Stage 3 · D. Stage 4 · E. Deep tissue injury

**Answer: D.**

**10.** A 3-month-old girl has a rapidly growing red raised lesion on her upper eyelid that was not present at birth and is now closing her eye. What is the first-line treatment?

A. Observation only · B. Oral propranolol · C. Pulsed dye laser · D. Radiotherapy · E. Surgical excision

**Answer: B.** Periorbital infantile haemangioma risks amblyopia.

*References: Bailey & Love's Short Practice of Surgery, 28th Ed.; Blecha, Surgery, 4th Ed.*

PART 17

# Cardiothoracic Surgery

## Chapter 108: Carcinoma of the Lung and the Solitary Pulmonary Nodule

### Carcinoma of the Lung

**Importance:** The **leading cause of cancer death worldwide**. **Smoking causes ~85%** of cases (cigarettes, bidi, **huqqa/shisha** in Pakistan); risk rises with pack-years.

**Other risk factors:** passive smoking, **asbestos** (synergistic with smoking), radon, occupational carcinogens (arsenic, chromium, nickel), air pollution, previous lung disease (fibrosis, TB scars), family history.

#### Types

| Type | Frequency | Features |
|---|---|---|
| **Non-small cell lung cancer (NSCLC)** | **~85%** | Treated by surgery when early |
| — **Adenocarcinoma** | **Commonest overall**; commonest in **non-smokers and women** | **Peripheral**; EGFR, ALK, ROS1, KRAS mutations (targeted therapy) |
| — Squamous cell carcinoma | Smokers | **Central**; cavitation; **hypercalcaemia (PTHrP)** |
| — Large cell carcinoma | Less common | Peripheral, poorly differentiated |
| **Small cell lung cancer (SCLC)** | ~15% | **Central**, neuroendocrine, **very aggressive, early metastasis**; **SIADH, ectopic ACTH (Cushing's), Lambert–Eaton syndrome**; usually **not surgical** — chemoradiotherapy |
| Carcinoid tumour | Rare | Low-grade neuroendocrine; young; bronchial obstruction; surgery curative |

#### Clinical features

- **Persistent cough** (commonest), **haemoptysis**, dyspnoea, chest pain, recurrent or non-resolving pneumonia, weight loss
- **Local spread: hoarseness** (left recurrent laryngeal nerve), **superior vena cava obstruction** (facial swelling, distended neck veins), pleural effusion, phrenic nerve palsy (raised hemidiaphragm), dysphagia
- **Pancoast (superior sulcus) tumour:** apical tumour → **Horner's syndrome** (sympathetic chain), shoulder/arm pain and weakness (**T1 root — small hand muscles**)
- **Metastases:** brain, bone, liver, adrenals; supraclavicular nodes
- **Paraneoplastic: finger clubbing**, hypertrophic pulmonary osteoarthropathy, hypercalcaemia, SIADH, Cushing's, Lambert–Eaton, dermatomyositis

### Investigations

- **Chest X-ray** (first test), **contrast CT chest and upper abdomen** (staging, liver and adrenals)
- **PET-CT** — nodal and distant staging before curative treatment
- **Tissue diagnosis: bronchoscopy** with biopsy (central tumours), **CT-guided percutaneous biopsy** (peripheral), **EBUS-TBNA** (endobronchial ultrasound needle aspiration of mediastinal nodes), pleural fluid cytology; molecular testing (EGFR, ALK, PD-L1)
- MRI brain; bone scan if symptoms
- **Fitness for surgery:** spirometry (**$FEV_1$**), **DLCO** (gas transfer), exercise testing; predicted post-operative $FEV_1$ and DLCO >40% generally acceptable

### Management of NSCLC

| Stage | Treatment |
|---|---|
| **Early (I–II)** | **Surgical resection — lobectomy** (standard) with **systematic mediastinal lymph node dissection**, preferably by **VATS (video-assisted thoracoscopic surgery)** or robotic surgery; segmentectomy/ wedge for small tumours or limited lung function; **stereotactic ablative radiotherapy (SABR)** for unfit patients |
| **Stage II–IIIA** | Surgery + **adjuvant chemotherapy**, or perioperative chemo-immunotherapy; adjuvant **osimertinib** for EGFR-mutant tumours |
| **Unresectable III** | **Concurrent chemoradiotherapy** + durvalumab |
| **Stage IV** | **Targeted therapy** (EGFR — osimertinib; ALK — alectinib), **immunotherapy** (pembrolizumab), chemotherapy; palliation — stents for SVCO and airways, pleurodesis, radiotherapy |

**Pneumonectomy** for central tumours involving the main bronchus — higher mortality (~5–8%), bronchopleural fistula, right heart strain.

**Contraindications to surgery:** distant metastases, malignant pleural effusion, N3 nodes, invasion of vital mediastinal structures, poor lung function, SCLC (except very early).

## Solitary Pulmonary Nodule

**Definition:** A single rounded opacity **≤3 cm** surrounded by lung, without lymphadenopathy or atelectasis (>3 cm = mass, likely malignant).

**Causes: malignant** — primary lung cancer, metastasis, carcinoid; **benign** — **granuloma (TB — very common in Pakistan)**, hamartoma (**"popcorn" calcification**), healed infection, fungal (aspergilloma), AV malformation.

**Features suggesting malignancy:** age >40–50, smoking, larger size, **spiculated or irregular margin**, upper lobe, growth on serial scans, **PET avid**. **Benign features:** central, diffuse, laminated or popcorn **calcification**; **no growth for 2 years** (solid nodules); fat within (hamartoma).

**Management (e.g. Fleischner/BTS guidelines):** small nodules (<6 mm) in low-risk patients — no follow-up or a single scan; intermediate — **surveillance CT** (volume doubling time); high risk — **PET-CT and biopsy or surgical excision** (VATS wedge resection).

> **Exam Alert:** Smoking causes most lung cancer; adenocarcinoma is commonest overall and in non-smokers. Small cell is central, causes SIADH and is treated with chemoradiotherapy, not surgery. Lobectomy with node dissection is standard for early NSCLC. Pancoast tumour causes Horner's syndrome and T1 root signs. In Pakistan, always consider TB in a lung nodule.

