

FOR BDS STUDENTS • BASED ON BAILEY & LOVE, 28th EDITION

BDS

General Surgery

Exam-Focused Revision



Definitions • Clinical Features • Investigations • Management
Revision Tables • Exam Pearls • One-Best MCQs with Explanations

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A concise revision guide for BDS students, based on *Bailey & Love's Short Practice of Surgery*, 28th Edition

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BDS General Surgery: Exam-Focused Revision

First Edition, 2026

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Disclaimer. Medicine is an ever-changing science. The author has checked the information against *Bailey & Love's Short Practice of Surgery* (28th Edition) and standard practice. Readers are advised to confirm drug doses and current guidelines before applying them in patient care. This book is intended as a revision aid and not as a substitute for the standard textbook.

Website: professorzahid.com

بسم الله الرحمن الرحيم

In the name of Allah, the Most Gracious, the Most Merciful

Dedication

*To my late beloved **parents**,
whose prayers, sacrifices and love made me who I am;
may Allah grant them the highest place in Jannah.*

*To my **teachers**,
who taught me not only surgery but the dignity of the profession,
and whose example I still try to follow.*

*To my dear wife, **Prof. Dr. Tayyaba Majeed**,
for her patience through long theatre lists and late nights,
and for being my strength through every season of life.*

*To my son, **Hamis Mahmood**, and all my **family members**,
whose love, support and understanding
gave me the time and peace to write.*

*To my **colleagues**,
with whom I have shared the operating theatre, the wards and the classroom,
and from whom I have learnt so much.*

*And to my **students**, past, present and future,
whose questions keep me learning,
and for whom this book was written.*

— Zahid Mahmood

Preface

Dental students study General Surgery at a stage when their minds are rightly occupied with teeth, jaws and the oral cavity. Yet the dentist of tomorrow will meet the bleeding patient, the patient on warfarin, the diabetic with a spreading facial infection, the smoker with a white patch on the tongue, and the woman with a lump in her neck. A sound grasp of surgical principles and of head-and-neck disease is therefore not optional for a dental surgeon; it is part of safe practice.

Over nearly thirty years of teaching MBBS and BDS students, I have found that most students do not lack ability; they lack a clear, compact text to revise from in the final weeks before the examination. Large textbooks are essential for understanding, but difficult to revise. This book was written to fill that gap.

Every topic follows the same simple order: **definition, clinical features, investigations, management and complications**. Key facts are gathered into revision tables, high-yield points into **Exam Pearls**, and every chapter ends with **One-Best-Answer MCQs** with answers and explanations, written in the style of the UHS and professional examinations.

All content follows *Bailey & Love's Short Practice of Surgery*, 28th Edition. The book is a companion to that textbook, not a replacement for it. Students are encouraged to read the relevant chapters of Bailey & Love for depth, and to use this book to consolidate and revise.

I pray that this small effort proves useful to my students, and I welcome suggestions for improvement through professorzahid.com.

Prof. Dr. Zahid Mahmood

Lahore, 2026

About the Author

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He is known among students for his structured, exam-oriented teaching style, and has developed lecture series, MCQ banks and OSPE material for undergraduate and postgraduate surgical training. He is also active in public health awareness through his website and social-media channels.

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How to Use This Book

Each disease is presented in a fixed sequence so that you can answer any long or short question in the same logical order the examiner expects:

Standard Topic Layout

- **Definition** — learn it word-perfect; it is the first line of every answer.
- **Aetiology / Classification** — brief, examination-relevant.
- **Clinical Features** — symptoms and signs.
- **Investigations** — in the order you would request them.
- **Management** — conservative, medical and surgical.
- **Complications** — of the disease and of its treatment.

Special Features

- **Revision Tables** — compare and contrast at a glance.
- ★ **Exam Pearls** — high-yield facts frequently tested in viva and MCQs.
- **Dental Relevance** boxes — what the topic means for the practising dentist.
- **Chapter MCQs** — one-best-answer questions with keys and explanations.

Suggested plan: read the chapter once, then revise from the tables and Exam Pearls, and finally attempt the MCQs without looking at the answers. Mark the questions you got wrong and re-read those sections the night before the examination.

Contents

Preface	6
About the Author	7
How to Use This Book	8
Contents	9
Abbreviations	11
Surgical Infections	13
Shock	22
Haemorrhage and Blood Transfusion	29
Fluids, Electrolytes and Acid-Base Balance	36
Preoperative Assessment and Preparation	42
Postoperative Care and Complications	48
Cleft Lip and Palate	55
Oral and Odontogenic Infections	61
Oral Mucosal and Premalignant Lesions	66
Oral Cancer	71
Cysts and Tumours of the Jaws	77
Neck Swellings and Congenital Lesions of the Neck	84
Cervical Lymphadenopathy	90
Neck Dissection	96
The Thyroid Gland: Goitre, Thyrotoxicosis and Thyroiditis	101
Thyroid Cancer and Complications of Thyroidectomy	108
The Parathyroid Glands	114
Salivary Glands: Inflammatory and Obstructive Disorders	120
Salivary Gland Tumours	126
Dysphagia and Benign Disorders of the Oesophagus	133
Carcinoma of the Oesophagus	139
Mock Paper 1	145
Mock Paper 2	151
Mock Paper 1 — Answer Key and Model Answers	157
Mock Paper 2 — Answer Key and Model Answers	160
High-Yield One-Liners for Last-Minute Revision	163
References and Further Reading	166

Abbreviations

Abbreviation	Meaning
ABG	Arterial blood gas
ASA	American Society of Anesthesiologists
ATLS	Advanced Trauma Life Support
CRP	C-reactive protein
CT	Computed tomography
CVP	Central venous pressure
DIC	Disseminated intravascular coagulation
FNAC	Fine-needle aspiration cytology
GCS	Glasgow Coma Scale
INR	International normalised ratio
MAP	Mean arterial pressure
MRI	Magnetic resonance imaging
MRSA	Methicillin-resistant <i>Staphylococcus aureus</i>
NSAID	Non-steroidal anti-inflammatory drug
OPG	Orthopantomogram
SIRS	Systemic inflammatory response syndrome
SSI	Surgical site infection
TNM	Tumour, Node, Metastasis
USG	Ultrasonography
WHO	World Health Organization

PART I

Principles of General Surgery

Surgical Infections • Shock • Haemorrhage • Fluids & Electrolytes • Preoperative
Assessment • Postoperative Care

CHAPTER 1

Surgical Infections

Learning Objectives

- Define infection, SIRS, sepsis and septic shock.
- Classify surgical wounds and surgical site infections (SSI).
- Describe the diagnosis and management of cellulitis, abscess, necrotising fasciitis, gas gangrene, tetanus and actinomycosis.
- Apply universal precautions and post-exposure prophylaxis for blood-borne viruses in dental and surgical practice.

1.1 Basic Definitions

- **Infection:** invasion and multiplication of micro-organisms in body tissues, producing a local or systemic host response.
- **Contamination:** presence of organisms without invasion or host response.
- **Colonisation:** organisms multiply on a surface but do not invade (e.g. MRSA in the nose).
- **SIRS (Systemic Inflammatory Response Syndrome):** two or more of — temperature $>38^{\circ}\text{C}$ or $<36^{\circ}\text{C}$; heart rate $>90/\text{min}$; respiratory rate $>20/\text{min}$ (or $\text{PaCO}_2 <4.3 \text{ kPa}$); WBC $>12\,000$ or $<4\,000/\text{mm}^3$.
- **Sepsis (Sepsis-3):** life-threatening organ dysfunction caused by a dysregulated host response to infection (rise in SOFA score of 2 or more).
- **Septic shock:** sepsis with persistent hypotension needing vasopressors to keep MAP $\geq 65 \text{ mmHg}$ and serum lactate $>2 \text{ mmol/L}$ despite adequate fluid resuscitation.

Factors determining whether infection develops

Table 1.1 Determinants of surgical infection

Organism factors	Host factors (local)	Host factors (systemic)
Virulence (toxins, capsule)	Dead tissue, haematoma	Diabetes mellitus
Number (inoculum size)	Foreign body (sutures, implants)	Malnutrition, obesity
Antibiotic resistance (MRSA)	Poor blood supply, tension	Steroids, chemotherapy, HIV
Synergy between organisms	Dead space, poor technique	Smoking, old age, jaundice, uraemia

★ EXAM PEARLS

- Most surgical infections are **endogenous** (from the patient's own flora). In the mouth, the oral flora is mixed aerobic and anaerobic — hence the use of **amoxicillin ± metronidazole** for odontogenic infections.
- The "**golden period**" for primary closure of a contaminated wound is about 6 hours; beyond this, delayed primary closure is safer.

1.2 Classification of Surgical Wounds

Table 1.2 Wound classification and expected infection rates

Class	Definition	Example	Approx. SSI rate
Clean	No viscus (GIT, respiratory, urinary) opened; no inflammation	Thyroidectomy, hernia repair	1-2%
Clean-contaminated	Viscus opened under controlled conditions; minimal spillage	Cholecystectomy, oral cavity surgery	<10%
Contaminated	Open viscus with gross spillage, acute inflammation, fresh traumatic wound	Open bowel injury, fresh compound fracture	15-20%
Dirty	Established infection, pus, perforated viscus, old traumatic wound	Perforated appendix, abscess drainage	Up to 40%

Dental relevance: surgery within the oral cavity is at least **clean-contaminated** because the mucosa is colonised. Neck dissection combined with an oral resection is therefore classed as clean-contaminated and receives antibiotic prophylaxis.

1.3 Surgical Site Infection (SSI)

Definition: infection occurring at the operative site within **30 days** of surgery (or within **1 year** if an implant is left in place).

Classification (CDC)

- **Superficial incisional** — skin and subcutaneous tissue.
- **Deep incisional** — fascia and muscle.
- **Organ/space** — any part of the anatomy opened or handled (e.g. subphrenic abscess).

Clinical features

- Usually appears on the **5th-7th postoperative day**.
- Pain, swelling, erythema, warmth and tenderness of the wound.
- Purulent discharge; fever; wound may gape (dehiscence).
- Systemic features of sepsis in severe cases.

Investigations

- Wound swab / pus for **Gram stain, culture and sensitivity**.
- Full blood count (leucocytosis), CRP.
- Blood culture if febrile or septic.
- Blood glucose (hidden diabetes).
- Ultrasound or CT for deep or organ/space collections.

Management

- Open the wound — remove a few sutures and let pus drain ("*Ubi pus, ibi evacua*" — where there is pus, drain it).
- Daily dressing; debride dead tissue.
- Antibiotics only if there is **cellulitis or systemic sepsis**, guided by culture.
- Image-guided percutaneous drainage for deep collections; re-operation if needed.
- Control diabetes, correct nutrition.

Prevention of SSI

Table 1.3 Prevention of surgical site infection

Phase	Measures
Preoperative	Treat remote infection; control blood sugar; stop smoking; shower; hair removal by clippers (not razor) on the day of surgery; short preoperative stay
Intraoperative	Skin preparation with chlorhexidine-alcohol or povidone-iodine; antibiotic prophylaxis at induction; gentle tissue handling; haemostasis; avoid dead space; maintain normothermia and oxygenation
Postoperative	Aseptic dressing technique; hand hygiene; early removal of drains and catheters

1.4 Antibiotic Prophylaxis

- **Indication:** clean-contaminated and contaminated surgery; clean surgery involving an implant/prosthesis or where infection would be catastrophic.
- **Timing:** intravenously at **induction of anaesthesia** (within 60 minutes before incision), so that tissue levels are high when the incision is made.
- **Duration:** usually a **single dose**; repeat if surgery lasts longer than the drug's half-life (~4 h) or blood loss exceeds 1.5 L.
- Dirty wounds need a **therapeutic course**, not prophylaxis.

★ EXAM PEARLS

- Prophylactic antibiotics given **after** the incision or continued for days do **not** reduce SSI further — they only encourage resistance and *C. difficile* infection.
- Antibiotic prophylaxis against infective endocarditis before dental procedures is now restricted to **high-risk cardiac patients** (prosthetic valve, previous endocarditis, certain congenital heart diseases), as per local guidelines.

1.5 Cellulitis

Definition: spreading, non-suppurative inflammation of the skin and subcutaneous tissue, usually due to ***Streptococcus pyogenes*** (β -haemolytic streptococcus), sometimes *Staphylococcus aureus*.

- **Clinical features:** diffuse, red, hot, tender swelling with ill-defined edge; no fluctuation; fever and malaise; lymphangitis (red streaks) and tender regional lymph nodes.
- **Investigations:** mainly clinical; FBC, blood glucose; blood culture if systemically unwell; ultrasound to exclude an underlying abscess.
- **Management:** rest, elevation, analgesia; **benzylpenicillin / flucloxacillin** (or co-amoxiclav); treat portal of entry and diabetes.
- **Complications:** abscess formation, necrotising fasciitis, septicaemia.