# Chapter 109: Pleural Disease — Spontaneous Pneumothorax, Pleural Effusion and Empyema

## Spontaneous Pneumothorax

**Definition:** Air in the pleural space without trauma.

- **Primary spontaneous pneumothorax:** no lung disease; **tall, thin young men**, **smokers** (cannabis and tobacco); rupture of **apical subpleural blebs**
- **Secondary spontaneous pneumothorax:** underlying lung disease — **COPD** (commonest), asthma, **TB**, cystic fibrosis, interstitial lung disease, HIV (Pneumocystis); more dangerous (poor reserve)
- Catamenial pneumothorax (with menstruation — endometriosis)

**Clinical features:** sudden pleuritic chest pain and breathlessness; reduced breath sounds, hyper-resonance. **Tension pneumothorax** (hypotension, tracheal deviation) is a clinical emergency — decompress immediately (Chapter 19).

**Investigations: erect PA chest X-ray** (visible pleural edge, no lung markings beyond); CT when uncertain or for planning surgery. Size: **large if visible rim ≥2 cm at the level of the hilum** (BTS).

**Management (BTS 2023 approach)**

| Situation | Management |
|---|---|
| Primary, minimal symptoms | **Conservative** — observation, often as outpatient with follow-up X-ray |
| Primary, symptomatic | **Needle aspiration** or **ambulatory device**; **chest drain** if fails |
| Secondary | Admit; **chest drain** (small-bore Seldinger) for most; aspiration only for small ones; oxygen |
| Tension | Immediate decompression, then chest drain |

**Advice: stop smoking**; **avoid air travel until resolved** (and for 1–2 weeks after); **avoid scuba diving permanently** unless definitive surgery.

**Indications for surgery: second ipsilateral pneumothorax**, first contralateral, **bilateral simultaneous**, **persistent air leak >5–7 days** or failure of lung to re-expand, spontaneous haemothorax, high-risk occupations (pilots, divers), pregnancy planning in some. **Operation: VATS bullectomy/blebectomy with pleurodesis** (mechanical pleural abrasion or **pleurectomy**) — recurrence <5%. Chemical pleurodesis via drain (talc) for patients unfit for surgery.

## Pleural Effusion

**Definition:** Excess fluid in the pleural space. **Light's criteria** distinguish **exudate** from transudate — exudate if any of: pleural fluid protein / serum protein **>0.5**, pleural LDH / serum LDH **>0.6**, pleural LDH > two-thirds of the upper limit of normal serum LDH.

| Transudate | Exudate |
|---|---|
| **Heart failure** (commonest overall), cirrhosis, nephrotic syndrome, hypoalbuminaemia, hypothyroidism, peritoneal dialysis | **Pneumonia (parapneumonic)**, **tuberculosis** (common in Pakistan — lymphocytic, **ADA raised**), **malignancy** (lung, breast, lymphoma, mesothelioma), pulmonary embolism, pancreatitis, subphrenic abscess, autoimmune (RA, SLE) |

**Investigations:** CXR (blunted costophrenic angle, meniscus), **USG (guides tap)**, **diagnostic pleural aspiration** — appearance, protein, LDH, glucose, **pH**, cell count, Gram stain, culture, AFB/GeneXpert, ADA, cytology; CT chest; **pleural biopsy** (USG/CT-guided or **thoracoscopic — highest yield**) for undiagnosed exudates.

**Malignant pleural effusion:** therapeutic drainage for symptoms; **talc pleurodesis** (via drain or thoracoscopy) or **indwelling pleural catheter** for recurrent effusions.

**Mesothelioma:** malignant tumour of the pleura linked to **asbestos** exposure (latency 20–40 years); chest pain, effusion, pleural thickening; poor prognosis; chemotherapy/immunotherapy.

### Empyema Thoracis

**Definition: Pus in the pleural cavity**. Most follow **pneumonia** (parapneumonic); also post-surgery, trauma, oesophageal perforation, subphrenic abscess, **TB empyema**.

**Stages:** (1) **exudative** (thin, free-flowing), (2) **fibrinopurulent** (loculations, pH falls), (3) **organising** (thick "peel" encases the lung — **trapped lung**).

**Clinical features:** persistent fever despite antibiotics for pneumonia, pleuritic pain, malaise, weight loss, signs of effusion; raised WBC and CRP.

**Diagnosis:** USG/CT ("split pleura" sign — enhancing thickened pleura), aspiration — **frank pus, or pH <7.2, glucose low, positive Gram stain/culture → needs drainage**.

**Management**

1. **Antibiotics** (IV, then prolonged oral, ~4–6 weeks) covering anaerobes
2. **Chest drain** (image-guided) for complicated parapneumonic effusion or empyema
3. **Intrapleural fibrinolytic therapy** (tPA + DNase) for loculated collections
4. **Surgery** — **VATS or open decortication** (remove the peel to re-expand the lung) for failed drainage or organising empyema; **open drainage (rib resection, Eloesser flap)** for chronic empyema in unfit patients
5. Nutrition; treat TB with ATT

> **Exam Alert:** Primary spontaneous pneumothorax affects tall thin young smokers; surgery (VATS bullectomy + pleurodesis) for a second episode or persistent air leak; no diving. Light's criteria identify exudates. Pleural fluid pH <7.2 or pus means drainage. Decortication treats organising empyema.

## Chapter 110: Adult Cardiac Surgery — Cardiopulmonary Bypass, CABG and Valve Surgery

### Cardiopulmonary Bypass (CPB)

**Principle:** The "heart–lung machine" takes over circulation and gas exchange so the heart can be stopped and opened.

- **Access:** median sternotomy
- **Systemic heparinisation** (reversed at the end with **protamine**)
- **Venous blood** drained from the right atrium/venae cavae → **oxygenator** (membrane) → heat exchanger → **pump** → returned to the **ascending aorta**
- **Aortic cross-clamp** isolates the heart; **cardioplegia** (cold, potassium-rich solution) stops the heart in diastole and protects the myocardium
- Systemic cooling (hypothermia) reduces oxygen demand

**Complications of CPB:** bleeding (heparin, platelet dysfunction), **systemic inflammatory response**, stroke (emboli), renal impairment, "post-pump" cognitive dysfunction, myocardial stunning, haemolysis.