1.6 Abscess

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

- **Clinical features:** painful, hot, red, tender swelling; **fluctuation** (may be absent in deep abscesses — e.g. parotid, breast, neck spaces); throbbing pain, swinging fever.
- **Investigations:** FBC (neutrophilia); ultrasound to confirm pus and guide aspiration; pus for culture; blood sugar.
- **Management: incision and drainage** — incise at the most dependent/fluctuant point, break loculi, irrigate, leave open or pack; antibiotics if surrounding cellulitis, diabetes or immunosuppression.

- **Complications:** spread (cellulitis, septicaemia), sinus formation, antibioma (an abscess treated with antibiotics alone, leaving a hard sterile mass).

Table 1.4 Cellulitis versus abscess

Feature	Cellulitis	Abscess
Organism	<i>Streptococcus pyogenes</i>	<i>Staphylococcus aureus</i>
Nature	Spreading, diffuse	Localised collection
Edge	Ill-defined	Well-defined
Fluctuation	Absent	Present (superficial)
Pus	Absent	Present
Treatment	Antibiotics	Incision and drainage

1.7 Necrotising Soft-Tissue Infection (Necrotising Fasciitis)

Definition: a rapidly spreading infection of the fascia and subcutaneous tissue with thrombosis of nutrient vessels and necrosis of overlying skin. A **surgical emergency**.

- **Type 1 (polymicrobial):** aerobes + anaerobes; diabetic and elderly patients; includes **Fournier's gangrene** (perineum/scrotum).
- **Type 2 (monomicrobial):** Group A *Streptococcus* ± *S. aureus* — "flesh-eating" infection, may follow minor trauma.
- **Cervical necrotising fasciitis** may follow an **odontogenic infection**.

Clinical features

- **Pain out of proportion** to the visible signs (earliest clue).
- Rapidly spreading oedema beyond erythema; skin turns dusky, then purple, with blisters (bullae) and anaesthesia.
- Crepitus may be present; marked systemic toxicity — septic shock.

Investigations

- Diagnosis is **clinical** — surgery must not be delayed for tests.
- FBC, CRP, sodium, creatinine, glucose (LRINEC score).
- X-ray/CT may show gas in soft tissues.
- Finger test at surgery: fascia separates easily, "dishwater" pus, no bleeding.

Management

- Resuscitation (sepsis bundle).
- **Urgent radical surgical debridement** of all dead tissue; re-look every 24–48 h.
- High-dose broad-spectrum IV antibiotics: e.g. **meropenem/piperacillin-tazobactam + clindamycin** (clindamycin suppresses toxin production).
- ICU care; later skin grafting.
- Mortality 20–40%, higher with delay.

1.8 Gas Gangrene (Clostridial Myonecrosis)

Definition: rapidly spreading necrosis of **muscle** with gas production, caused by ***Clostridium perfringens*** (gram-positive, anaerobic, spore-forming). Its α -toxin (lecithinase) destroys cell membranes.

- **Predisposing:** deep, contaminated, crushed wounds with dead muscle (war, road accidents); amputations in ischaemic limbs.

- **Clinical features:** incubation <24–72 h; severe pain; oedema; bronze then black skin; **crepitus**; thin brown discharge with sweet "mousy" odour; profound toxaemia, tachycardia, shock.
- **Investigations:** Gram stain of exudate (gram-positive rods, few pus cells); X-ray shows gas in muscle planes; creatine kinase raised.
- **Management:** resuscitation; **radical excision of all dead muscle** (amputation if needed); high-dose **benzylpenicillin + clindamycin** (or metronidazole); hyperbaric oxygen where available.
- **Prevention:** thorough debridement of traumatic wounds; leave contaminated wounds open.

1.9 Tetanus

Definition: an acute disease caused by the exotoxin **tetanospasmin** of *Clostridium tetani*, characterised by muscle rigidity and spasms. The toxin travels along nerves and blocks release of the inhibitory neurotransmitters **GABA and glycine**.

Clinical features

- Incubation usually **3–21 days**; a short incubation means a worse prognosis.
- **Trismus (lockjaw)** — usually the first sign; the patient may first present to a **dentist**.
- **Risus sardonicus** (sardonic smile), dysphagia, neck stiffness.
- **Opisthotonus** (arched back), board-like abdomen.
- Painful reflex **spasms** provoked by noise, light or touch; consciousness preserved.
- Autonomic instability: sweating, tachycardia, labile BP.

Investigations

- Diagnosis is **clinical**. Culture of the wound is often negative.
- Spatula test: touching the posterior pharynx causes reflex jaw spasm (bites the spatula).

Management

- Admit to a quiet, dark room / ICU.
- Wound debridement.
- **Human tetanus immunoglobulin** (HTIG) to neutralise unbound toxin.
- **Metronidazole** (preferred) to eradicate the organism.
- Control spasms: benzodiazepines (diazepam), magnesium sulphate; paralysis and ventilation in severe cases.
- Early **tracheostomy** for airway protection; nutrition; active immunisation on recovery (the disease does not confer immunity).

Table 1.5 Tetanus prophylaxis after a wound

Immunisation status	Clean minor wound	Tetanus-prone wound
Fully immunised, booster <10 years	Nothing	Nothing (consider HTIG if very high risk)
Fully immunised, booster >10 years	Toxoid booster	Toxoid booster
Incomplete / unknown	Toxoid course	Toxoid + HTIG

1.10 Actinomycosis

Definition: chronic suppurative granulomatous infection caused by *Actinomyces israelii*, a gram-positive anaerobic commensal of the mouth.

- **Types:** cervicofacial (commonest, ~60%), thoracic, abdominal (ileocaecal), pelvic (IUCD).
- **Cervicofacial:** follows dental extraction, caries or jaw trauma; affects the angle of the mandible.
- **Clinical features:** hard, "woody" induration, purplish skin, multiple discharging sinuses, pus containing yellow "sulphur granules"; little pain; lymph nodes usually not enlarged.
- **Investigations:** pus for sulphur granules and Gram stain (branching gram-positive filaments), anaerobic culture; biopsy; OPG for jaw involvement.
- **Management:** prolonged high-dose penicillin (6–12 weeks or more); drainage of abscesses and excision of sinus tracts; treat dental source.

1.11 Sepsis — Initial Management

The early recognition and treatment of sepsis saves lives. A practical bundle to start within the **first hour** ("Sepsis Six"):

Table 1.6 The Sepsis Six (first hour)

Give three	Take three
High-flow oxygen (target SpO ₂ 94–98%)	Blood cultures (before antibiotics)
IV broad-spectrum antibiotics	Serum lactate (and FBC)
IV fluid challenge (crystalloid)	Urine output monitoring (catheter)

Above all, find and control the **source** — drain the abscess, debride dead tissue, remove infected lines or implants (**source control**).