## Coronary Artery Bypass Grafting (CABG)

**Indications (heart team decision with cardiologists):**

- **Left main stem stenosis** (>50%)
- **Triple-vessel disease**, especially with **reduced left ventricular function** or **diabetes**
- Two-vessel disease involving the **proximal left anterior descending (LAD)** artery
- Angina not controlled by medical therapy or unsuitable for PCI (stents); failed PCI

**CABG vs PCI:** CABG gives better long-term survival and less repeat revascularisation in **diabetics and complex multivessel/left main disease** (SYNTAX score); PCI is less invasive for simpler disease.

**Conduits**

| Conduit | Patency at 10 years | Notes |
|---|---|---|
| **Left internal mammary (thoracic) artery (LIMA) to LAD** | **>90%** | **Best conduit** — improves survival; always used if possible |
| Radial artery | ~80–90% | Second arterial graft (check Allen's test/ulnar collateral) |
| **Long saphenous vein** | ~50–60% | Commonest second conduit; vein graft disease limits longevity |
| Right internal mammary artery | High | Bilateral IMA — higher sternal wound risk in diabetics/obese |

Off-pump CABG ("beating heart") avoids CPB in selected patients.

**Complications of cardiac surgery:** bleeding and **cardiac tamponade** (return to theatre), **atrial fibrillation** (commonest arrhythmia, ~30% — day 2–4), low cardiac output, perioperative MI, **stroke**, acute kidney injury, **sternal wound infection and mediastinitis** (risk factors — diabetes, obesity, bilateral IMA, COPD), leg wound problems (vein harvest), pneumonia. Operative mortality for elective CABG ~1–2%.

## Valve Surgery

**Commonest lesions: aortic stenosis** (degenerative/calcific in the elderly; bicuspid valve in younger patients) and **mitral regurgitation** in developed countries; **rheumatic heart disease** (mitral stenosis, mixed mitral and aortic disease) remains **common in Pakistan and South Asia**.

| Lesion | Key features | Indications for intervention | Options |
|---|---|---|---|
| **Aortic stenosis** | Triad of **angina, syncope, dyspnoea (heart failure)**; ejection systolic murmur to carotids; slow-rising pulse | **Severe AS with symptoms** (mean gradient >40 mmHg, area <1 $cm^2$), or asymptomatic with LV dysfunction | **Surgical aortic valve replacement (SAVR)**; **TAVI** (transcatheter aortic valve implantation) — elderly/high-risk and increasingly intermediate-risk |
| **Mitral stenosis** (rheumatic) | Dyspnoea, AF, haemoptysis, embolism; mid-diastolic murmur, loud S1, opening snap | Symptomatic moderate–severe MS (area <1.5 $cm^2$) | **Percutaneous balloon mitral valvotomy** (pliable valve, no LA thrombus, ≤ mild MR); surgical valve replacement |
| **Mitral regurgitation** | Pansystolic murmur to axilla; degenerative (prolapse), ischaemic, rheumatic | Symptomatic severe MR, or LV dysfunction/dilatation | **Mitral valve repair (preferred)** or replacement; transcatheter edge-to-edge repair (MitraClip) in high-risk |
| **Aortic regurgitation** | Collapsing pulse, early diastolic murmur | Symptoms, LV dilatation/ dysfunction | AVR ± aortic root surgery |

| Lesion | Key features | Indications for intervention | Options |
|---|---|---|---|
| **Infective endocarditis** | Fever, new murmur, emboli; Duke criteria | **Heart failure, uncontrolled infection (abscess), large vegetations with emboli** | Antibiotics + early surgery |

### Prosthetic valves

| Mechanical valve | Biological (tissue) valve |
|---|---|
| **Durable (lifelong)** | Degenerates in **10–15 years** (faster in young) |
| **Lifelong warfarin** (target INR 2.5–3.5) — bleeding risk; **DOACs contraindicated** | Anticoagulation usually for 3 months only |
| Preferred in younger patients (<60) | Preferred in **older patients (>65)**, women planning pregnancy, poor anticoagulation compliance |
| Audible click | Valve-in-valve TAVI possible later |

**Prosthetic valve complications:** thrombosis, **embolism**, endocarditis (antibiotic prophylaxis for dental procedures), paravalvular leak, haemolysis, structural degeneration (tissue valves), anticoagulant bleeding.

> **Exam Alert:** LIMA to LAD is the best bypass conduit. CABG is preferred to PCI in diabetics with multivessel or left main disease. Atrial fibrillation is the commonest complication after cardiac surgery. Mechanical valves need lifelong warfarin (not DOACs); tissue valves suit older patients. Rheumatic mitral stenosis remains common in Pakistan — balloon valvotomy if the valve is suitable.

# Chapter 111: Aortic Dissection, Congenital Heart Disease and Mediastinal Masses

## Acute Aortic Dissection

**Definition:** A tear in the **intima** allows blood to enter the media, creating a **false lumen** that propagates along the aorta.

**Risk factors: hypertension (most important)**, **Marfan syndrome** and other connective tissue disorders (Ehlers–Danlos, Loeys–Dietz), **bicuspid aortic valve**, aortic coarctation, pregnancy, cocaine, previous cardiac surgery or catheterisation, trauma.

### Stanford classification

| Type | Involvement | Management |
|---|---|---|
| **Type A** (~60–70%) | **Ascending aorta** involved (± arch/descending) | **Emergency surgery** — replacement of ascending aorta (± aortic valve/arch) under CPB; mortality rises ~1–2% per hour untreated |
| **Type B** | **Descending aorta only** (distal to left subclavian artery) | **Medical** — strict BP and heart rate control; **TEVAR** (thoracic endovascular aortic repair) if complicated (malperfusion, rupture, uncontrolled pain/hypertension, rapid expansion) |

(DeBakey: type I — ascending + descending; II — ascending only; III — descending only.)

**Clinical features: sudden, severe, "tearing" chest pain radiating to the back** (between scapulae), maximal at onset; **pulse deficit or BP difference >20 mmHg between arms**; new **aortic regurgitation** murmur; complications — cardiac tamponade, MI (coronary involvement, often right), stroke, paraplegia, mesenteric/renal/limb ischaemia; shock.

**Investigations:** ECG (exclude/identify MI — **do not thrombolyse**), CXR (**widened mediastinum** in ~60%), **CT aortography — investigation of choice**; **transoesophageal echocardiography** in unstable patients; D-dimer (normal makes dissection unlikely).

**Initial management:** analgesia (opioid), **IV beta-blocker (labetalol, esmolol) to lower heart rate (<60) and systolic BP (100–120 mmHg)** — reduces shear stress; vasodilator after beta-blockade; avoid anticoagulants and thrombolytics; urgent cardiothoracic referral.

## Congenital Heart Disease (Surgical Overview)

**Incidence:** about 8 per 1,000 live births (higher with consanguinity, common in Pakistan); associated with Down syndrome (AVSD), maternal diabetes, rubella, drugs.

| Group | Lesions | Key surgical points |
|---|---|---|
| **Acyanotic — left-to-right shunts** | **VSD (commonest congenital heart defect)**, ASD, **PDA**, AVSD | Small VSDs often close spontaneously; large ones — patch closure (prevent **Eisenmenger syndrome** — irreversible pulmonary hypertension with shunt reversal); ASD — device or surgical closure; PDA — indomethacin/ibuprofen/ paracetamol in preterms, device or ligation |
| **Acyanotic — obstructive** | **Coarctation of the aorta**, aortic stenosis, pulmonary stenosis | Coarctation — **radio-femoral delay**, upper limb hypertension, **rib notching** on CXR, "3" sign; repair (resection and end-to-end anastomosis) or balloon/stent |
| **Cyanotic** | **Tetralogy of Fallot (commonest cyanotic)**, transposition of the great arteries (TGA — commonest cyanotic in newborns), tricuspid atresia, truncus arteriosus, TAPVC, hypoplastic left heart | **Tetralogy:** VSD, overriding aorta, **pulmonary stenosis (RVOT obstruction)**, RV hypertrophy — **"tet spells"** (squatting), **boot-shaped heart** — complete repair at ~6 months; Blalock–Taussig shunt as palliation. **TGA:** prostaglandin E1 to keep the duct open, balloon atrial septostomy, then **arterial switch operation** in the first weeks |

**Prostaglandin E1** keeps the ductus arteriosus open in **duct-dependent lesions** (severe pulmonary stenosis/atresia, TGA, critical coarctation, hypoplastic left heart) — life-saving before surgery.

## Mediastinal Masses

**Classify by compartment** (on lateral CXR/CT) — site suggests the diagnosis:

| Compartment | Common masses |
|---|---|
| **Anterior** ("**4 Ts**") | **Thymoma** (associated with **myasthenia gravis**), **Teratoma** and other germ cell tumours, **(Terrible) lymphoma**, retrosternal **Thyroid** (goitre) |
| **Middle** | **Lymphadenopathy** (lymphoma, TB, sarcoidosis, metastases), bronchogenic and pericardial cysts, aortic aneurysm |
| **Posterior** | **Neurogenic tumours** (schwannoma, neurofibroma — adults; **neuroblastoma** — children), oesophageal lesions, hiatus hernia, paravertebral abscess (TB spine) |

**Clinical features:** often incidental; cough, chest pain, dyspnoea, **SVC obstruction**, dysphagia, hoarseness; systemic — myasthenia (thymoma), B symptoms (lymphoma), gynaecomastia (germ cell — β-hCG). **Anterior mediastinal masses can cause fatal airway collapse during general anaesthesia** — careful anaesthetic planning.

**Investigations:** CT chest (± MRI), tumour markers (**AFP, β-hCG** for germ cell tumours; LDH), acetylcholine receptor antibodies (thymoma/myasthenia); **biopsy** (CT-guided, EBUS, mediastinoscopy, VATS) — except for resectable thymoma (avoid seeding).

**Management: thymectomy** (median sternotomy, VATS or robotic) for thymoma and selected patients with myasthenia gravis; chemotherapy for lymphoma (no surgery) and germ cell tumours (± resection of residual mass); excision of neurogenic tumours and cysts.

> **Exam Alert:** Tearing chest pain to the back with unequal arm pulses = aortic dissection; CT aortography; Type A (ascending) needs emergency surgery, Type B is treated medically unless complicated; never thrombolyse. VSD is the commonest congenital heart defect; tetralogy of Fallot the commonest cyanotic lesion. Anterior mediastinal "4 Ts": thymoma, teratoma, terrible lymphoma, thyroid.

## Self-Assessment: Part 17 SBAs

**1.** A 60-year-old heavy smoker has a central lung mass, confusion and serum sodium of 118 mmol/L with concentrated urine. What is the most likely tumour type?

A. Adenocarcinoma · B. Carcinoid tumour · C. Large cell carcinoma · D. Small cell carcinoma · E. Squamous cell carcinoma

**Answer: D.** SIADH is classically associated with small cell lung cancer.

**2.** A 58-year-old man has ptosis and a constricted pupil on the right, with pain down the inner arm and wasting of small hand muscles. Chest X-ray shows a right apical opacity. What is the most likely diagnosis?

A. Cervical rib · B. Mesothelioma · C. Pancoast tumour · D. Thymoma · E. Tuberculosis

**Answer: C.** Superior sulcus tumour with Horner's syndrome and T1 involvement.

**3.** A 62-year-old woman with good lung function has a 2.5 cm peripheral adenocarcinoma of the right upper lobe with no nodal or distant spread on PET-CT. What is the standard treatment?

A. Chemotherapy alone · B. Palliative radiotherapy · C. Pneumonectomy · D. Right upper lobectomy with mediastinal lymph node dissection · E. Targeted therapy alone

**Answer: D.** Preferably by VATS.

**4.** A tall, thin 22-year-old smoker has a second right-sided spontaneous pneumothorax in 6 months. What is the most appropriate definitive management?

A. Avoid air travel only · B. Needle aspiration again · C. Observation · D. Oxygen therapy · E. VATS bullectomy with pleurodesis

**Answer: E.** A second ipsilateral episode is an indication for surgery.

**5.** A 45-year-old man treated for pneumonia remains febrile after 10 days. Ultrasound shows a loculated pleural collection; aspirate is turbid with pH 6.9. What is the next step?

A. Change to oral antibiotics and discharge · B. Chest drain with intrapleural fibrinolytics and IV antibiotics · C. Observation · D. Repeat aspiration in 2 weeks · E. Steroids

**Answer: B.** Complicated parapneumonic effusion/empyema; decortication if this fails.

**6.** A 65-year-old diabetic has angina with triple-vessel coronary disease and reduced left ventricular function. Which conduit gives the best long-term patency when grafted to the LAD?