1.12 Blood-Borne Viruses and Universal Precautions

Surgeons and dentists are exposed to blood and saliva every day. All patients must be treated as potentially infectious — **standard (universal) precautions**.

Table 1.7 Risk of transmission after a needlestick injury from an infected source

Virus	Approx. risk	Protection
Hepatitis B (HBsAg positive)	~30%	Vaccination of all health workers; HBIG + vaccine after exposure
Hepatitis C	~1.8–3%	No vaccine; follow-up testing; early antiviral treatment if infected
HIV	~0.3%	PEP — antiretroviral drugs started ideally within 1 hour (up to 72 h), for 28 days

Standard precautions

- Hand hygiene; gloves (double gloving in high-risk surgery), mask, eye protection/visor, gown.
- Safe handling of sharps — no recapping of needles; sharps containers; use instruments, not fingers, to hold needles.
- Proper sterilisation of instruments (autoclave); disposal of clinical waste.
- **After a sharps injury:** encourage bleeding, wash with soap and water (do not suck or scrub), report immediately, test source and recipient, start PEP if indicated.

★ **EXAM PEARLS**

- Remember the "rule of 3s" for needlestick risk: **HBV 30%, HCV 3%, HIV 0.3%**.
- Hepatitis B is the only one of the three preventable by **vaccination** — every dental student must be vaccinated and check antibody levels.

1.13 Chapter Revision Table

Table 1.8 Organisms and their key features

Condition	Organism	Hallmark	Key treatment
Cellulitis	<i>S. pyogenes</i>	Spreading, ill-defined erythema	Penicillin/flucloxacillin
Abscess	<i>S. aureus</i>	Fluctuant localised pus	Incision & drainage
Necrotising fasciitis	Polymicrobial / Group A strep	Pain out of proportion	Urgent debridement
Gas gangrene	<i>C. perfringens</i>	Crepitus, myonecrosis	Radical excision + penicillin
Tetanus	<i>C. tetani</i>	Trismus, spasms	HTIG + metronidazole + sedation
Actinomycosis	<i>A. israelii</i>	Sulphur granules, sinuses	Long-term penicillin

Chapter MCQs (One Best Answer)

Q1. A 35-year-old farmer presents to a dental clinic complaining that he cannot open his mouth. Ten days ago he had a deep puncture wound of the foot from a rusty nail. He is fully conscious, sweating, and has a fixed "grin". Which neurotransmitter release is blocked by the toxin responsible?

- A. Acetylcholine
- B. Dopamine
- C. Glycine
- D. Noradrenaline
- E. Serotonin

Q2. A 50-year-old man has a hard, painless swelling at the angle of the mandible 6 weeks after a molar extraction. There are several discharging sinuses, and the pus contains yellow granules. What is the treatment of choice?

- A. Incision and drainage alone
- B. Long-term high-dose penicillin
- C. Radiotherapy
- D. Short course of metronidazole
- E. Wide excision with neck dissection

Q3. A diabetic patient on day 2 after an elective procedure develops severe pain in the wound out of proportion to the findings, with dusky skin, blisters and hypotension. What is the most important next step?

- A. CT scan before deciding treatment
- B. Hyperbaric oxygen therapy
- C. Oral antibiotics and review in 24 h
- D. Urgent radical surgical debridement
- E. Wound swab and await culture

Q4. For an elective clean-contaminated operation, when should a prophylactic antibiotic ideally be given?

- A. 24 hours before surgery
- B. At induction of anaesthesia
- C. At skin closure
- D. For 5 days after surgery
- E. Only if fever develops

Q5. A thyroidectomy performed for a benign goitre would be classified as which type of wound?

- A. Clean
- B. Clean-contaminated
- C. Contaminated
- D. Dirty
- E. Infected

Q6. A dental student sustains a needlestick injury from a patient known to be HIV positive. What is the most appropriate immediate action after washing the wound?

- A. Apply a tourniquet above the site
- B. Start post-exposure prophylaxis as soon as possible
- C. Suck the wound to remove blood
- D. Test for HIV after 6 months only
- E. Wait for the source patient's viral load result

Q7. A 70-year-old man has a crushed thigh after a road accident. Two days later he is toxic with crepitus in the thigh, bronze skin and a sweet-smelling discharge. Gram stain shows gram-positive rods with few pus cells. Which toxin is chiefly responsible for tissue destruction?

- A. Alpha toxin (lecithinase)
- B. Coagulase
- C. Enterotoxin B
- D. Streptolysin O
- E. Tetanospasmin

Q8. A surgical wound becomes red, swollen and discharges pus on the 6th postoperative day. Which is the most appropriate initial treatment?

- A. Apply a pressure dressing
- B. Give antibiotics and keep sutures intact
- C. Open the wound by removing sutures and allow drainage
- D. Re-suture the wound under anaesthesia
- E. Start steroids

Answer Key & Explanations

1-C 2-B 3-D 4-B 5-A 6-B 7-A 8-C

Q1 — C. This is tetanus (trismus, risus sardonicus). Tetanospasmin blocks release of the inhibitory neurotransmitters glycine and GABA, producing unopposed muscle contraction. Acetylcholine release is blocked by botulinum toxin, not tetanus toxin.

Q2 — B. Woody induration, multiple sinuses and sulphur granules after dental extraction indicate cervicofacial actinomycosis. Treatment is prolonged high-dose penicillin for weeks to months, with drainage of collections when present.

Q3 — D. Pain out of proportion, dusky skin, bullae and shock indicate necrotising fasciitis. This is a surgical emergency; resuscitation, IV antibiotics and immediate radical debridement are required. Investigations must not delay surgery.

Q4 — B. Prophylactic antibiotics are given intravenously at induction (within 60 minutes before incision) so that tissue concentrations are high at the time of incision. A single dose usually suffices; prolonged courses add no benefit.

Q5 — A. In a clean wound no hollow viscus (respiratory, alimentary, urinary tract) is entered and there is no inflammation. Thyroidectomy is the classic example, with an expected infection rate of 1–2%.

Q6 — B. After encouraging bleeding and washing with soap and water, the injury is reported and antiretroviral PEP is started as early as possible — ideally within 1 hour and certainly within 72 hours — for 28 days. Sucking or scrubbing the wound is not advised.

Q7 — A. This is gas gangrene due to *Clostridium perfringens*. Its alpha toxin, a lecithinase (phospholipase C), destroys cell membranes, causing myonecrosis and haemolysis. Treatment is radical excision of dead muscle with penicillin and clindamycin.

Q8 — C. The principle is to drain pus. Removing a few sutures to open the wound, with regular dressings, is the key step. Antibiotics are added only for spreading cellulitis or systemic sepsis.

CHAPTER 2

Shock

Learning Objectives

- Define shock and describe its classification.
- Grade haemorrhagic shock and recognise its clinical features.
- Outline the resuscitation and monitoring of a shocked patient.
- Recognise and treat anaphylaxis and vasovagal syncope in the dental chair.

2.1 Definition

Shock is a systemic state of **inadequate tissue perfusion and oxygenation**, leading to a switch from aerobic to anaerobic metabolism, cellular hypoxia, lactic acidosis and, if uncorrected, organ failure and death.

The essential problem is at the **cellular level** — oxygen delivery fails to meet demand. Blood pressure may be normal in early (compensated) shock, so a normal BP does **not** exclude shock.

2.2 Classification

Table 2.1 Classification of shock (Bailey & Love)

Type	Mechanism	Common causes
Hypovolaemic	Reduced circulating volume → low preload	Haemorrhage, burns, vomiting, diarrhoea, intestinal obstruction, pancreatitis
Cardiogenic	Pump failure	Myocardial infarction, arrhythmias, myocarditis, valve rupture
Obstructive	Mechanical obstruction to cardiac filling or outflow	Tension pneumothorax, cardiac tamponade, massive pulmonary embolism
Distributive	Vasodilatation and maldistribution of flow	Septic, anaphylactic, neurogenic (spinal cord injury)
Endocrine	Hormonal causes of circulatory failure	Adrenal (Addisonian) crisis, hypothyroidism, thyrotoxic crisis

★ EXAM PEARLS

- **Hypovolaemic shock** (usually haemorrhage) is the commonest type in surgical practice.
- Patients on long-term **steroids** undergoing surgery may develop an **Addisonian crisis** — refractory hypotension that responds to IV hydrocortisone.
- Neurogenic shock gives **hypotension with bradycardia** and warm peripheries — unlike all other types, where tachycardia is the rule.

2.3 Pathophysiology in Brief

- **Compensatory response:** sympathetic stimulation (tachycardia, vasoconstriction, cold clammy skin), renin-angiotensin-aldosterone and ADH release (oliguria, salt and water retention).
- **Cellular:** anaerobic metabolism → lactate accumulates → metabolic acidosis; failure of Na^+/K^+ pump → cell swelling and death.
- **Inflammatory:** release of cytokines → capillary leak → SIRS → multiple organ dysfunction syndrome (MODS).
- **Ischaemia-reperfusion injury:** restoring flow releases acid, potassium and free radicals, which can worsen organ injury.

Phases of shock

Table 2.2 Severity of shock

Phase	Features
Compensated	BP maintained by compensatory mechanisms; tachycardia, cool peripheries; occult hypoperfusion (raised lactate)
Decompensated	Falling BP, oliguria, acidosis, confusion — progressive organ dysfunction
Irreversible	Cellular damage too great; death despite resuscitation

2.4 Clinical Features

Table 2.3 Clinical features by type of shock

Feature	Hypovolaemic	Cardiogenic	Septic (hyperdynamic)	Neurogenic
Skin	Cold, pale, clammy	Cold, clammy	Warm, flushed (early)	Warm
Pulse	↑ (thready)	↑	↑ (bounding)	↓ (bradycardia)
BP	↓	↓	↓	↓
JVP / CVP	↓	↑	↓ / normal	↓
Cardiac output	↓	↓	↑ early	↓
Urine output	↓	↓	↓	↓

★ EXAM PEARLS

- The **jugular venous pressure** separates cardiogenic/obstructive shock (JVP raised) from hypovolaemic shock (JVP low).
- In a **young fit patient** and in patients on **β-blockers**, tachycardia may be absent and BP preserved until very late.

2.5 Haemorrhagic Shock — Grading

The ATLS classification relates the estimated blood loss (adult of 70 kg, blood volume ≈ 5 L) to the physiological signs.

Table 2.4 Classes of haemorrhagic shock (ATLS)

Parameter	Class I	Class II	Class III	Class IV
Blood loss (%)	<15%	15–30%	30–40%	>40%
Blood loss (mL)	<750	750–1500	1500–2000	>2000
Pulse rate	<100	100–120	120–140	>140
Blood pressure	Normal	Normal	Decreased	Decreased
Pulse pressure	Normal	Decreased	Decreased	Decreased
Respiratory rate	14–20	20–30	30–40	>35
Urine output (mL/h)	>30	20–30	5–15	Negligible
Mental state	Slightly anxious	Mildly anxious	Anxious, confused	Confused, lethargic
Fluid / blood	Crystalloid	Crystalloid ± blood	Blood products	Massive transfusion

★ EXAM PEARLS

- **Hypotension appears only in Class III** (blood loss >30%, i.e. >1.5 L). The earliest sign of haemorrhage is usually **tachycardia** with a **narrowed pulse pressure**.

2.6 Investigations and Monitoring

Table 2.5 Monitoring the shocked patient

Minimum	Additional
Pulse, BP, respiratory rate, temperature	Arterial line (invasive BP)
Pulse oximetry (SpO ₂)	Central venous pressure (CVP)
ECG monitoring	Cardiac output monitoring (echo, Doppler)
Urine output (urinary catheter) — target >0.5 mL/kg/h	Serial lactate and base deficit
GCS / mental state	Mixed/central venous oxygen saturation

Laboratory tests

- FBC, grouping and cross-matching, coagulation profile (PT/INR, APTT, fibrinogen).
- Urea, creatinine, electrolytes, glucose, liver function tests.
- **Arterial blood gas** — metabolic acidosis, base deficit; **serum lactate** (marker of tissue hypoperfusion and severity).
- Blood cultures (sepsis); ECG, cardiac enzymes (troponin) and echocardiography (cardiogenic).
- Imaging to find the source: chest X-ray, FAST ultrasound, CT.

2.7 Management — General Principles

Treatment runs **simultaneously**: resuscitate, monitor, and identify and treat the cause. Use the **ABCDE** approach.

- **A - Airway** with cervical spine protection in trauma.
- **B - Breathing**: high-flow oxygen; decompress a tension pneumothorax.
- **C - Circulation**: two large-bore (14–16 G) cannulae; take bloods; **stop the bleeding**; fluid therapy.
- **D - Disability** (GCS, pupils, glucose); **E - Exposure** (look for injuries, prevent hypothermia).