A. Long saphenous vein · B. Left internal mammary artery · C. Radial artery · D. Short saphenous vein · E. Synthetic graft

**Answer: B.**

**7.** On the third day after CABG, a patient develops palpitations and an irregularly irregular pulse of 140/min. What is the most likely rhythm?

A. Atrial fibrillation · B. Complete heart block · C. Sinus arrhythmia · D. Ventricular fibrillation · E. Ventricular tachycardia

**Answer: A.** The commonest arrhythmia after cardiac surgery.

**8.** A 35-year-old woman needs mitral valve replacement for rheumatic disease and plans pregnancy. A mechanical valve is chosen after discussion. Which anticoagulant is required long term?

A. Aspirin alone · B. Apixaban · C. Dabigatran · D. No anticoagulant · E. Warfarin

**Answer: E.** DOACs are contraindicated with mechanical valves; warfarin needs special management in pregnancy.

**9.** A 55-year-old hypertensive man has sudden severe tearing chest pain radiating between the shoulder blades. BP is 170/100 mmHg in the right arm and 130/80 mmHg in the left. CT shows a dissection flap in the ascending aorta. What is the definitive management?

A. Emergency surgical repair · B. Medical BP control only · C. Percutaneous coronary intervention · D. TEVAR of the descending aorta · E. Thrombolysis

**Answer: A.** Stanford type A dissection.

**10.** A 30-year-old woman with fatigable weakness and double vision has a mass in the anterior mediastinum on CT. Which tumour is most likely?

A. Bronchogenic cyst · B. Neurofibroma · C. Oesophageal leiomyoma · D. Schwannoma · E. Thymoma

**Answer: E.** Thymoma is associated with myasthenia gravis.

*References: Bailey & Love's Short Practice of Surgery, 28th Ed.; Blecha, Surgery, 4th Ed.*

PART 18

# Principles of Modern Surgical Practice

## Chapter 112: Minimal Access and Robotic Surgery

**Definition:** Minimal access surgery (MAS) performs operations through small incisions or natural orifices using a camera and long instruments — **laparoscopy** (abdomen), **thoracoscopy/VATS** (chest), **arthroscopy** (joints), endoscopic and endoluminal surgery, and **robot-assisted surgery**.

**Advantages over open surgery: less post-operative pain**, **shorter hospital stay**, faster return to work, **fewer wound infections and incisional hernias**, better cosmesis, fewer adhesions, magnified view, reduced immune and stress response.

**Disadvantages:** loss of tactile feedback (haptics), **two-dimensional view** (unless 3D), fulcrum effect and restricted movement, long learning curve, expensive equipment, longer operating time early in experience, specific complications.

### Pneumoperitoneum

- **Carbon dioxide ($CO_2$)** is used — non-flammable, cheap, highly soluble (low embolism risk), rapidly absorbed
- Usual intra-abdominal pressure **12–15 mmHg** (lower in children and frail patients)
- **Access: open (Hasson) technique** — safest, recommended; Veress needle (closed); optical trocars

#### Physiological effects of pneumoperitoneum

- **Cardiovascular:** reduced venous return and cardiac output (especially with head-up position), increased systemic vascular resistance; vagal bradycardia on insufflation
- **Respiratory:** splinting of diaphragm, reduced lung compliance; **$CO_2$ absorption → hypercapnia and respiratory acidosis** (anaesthetist increases ventilation)
- **Renal:** reduced renal blood flow and urine output
- Raised intracranial pressure; reduced splanchnic flow

**Relative contraindications:** severe cardiorespiratory disease (cannot tolerate pneumoperitoneum), **uncorrected coagulopathy**, extensive adhesions, massive bowel distension, haemodynamic instability (trauma), late pregnancy (modified technique possible).

### Complications Specific to Laparoscopy

| Complication | Key points |
|---|---|
| **Access injuries** | **Bowel or major vessel injury** (aorta, iliac vessels) during trocar or Veress insertion — most occur at entry; reduced by open (Hasson) technique |

| Complication | Key points |
|---|---|
| **Electrosurgical (diathermy) injuries** | **Insulation failure**, **direct coupling**, **capacitive coupling**; unrecognised thermal bowel injury presents days later with peritonitis — use **bipolar** or ultrasonic energy where possible |
| **Gas-related** | **$CO_2$ embolism** (sudden hypotension, "mill-wheel" murmur, drop in end-tidal $CO_2$ — stop insufflation, left lateral head-down, aspirate), surgical emphysema, pneumothorax/ pneumomediastinum, hypercapnia, **shoulder-tip pain** (diaphragmatic irritation — commonest after-effect) |
| **Port-site problems** | **Port-site hernia** (close fascia of ports ≥10 mm), infection, bleeding (inferior epigastric vessels), port-site tumour metastasis |
| Others | Hypothermia, positioning injuries, conversion to open surgery (not a complication — good judgement) |

**Common laparoscopic operations:** cholecystectomy (gold standard), appendicectomy, hernia repair (TEP/ TAPP), fundoplication, Heller's myotomy, bariatric surgery, colectomy and rectal surgery, splenectomy, adrenalectomy, nephrectomy (donor and radical), hysterectomy, **diagnostic laparoscopy** (acute abdomen, trauma, staging of cancer).

### Robot-Assisted Surgery

- Surgeon sits at a **console** remote from the patient and controls robotic arms holding a 3D camera and **wristed instruments** (e.g. da Vinci system)
- **Advantages: 3D high-definition magnified view**, **wristed instruments with 7 degrees of freedom**, **tremor filtration** and motion scaling, better ergonomics (less surgeon fatigue) — particularly useful in **narrow spaces (pelvis)**: **radical prostatectomy** (commonest robotic operation), rectal cancer surgery, hysterectomy, partial nephrectomy, cardiac and thoracic surgery
- **Disadvantages: high cost** (purchase, maintenance, instruments), lack of haptic feedback, longer set-up and theatre time, limited access in low-resource settings; remote surgeon — team communication and emergency undocking skills are essential
- Robotic surgery is now available in a few centres in Pakistan

**Other developments:** natural orifice transluminal endoscopic surgery (NOTES), single-incision laparoscopy, transanal TME (taTME), **endoscopic surgery** (ESD, POEM), fluorescence-guided surgery (**indocyanine green** — bile duct and bowel perfusion), augmented reality and **artificial intelligence** in surgical video analysis, simulation-based training.