Fluid therapy

- **Fluid challenge**: 250–500 mL crystalloid (Ringer's lactate/Hartmann's or 0.9% saline) rapidly; observe response.
- **Responders**: improve and remain stable. **Transient responders**: improve then deteriorate — ongoing loss. **Non-responders**: no improvement — severe ongoing bleeding or non-hypovolaemic cause; need urgent intervention.
- In haemorrhage, give **blood and blood products early** rather than large volumes of crystalloid (which dilutes clotting factors and worsens acidosis).

Damage-control (haemostatic) resuscitation in haemorrhage

- **Permissive hypotension** — target a lower BP (systolic ~80–90 mmHg) until bleeding is controlled (not in head injury).
- Balanced transfusion of red cells, plasma and platelets (approximately **1:1:1**).
- **Tranexamic acid** 1 g IV within **3 hours** of injury, then 1 g over 8 hours.
- Prevent the "**lethal triad**": hypothermia, acidosis and coagulopathy.
- Early surgical or radiological control of bleeding (damage-control surgery).

Specific measures by type

Table 2.6 Treatment by type of shock

Type	Specific treatment
Hypovolaemic	Control loss; crystalloid then blood products
Septic	Fluids, antibiotics within 1 h, source control ; noradrenaline if hypotension persists
Cardiogenic	Cautious fluids; inotropes (dobutamine); treat MI (PCI/thrombolysis); intra-aortic balloon pump
Obstructive	Needle decompression of tension pneumothorax; pericardiocentesis; thrombolysis for PE
Anaphylactic	IM adrenaline ; remove trigger; fluids, oxygen, antihistamine, hydrocortisone
Neurogenic	Fluids, vasopressors, atropine for bradycardia; spinal immobilisation
Adrenal crisis	IV hydrocortisone 100 mg; fluids; correct glucose

End-points of resuscitation

- MAP ≥ 65 mmHg; heart rate falling; warm peripheries; normal mental state.
- **Urine output >0.5 mL/kg/h** — the simplest bedside guide.
- Normalising **lactate** and base deficit (correcting occult hypoperfusion).

2.8 Complications of Shock

Table 2.7 Organ effects of shock

System	Complication
Kidney	Acute kidney injury (pre-renal $\rightarrow$ acute tubular necrosis)
Lung	Acute respiratory distress syndrome (ARDS)
Blood	Disseminated intravascular coagulation (DIC)
Gut	Stress ulceration, bacterial translocation, ileus
Liver	Ischaemic hepatitis, jaundice
Brain / heart	Confusion, coma; myocardial depression and arrhythmias
Overall	Multiple organ dysfunction syndrome (MODS) and death

2.9 Shock in the Dental Chair

Dental relevance: most collapses in a dental surgery are due to **vasovagal syncope**, but the dentist must instantly recognise **anaphylaxis** (to local anaesthetic additives, latex, penicillin or chlorhexidine), which can kill within minutes.

Table 2.8 Vasovagal syncope versus anaphylaxis

Feature	Vasovagal syncope	Anaphylaxis
Onset	Anxiety, pain, sight of needle	Minutes after drug/latex exposure
Pulse	Slow , weak	Rapid , weak
Skin	Pale, sweaty, no rash	Urticaria , flushing, angio-oedema
Airway / breathing	Normal	Stridor , wheeze, hoarseness
Recovery	Quick when laid flat	Progressive unless treated
Treatment	Lay supine, raise legs, oxygen	Adrenaline 0.5 mg IM (0.5 mL of 1:1000), call for help

Anaphylaxis — Emergency Steps (Adult)

- Stop the trigger; call for help; lay the patient flat with legs raised (sit up if breathing is difficult).
- **Adrenaline 0.5 mg intramuscular** (0.5 mL of 1:1000) into the anterolateral thigh; **repeat after 5 minutes** if no improvement.
- High-flow oxygen; IV access and rapid crystalloid bolus (500–1000 mL).
- Chlorphenamine and hydrocortisone are **second-line** — never delay adrenaline for them.
- Monitor and transfer to hospital; biphasic reaction can occur.

2.10 Chapter Revision Table**Table 2.9 Shock at a glance**

Point	Remember
Definition	Inadequate tissue perfusion and oxygenation
Commonest type in surgery	Hypovolaemic (haemorrhagic)
Earliest sign of bleeding	Tachycardia, narrowed pulse pressure
BP falls at	Class III (>30% loss)
Best bedside monitor	Urine output >0.5 mL/kg/h
Marker of hypoperfusion	Serum lactate
Bradycardia + hypotension	Neurogenic shock (or vasovagal)
Raised JVP + hypotension	Cardiogenic or obstructive shock
Vasopressor in septic shock	Noradrenaline
Drug of choice in anaphylaxis	Adrenaline 0.5 mg IM

Chapter MCQs (One Best Answer)

Q1. A 25-year-old man is brought after a road accident. Pulse 128/min, BP 90/60 mmHg, respiratory rate 32/min, urine output 10 mL/h and he is anxious and confused. What is his approximate blood loss?

- A. <750 mL
- B. 750–1500 mL
- C. 1500–2000 mL
- D. 2500–3000 mL
- E. >3500 mL

Q2. A 30-year-old woman becomes breathless with stridor, generalised urticaria and a rapid weak pulse within minutes of receiving a local anaesthetic injection in a dental chair. What is the first drug to give?

- A. Adrenaline 0.5 mg intramuscular
- B. Adrenaline 1 mg intravenous bolus
- C. Chlorphenamine 10 mg intravenous
- D. Hydrocortisone 200 mg intravenous
- E. Salbutamol nebuliser

Q3. A patient faints during a dental extraction. He is pale and sweating with a pulse of 48/min and no rash or wheeze. What is the most appropriate immediate management?

- A. Give adrenaline intramuscularly
- B. Give intravenous hydrocortisone
- C. Lay him flat and raise his legs
- D. Perform needle decompression of the chest
- E. Start chest compressions

Q4. A patient who has taken prednisolone for rheumatoid arthritis for two years develops severe hypotension after a minor operation that does not respond to IV fluids. What is the most likely cause?

- A. Acute adrenal insufficiency
- B. Anaphylaxis
- C. Cardiac tamponade
- D. Neurogenic shock
- E. Pulmonary embolism

Q5. Which single bedside measurement is the most useful guide to adequacy of resuscitation in a shocked surgical patient?

- A. Blood pressure
- B. Capillary refill time
- C. Hourly urine output
- D. Pulse oximetry
- E. Temperature

Q6. A motorcyclist with a stab wound to the chest is hypotensive and tachycardic with distended neck veins, absent breath sounds on the right and trachea deviated to the left. What is the immediate treatment?