> **Exam Alert:** $CO_2$ is used for pneumoperitoneum at 12–15 mmHg; it causes hypercapnia and reduced venous return. Open (Hasson) entry is safest. Most serious injuries occur at access. Unrecognised diathermy injury presents days later. Robotic surgery gives 3D vision, wristed instruments and tremor filtration but lacks haptic feedback and is costly.

## Chapter 113: Ethics, Consent and Law in Surgical Practice

### The Four Principles of Medical Ethics (Beauchamp and Childress)

| Principle | Meaning | Surgical example |
|---|---|---|
| **Autonomy** | Respect the competent patient's right to decide | A competent patient may refuse surgery or blood, even if life-saving |
| **Beneficence** | Act in the patient's best interests | Offer the operation most likely to benefit |

| Principle | Meaning | Surgical example |
|---|---|---|
| **Non-maleficence** | "First, do no harm" | Avoid unnecessary operations; operate within competence |
| **Justice** | Fairness in distribution of resources and care | Fair waiting lists and organ allocation; treat all patients equally |

Also: **honesty (truth-telling)**, **confidentiality**, **dignity** and respect, and the **duty of candour** (openness when things go wrong).

## Informed Consent

**Valid consent requires three elements:**

1. **Capacity (competence)** — the patient can **understand**, **retain**, **weigh** the information, and **communicate** a decision
2. **Adequate information** — diagnosis, nature and purpose of the procedure, **benefits, material risks** (common and serious), **alternatives including no treatment**, who will operate, recovery
3. **Voluntariness** — free from pressure or coercion (including from family)

**Material risks:** following the **Montgomery** principle (UK, 2015), doctors must disclose risks that **a reasonable person in the patient's position would consider significant**, or that this particular patient would want to know — not only what other doctors think should be disclosed (the older **Bolam** standard). This patient-centred approach is now the international standard of good practice.

**Forms of consent:** implied (holding out an arm for a blood test), verbal, **written** (operations, anaesthesia, procedures with significant risk). The signature is evidence of a discussion — **consent is a process, not a form**. Consent should ideally be taken by the operating surgeon or a trained person, in a language the patient understands (Urdu or regional language — use a trained interpreter, not a child), with time to consider.

**Special situations**

- **Emergency, unconscious patient:** treat in the patient's **best interests** (doctrine of necessity), limited to what is immediately necessary; respect a known valid advance refusal
- **Children (minors):** consent from parent or legal guardian; involve the child according to maturity (in the UK, **Gillick competence** allows mature children to consent); emergency life-saving treatment should not be delayed by parental refusal — seek legal/ethical support
- **Adults lacking capacity:** decide in their best interests, involving family/legal representatives; capacity is decision-specific and may fluctuate
- **Refusal of blood (e.g. Jehovah's Witnesses):** a competent adult's refusal must be respected — plan alternatives (cell salvage, tranexamic acid, iron, erythropoietin)
- **Additional procedures:** do not perform an extra, non-urgent procedure (e.g. removing an ovary) that was not consented to

## Confidentiality

Information about patients must be kept confidential. **Exceptions:** patient consent; legal requirement (court order, notifiable diseases, gunshot and medico-legal cases — police notification); serious risk of harm to others (public interest). Be careful with **photographs and social media** — never post identifiable patient images without explicit written consent.

### Medical Negligence

**For negligence to be proven, all four elements are required:**

1. **Duty of care** owed to the patient
2. **Breach** of that duty (care below the standard of a responsible body of practitioners — Bolam/Bolitho tests)
3. **Causation** — the breach caused the harm
4. **Damage** (harm) resulted

**Prevention:** good communication, proper consent, **clear contemporaneous records** (dated, timed, signed, legible), working within competence, seeking senior help, following protocols, honest disclosure of errors.

**Pakistan:** medical practice is regulated by the **Pakistan Medical and Dental Council (PMDC)** code of ethics; medico-legal cases (assault, road traffic accidents, firearm injuries, poisoning) must be documented carefully and reported according to law; the provincial **Healthcare Commissions** (e.g. **Punjab Healthcare Commission**) handle complaints and set minimum service delivery standards.

### End-of-Life Decisions

- **Do-not-attempt-resuscitation (DNACPR)** decisions — discuss with the patient and family, document clearly
- Withholding or withdrawing futile treatment is ethically acceptable; **euthanasia is illegal** in Pakistan and most countries
- Palliative care focuses on comfort and dignity

> **Exam Alert:** Valid consent needs capacity, information and voluntariness. Disclose material risks a reasonable patient would want to know (Montgomery). A competent adult can refuse life-saving treatment. In emergencies, act in the best interests of an unconscious patient. Negligence requires duty, breach, causation and damage.

## Chapter 114: Patient Safety, Quality Improvement and Surgical Audit

**Importance:** Adverse events occur in about **1 in 10 hospital admissions**, and around half are preventable; surgical patients are at particular risk. Safety depends on **systems and teams**, not only individual skill.

### Human Factors and Error

- **Swiss cheese model (James Reason):** harm occurs when holes in several layers of defence (organisation, supervision, preconditions, individual actions) line up
- **Active failures** (unsafe acts by front-line staff — slips, lapses, mistakes, violations) vs **latent conditions** (system weaknesses — understaffing, fatigue, poor equipment, unclear protocols)
- **Non-technical skills** (NOTSS): **situation awareness**, **decision-making**, **communication and teamwork**, **leadership**
- Contributing factors: fatigue, hierarchy (juniors afraid to speak up), distraction, poor handover, time pressure
- Tools: **SBAR** for structured communication (**S**ituation, **B**ackground, **A**ssessment, **R**ecommendation), structured **handover**, closed-loop communication, "speak up" culture

## WHO Surgical Safety Checklist (2008)

Reduces surgical complications and mortality (by about one-third in the original international study). Three phases:

| Phase | When | Key checks |
|---|---|---|
| **Sign In** | **Before induction of anaesthesia** | Patient identity, site, procedure, **consent**; **site marked**; anaesthesia machine and medication check; pulse oximeter on; **allergies**; **difficult airway/aspiration risk**; **risk of >500 ml blood loss** (>7 ml/kg in children) |
| **Time Out** | **Before skin incision** | All team members introduce themselves by name and role; confirm patient, site and procedure; **antibiotic prophylaxis within the last 60 minutes**; anticipated critical events (surgeon, anaesthetist, nursing); **essential imaging displayed** |
| **Sign Out** | **Before the patient leaves the operating room** | Procedure recorded; **instrument, sponge and needle counts correct**; **specimen labelling**; equipment problems; key concerns for recovery |

**Never events:** serious, largely preventable incidents that should not occur if safety measures are followed — e.g. **wrong-site surgery**, wrong implant, **retained foreign object** (swab, instrument) after surgery, wrong-route drug administration, transfusion of ABO-incompatible blood, misplaced nasogastric tube not detected.