- A. CT scan of the chest
- B. Intravenous noradrenaline
- C. Needle decompression of the right chest
- D. Pericardiocentesis
- E. Rapid infusion of 2 L crystalloid

Q7. In a trauma patient with ongoing haemorrhage, tranexamic acid should be given within what time of injury to be effective?

- A. 30 minutes
- B. 3 hours
- C. 6 hours
- D. 12 hours
- E. 24 hours

Q8. A patient with a cervical spinal cord injury has a BP of 80/50 mmHg and a pulse of 52/min with warm peripheries. What type of shock is this?

- A. Cardiogenic
- B. Hypovolaemic
- C. Neurogenic
- D. Obstructive
- E. Septic

Answer Key & Explanations

1-C 2-A 3-C 4-A 5-C 6-C 7-B 8-C

Q1 — C. Pulse 120–140, reduced BP, respiratory rate 30–40, urine 5–15 mL/h and confusion represent Class III haemorrhage: 30–40% loss, i.e. about 1500–2000 mL in a 70 kg adult. Hypotension first appears in Class III.

Q2 — A. This is anaphylaxis. The first-line drug is intramuscular adrenaline 0.5 mg (0.5 mL of 1:1000) into the anterolateral thigh, repeated after 5 minutes if needed. IV bolus adrenaline is reserved for cardiac arrest or specialist use; antihistamines and steroids are second-line.

Q3 — C. Bradycardia, pallor and sweating without urticaria or bronchospasm indicate vasovagal syncope. Laying the patient supine and raising the legs restores cerebral perfusion; oxygen may be given. Adrenaline is for anaphylaxis.

Q4 — A. Long-term steroids suppress the hypothalamic-pituitary-adrenal axis. Surgical stress then causes an Addisonian (adrenal) crisis with refractory hypotension. Treatment is IV hydrocortisone, and these patients need perioperative steroid cover.

Q5 — C. Urine output reflects renal perfusion and is a simple, reliable end-organ marker of perfusion. A target of more than 0.5 mL/kg/h indicates adequate resuscitation. Blood pressure can be maintained despite hypoperfusion in compensated shock.

Q6 — C. Hypotension, raised JVP, absent breath sounds and tracheal deviation away from the affected side indicate tension pneumothorax — obstructive shock. It is a clinical diagnosis; immediate needle (or finger) decompression is life-saving, followed by a chest drain.

Q7 — B. Tranexamic acid, an antifibrinolytic, reduces mortality from bleeding when given within 3 hours of injury (1 g IV over 10 minutes, then 1 g over 8 hours). Given after 3 hours it is of no benefit and may be harmful.

Q8 — C. Loss of sympathetic outflow after a high spinal cord injury causes vasodilatation (warm skin) and unopposed vagal tone (bradycardia). Hypotension with bradycardia distinguishes neurogenic shock from hypovolaemic shock, where tachycardia is expected.

CHAPTER 3

Haemorrhage and Blood Transfusion

Learning Objectives

- Classify haemorrhage and describe methods of haemostasis.
- Assess and manage a patient with a bleeding disorder or on anticoagulants before dental surgery.
- Describe blood components, their indications and storage.
- List the complications of blood transfusion and of massive transfusion.

3.1 Definition and Classification of Haemorrhage

Haemorrhage is the escape of blood from the vascular system. It may be external (revealed) or internal (concealed).

Table 3.1 Classification of haemorrhage

Basis	Types
Vessel	Arterial — bright red, spurting with the pulse; Venous — dark red, steady flow; Capillary — oozing from raw surface
Visibility	Revealed (external, e.g. haematemesis, epistaxis) or Concealed (internal, e.g. ruptured spleen, fractured femur)
Timing	Primary — at the time of injury or operation Reactionary — within 24 hours , as BP rises and a ligature slips or a clot is dislodged Secondary — at 7–14 days , due to infection eroding a vessel
Duration	Acute, chronic, or acute-on-chronic

★ EXAM PEARLS

- **Reactionary haemorrhage** after thyroidectomy can cause a **neck haematoma** and airway obstruction — open the wound at the bedside (remove skin and muscle sutures) before returning to theatre.
- **Secondary haemorrhage** is a sign of infection; it often follows a small "herald bleed". After tooth extraction it presents around the end of the first week from an infected socket.

3.2 Normal Haemostasis

- **Vascular phase:** vasoconstriction of the injured vessel.
- **Platelet phase:** adhesion (via von Willebrand factor) and aggregation → primary platelet plug.
- **Coagulation phase:** clotting cascade → thrombin converts fibrinogen to fibrin → stable clot.
- **Fibrinolysis:** plasmin breaks down the clot during healing (inhibited by **tranexamic acid**).

3.3 Methods of Surgical Haemostasis

Table 3.2 Methods of controlling bleeding

Method	Examples
Mechanical	Direct pressure (gauze pack, bite on gauze for 20–30 min), packing, tourniquet, ligature, sutures, clips, bone wax
Thermal	Diathermy (monopolar/bipolar), laser, ultrasonic devices
Chemical / local agents	Adrenaline in local anaesthetic, oxidised cellulose (Surgicel), gelatin sponge, fibrin glue, topical thrombin
Pharmacological	Tranexamic acid (IV or 5% mouthwash), vitamin K, desmopressin (DDAVP), protamine (reverses heparin)
Replacement	Fresh frozen plasma, platelets, cryoprecipitate, factor concentrates

3.4 Bleeding Disorders

Table 3.3 Common bleeding disorders

Disorder	Defect	Laboratory picture	Treatment
Haemophilia A	Factor VIII deficiency; X-linked recessive (males)	↑ APTT; normal PT, platelets, bleeding time	Factor VIII concentrate; DDAVP (mild)
Haemophilia B (Christmas disease)	Factor IX deficiency; X-linked	↑ APTT; normal PT	Factor IX concentrate
von Willebrand disease	Deficient/defective vWF; autosomal dominant; commonest inherited	↑ Bleeding time ± ↑ APTT; normal platelet count	DDAVP; vWF-containing factor concentrate
Thrombocytopenia	Platelet count $<150 \times 10^9/L$	↓ Platelets, ↑ bleeding time	Treat cause; platelet transfusion if $<50 \times 10^9/L$ for surgery
Liver disease / vitamin K deficiency	Low factors II, VII, IX, X	↑ PT/INR	Vitamin K 10 mg IV; FFP
DIC	Consumption of factors and platelets	↑ PT, ↑ APTT, ↓ platelets, ↓ fibrinogen, ↑ D-dimer	Treat cause; replace products

Clinical features

- **Platelet/vessel defects:** petechiae, purpura, mucosal bleeding (gums, nose), immediate bleeding after extraction.
- **Coagulation defects:** deep bleeding into joints (haemarthrosis) and muscles, **delayed** bleeding hours after surgery.
- Ask about prolonged bleeding after previous extractions, circumcision or tonsillectomy, and family history.