**Other safety measures:** VTE risk assessment and prophylaxis, early warning scores (**NEWS2**) to detect deterioration, safe prescribing, antimicrobial stewardship, infection control (hand hygiene — WHO "5 moments"), safe handover, reducing fatigue.

## Clinical Governance

The framework through which organisations are accountable for continuously improving the quality of care. Components: **clinical audit**, **risk management and incident reporting**, **clinical effectiveness** (evidence-based practice), **education and training/CPD**, patient involvement and feedback, staff management, information management, research.

## Clinical Audit

**Definition:** A quality improvement process comparing **actual practice against agreed standards**, implementing change, and **re-auditing** to confirm improvement.

### The audit cycle

1. Choose a topic and **set standards/criteria** (e.g. "100% of patients receive antibiotic prophylaxis within 60 minutes of incision")
2. **Measure current practice** (collect data)
3. **Compare** with the standard
4. **Implement change** (education, protocols, checklists)
5. **Re-audit** ("close the loop")

### Audit vs research vs service evaluation

| Audit | Research |
|---|---|
| "Are we doing what we **should** be doing?" | "What **is** the best thing to do?" — generates new knowledge |
| Measures against a standard | Tests a hypothesis |
| Usually no ethics committee approval needed | Needs ethics approval and consent |

| Audit | Research |
|---|---|
| No allocation to different treatments | May involve randomisation |

**Other quality tools: morbidity and mortality (M&M) meetings** (learning, not blaming), **PDSA cycles** (Plan–Do–Study–Act) for rapid improvement, **root cause analysis** after serious incidents, outcome registries, surgical logbooks, **risk-adjusted outcome scores** (POSSUM, ASA).

**Duty of candour:** be **open and honest** with patients when something goes wrong — explain, apologise, and describe what will be done; report incidents to improve the system ("just culture").

> **Exam Alert:** WHO checklist: Sign In (before induction), Time Out (before incision — confirm antibiotics within 60 min), Sign Out (before leaving theatre — counts and specimens). Wrong-site surgery and retained swabs are never events. Audit compares practice with a standard and must close the loop with re-audit; research generates new knowledge.

# Chapter 115: Global Surgery, Disaster and Conflict Surgery

## Global Surgery

**Definition:** An area of study, research, practice and advocacy that aims to improve health outcomes and achieve **equity in surgical, anaesthesia and obstetric care** for all people worldwide.

**The Lancet Commission on Global Surgery (2015) — key messages:**

- **About 5 billion people lack access to safe, affordable surgical and anaesthesia care when needed** — most in low- and middle-income countries (LMICs)
- An estimated **143 million additional surgical procedures** are needed each year in LMICs
- **33 million people** face catastrophic health expenditure each year paying for surgery and anaesthesia
- Surgical conditions (injuries, cancers, obstetric complications, congenital anomalies, acute abdomen) account for a large share of the global burden of disease
- Investing in surgery is **cost-effective** and supports economic growth

**Six core indicators (targets for 2030)**

| Indicator | Target |
|---|---|
| **Access to timely essential surgery** | ≥80% of population within **2 hours** of a facility that can perform **caesarean section, laparotomy and treatment of open fracture** ("Bellwether procedures") |
| **Specialist surgical workforce density** | ≥**20 surgical, anaesthetic and obstetric physicians per 100,000** population |
| **Surgical volume** | ≥**5,000 procedures per 100,000** population per year |
| **Perioperative mortality rate** | Tracked and reported nationally |
| **Protection against impoverishing expenditure** | 100% protection |
| Protection against catastrophic expenditure | 100% protection |

The **World Health Assembly Resolution 68.15 (2015)** recognised emergency and essential surgery and anaesthesia as components of universal health coverage. Countries are encouraged to develop **National Surgical, Obstetric and Anaesthesia Plans (NSOAPs)**.

**Relevance to Pakistan:** shortage and uneven distribution of surgeons and anaesthetists (concentrated in cities), long travel times from rural areas, out-of-pocket payments, delayed presentation (advanced cancers, neglected trauma, obstructed hernias). Solutions include task-sharing and training of district-level doctors, **Sehat Sahulat** health insurance, telemedicine, and essential surgical capacity at district hospitals.

**Environmental sustainability:** operating theatres are among the most resource-intensive hospital areas — reduce anaesthetic gas emissions (avoid desflurane and nitrous oxide), reduce single-use plastics, reuse and reprocess equipment where safe.

## Disaster (Major Incident) Surgery

**Major incident / mass casualty incident:** an event where the number and severity of casualties exceed the available resources. Pakistan has experienced earthquakes (2005 Kashmir earthquake), floods (2010, 2022), bomb blasts and terrorist attacks, and building collapses.

**Principles of major incident response (MIMMS — "CSCATTT")**

- **C**ommand and control, **S**afety (self, scene, survivors), **C**ommunication, **A**ssessment — the management priorities
- **T**riage, **T**reatment, **T**ransport — the medical support

**Triage** — doing the **greatest good for the greatest number** with limited resources:

| Category | Colour | Example |
|---|---|---|
| **P1 — Immediate** | **Red** | Life-threatening but salvageable (airway obstruction, tension pneumothorax, haemorrhagic shock) |
| **P2 — Urgent** | **Yellow** | Needs treatment within hours (stable abdominal injury, long bone fractures) |
| **P3 — Delayed** | **Green** | Walking wounded, minor injuries |
| **Expectant** | Blue (or black) | Unsurvivable with available resources — comfort care |
| **Dead** | **Black** | — |

Triage is **dynamic** — repeated as conditions change. **Sieve** (rapid, at the scene — can the patient walk? breathing? respiratory rate, capillary refill) followed by **sort** (more detailed, at casualty clearing station).

**Crush syndrome** (earthquakes, building collapse): prolonged compression of muscle → on release, **rhabdomyolysis** → **hyperkalaemia** (cardiac arrest), myoglobinuria → **acute kidney injury**, hypovolaemia, compartment syndrome. **Give IV fluids before or during extrication**, aim for high urine output, treat hyperkalaemia, dialysis; fasciotomy only for established compartment syndrome.

## Conflict (War) Surgery and Blast Injuries

### Blast injury mechanisms

| Type | Mechanism | Injuries |
|---|---|---|
| **Primary** | **Blast wave (overpressure)** acting on **air-filled organs** | **Tympanic membrane rupture** (marker of exposure), **blast lung** (most lethal primary injury), bowel perforation, traumatic brain injury |
| **Secondary** | **Fragments/debris** propelled by the blast | **Penetrating injuries — commonest cause of casualties** |
| **Tertiary** | Body thrown against objects | Blunt injuries, fractures, traumatic amputation |
| **Quaternary** | Other effects | **Burns**, crush injuries, toxic inhalation, psychological trauma |

**Ballistic (gunshot) wounds:** damage depends on energy transferred — **high-velocity** bullets create a large **temporary cavity**, devitalising tissue far beyond the visible track and sucking in contamination.

**Principles of war wound surgery (ICRC):**

1. **Wound excision (debridement)** — remove all dead and contaminated tissue, foreign material; **fasciotomy** where needed
2. **Leave the wound open — never close war wounds primarily**
3. **Delayed primary closure** at **4–5 days** (or skin graft) once clean
4. Antibiotics (penicillin) and **tetanus prophylaxis**
5. **Damage control surgery** and **damage control resuscitation** (haemorrhage control, permissive hypotension, 1:1:1 blood products, tranexamic acid) for severely injured patients
6. Fracture stabilisation (external fixators in austere settings)

**Haemorrhage control: tourniquets** and **haemostatic dressings** have saved many lives in recent conflicts — **catastrophic haemorrhage is treated first (\ABCDE)**.

> **Exam Alert:** About 5 billion people lack access to safe, affordable surgery (Lancet Commission 2015); targets include access within 2 hours and 20 specialists per 100,000. Triage does the greatest good for the greatest number (red, yellow, green, black). Crush syndrome causes hyperkalaemia and renal failure — give fluids early. Secondary blast injuries are commonest; blast lung is the most lethal primary injury. War wounds are debrided and left open for delayed primary closure.

## Self-Assessment: Part 18 SBAs

**1.** During laparoscopic cholecystectomy, the anaesthetist notes a rising end-tidal $CO_2$ and respiratory acidosis. What is the cause?

A. Absorption of insufflated carbon dioxide · B. Bile leak · C. Haemorrhage · D. Malignant hyperthermia only · E. Vagal reflex

**Answer: A.** $CO_2$ is absorbed from the peritoneum; increase ventilation.

**2.** Four days after laparoscopic appendicectomy, a patient develops peritonitis. At laparotomy there is a small perforation of the caecum away from the operative site. What is the most likely mechanism?

A. Anastomotic leak · B. Missed appendix stump · C. Port-site hernia · D. Unrecognised thermal (diathermy) injury · E. Veress needle injury on entry

**Answer: D.** Thermal injuries typically present days later.

**3.** Which feature is a disadvantage of robot-assisted surgery compared with conventional laparoscopy?

A. Lack of haptic (touch) feedback and high cost · B. Loss of 3D vision · C. More tremor · D. Less wrist movement of instruments · E. Poor ergonomics for the surgeon

**Answer: A.**

**4.** A competent 50-year-old Jehovah's Witness needs a major operation and refuses blood transfusion even if her life is at risk. What is the most appropriate action?

A. Ask her husband to consent to transfusion · B. Declare her incompetent · C. Respect her refusal and plan blood-conservation strategies · D. Refuse to operate · E. Transfuse if she becomes unconscious

**Answer: C.** A competent adult's informed refusal must be respected.

**5.** During consent for thyroidectomy, which risk must be disclosed according to the Montgomery principle?

A. Only risks occurring in more than 10% · B. Only risks the surgeon considers important · C. Risks a reasonable patient in her position would consider significant, such as voice change · D. No risks, to avoid anxiety · E. Only the risk of death

**Answer: C.**

**6.** A patient sues after an operation. Which combination of elements must be proven for negligence?

A. Duty, breach, causation and damage · B. Duty and damage only · C. Error and complaint · D. Intention to harm · E. Breach only

**Answer: A.**

**7.** At which stage of the WHO Surgical Safety Checklist is antibiotic prophylaxis confirmed and the team introduced by name and role?

A. Before induction (Sign In) · B. Before skin incision (Time Out) · C. Before leaving theatre (Sign Out) · D. In the recovery room · E. On the ward the night before

**Answer: B.**

**8.** A surgical unit measures the percentage of patients receiving VTE prophylaxis, compares it with the national standard, introduces a prescribing prompt, and measures again 3 months later. What is this process?

A. Clinical audit · B. Randomised controlled trial · C. Root cause analysis · D. Case report · E. Service evaluation only

**Answer: A.** Re-measurement closes the audit loop.

**9.** After a building collapse, a man trapped for 8 hours with his legs crushed is about to be freed. What is the most important step before release?

A. Apply tourniquets to both legs and amputate · B. Give IV fluids · C. Give oral potassium supplements · D. Immediate fasciotomy at the scene · E. Withhold fluids until hospital

**Answer: B.** Prevents hyperkalaemic arrest and renal failure from crush syndrome.

**10.** A soldier has a high-velocity gunshot wound of the thigh with no major vascular injury. After debridement, how should the wound be managed?

A. Closed primarily with drains · B. Closed primarily without drains · C. Left open, with delayed primary closure after 4–5 days · D. Covered with an immediate flap · E. Treated with antibiotics alone

**Answer: C.** War wounds are never closed primarily.

*References: Bailey & Love's Short Practice of Surgery, 28th Ed.; Blecha, Surgery, 4th Ed.; WHO Surgical Safety Checklist; Lancet Commission on Global Surgery (2015).*