Investigations (coagulation screen)

- Platelet count; **PT/INR** (extrinsic pathway — warfarin, liver); **APTT** (intrinsic — heparin, haemophilia); fibrinogen; bleeding time / platelet function; specific factor assays.

3.5 The Anticoagulated Dental Patient

Table 3.4 Management of antithrombotic drugs for dental extraction

Drug	Practical advice
Warfarin	Check INR within 24 h (up to 72 h if stable). Extractions in primary care are generally safe if INR <4 ; use local haemostatic measures. Do not stop warfarin routinely (risk of thrombosis).
DOACs (apixaban, rivaroxaban, dabigatran)	For higher-risk procedures, miss or delay the morning dose as per local guidance; treat early in the day.
Antiplatelets (aspirin, clopidogrel)	Do not stop for dental extraction; use local measures.
Heparin (LMWH)	Plan treatment away from peak effect; liaise with physician.

Local Measures After Extraction

- Firm pressure: patient bites on damp gauze for 20–30 minutes.
- Pack the socket with **oxidised cellulose** or gelatin sponge and place sutures.
- **Tranexamic acid 5% mouthwash** 10 mL four times daily for 2–5 days.
- Avoid NSAIDs for analgesia; use paracetamol. Advise no hot drinks or vigorous rinsing on the first day.

3.6 Blood and Blood Components

Table 3.5 Blood components

Component	Storage	Main indications
Packed red cells	2–6°C, up to 35 days	Anaemia, acute blood loss. One unit raises Hb by about 10 g/L in an adult
Platelets	20–24°C with agitation, 5–7 days	Thrombocytopenia with bleeding, or count $<50 \times 10^9/L$ before surgery
Fresh frozen plasma	Frozen at –25°C or below	Multiple factor deficiency (DIC, liver disease, massive transfusion), warfarin reversal if PCC unavailable
Cryoprecipitate	Frozen	Rich in fibrinogen , factor VIII, vWF; fibrinogen <1.5 g/L
Prothrombin complex concentrate	Room temp / fridge	Rapid reversal of warfarin (with vitamin K)

Indications for red cell transfusion

- Acute blood loss with haemodynamic instability (Class III–IV haemorrhage).
- **Restrictive threshold:** Hb <70 g/L in stable patients (target 70–90 g/L); <80 g/L in patients with heart disease.
- Symptomatic chronic anaemia not responding to other treatment.

★ EXAM PEARLS

- Platelets are stored at **room temperature**, so they carry the highest risk of **bacterial contamination**.
- Group **O negative** is the universal red-cell donor; **AB positive** is the universal recipient. For plasma it is the reverse — **AB plasma** is the universal donor.

3.7 Complications of Blood Transfusion

Table 3.6 Complications of transfusion

Timing	Complication	Key point
Immediate	Acute haemolytic reaction	ABO incompatibility, usually clerical error ; fever, rigors, loin pain, hypotension, haemoglobinuria, DIC — stop transfusion at once
Immediate	Febrile non-haemolytic reaction	Commonest; due to leucocyte antibodies; slow transfusion, paracetamol
Immediate	Allergic / anaphylactic	Urticaria to anaphylaxis; anaphylaxis in IgA-deficient recipients
Immediate	TRALI	Transfusion-related acute lung injury — non-cardiogenic pulmonary oedema within 6 h
Immediate	TACO	Circulatory overload in elderly/cardiac patients — slow rate, diuretics
Immediate	Bacterial contamination	Commonest with platelets; septic shock
Delayed	Delayed haemolytic reaction	5–10 days later; anaemia, jaundice
Delayed	Infection	Hepatitis B and C, HIV, syphilis, malaria — all units screened
Delayed	Iron overload, GvHD, alloimmunisation	Repeated transfusions; GvHD prevented by irradiated blood

Massive transfusion

Definition: replacement of the patient's whole blood volume within 24 h, or 50% within 3 h, or more than 4 units in 1 hour.

- **Complications:** **hypothermia**, **coagulopathy** (dilution of platelets and factors), **hypocalcaemia** (citrate toxicity), **hyperkalaemia**, acidosis, ARDS.
- **Prevention:** blood warmers, balanced 1:1:1 ratio of red cells, plasma and platelets, calcium replacement, tranexamic acid.

Alternatives to allogeneic blood

- Preoperative correction of anaemia (oral/IV iron).
- Intraoperative **cell salvage**; acute normovolaemic haemodilution; preoperative autologous donation.
- Meticulous haemostasis and tranexamic acid. Important for patients who refuse blood (e.g. Jehovah's Witnesses).

3.8 Chapter Revision Table

Table 3.7 Haemorrhage at a glance

Point	Remember
Reactionary haemorrhage	Within 24 h — slipped ligature, rising BP
Secondary haemorrhage	7–14 days — infection
Haemophilia A	Factor VIII, ↑ APTT, X-linked
Commonest inherited bleeding disorder	von Willebrand disease
Warfarin monitoring	PT/INR; extraction safe if INR <4
Tranexamic acid mouthwash	5%, 10 mL four times a day
Highest bacterial contamination risk	Platelets (stored at 20–24°C)
Commonest cause of ABO reaction	Clerical (identification) error
Cryoprecipitate is rich in	Fibrinogen, factor VIII, vWF

Chapter MCQs (One Best Answer)

Q1. A 12-year-old boy bleeds persistently for two days after extraction of a premolar. His maternal uncle had similar problems. Platelet count and PT are normal, APTT is prolonged. What is the most likely diagnosis?

- A. Haemophilia A
- B. Immune thrombocytopenia
- C. Scurvy
- D. Vitamin K deficiency
- E. Warfarin toxicity

Q2. A 60-year-old man on warfarin for atrial fibrillation needs extraction of two lower molars. What is the most appropriate pre-procedure step?

- A. Change warfarin to aspirin for a week
- B. Check the INR within 24 hours of the procedure
- C. Give vitamin K the night before
- D. Give fresh frozen plasma before extraction
- E. Stop warfarin for 5 days

Q3. On the 8th day after extraction of an infected molar, a patient returns with fresh bleeding from the socket, which looks unhealthy and smells offensive. What type of haemorrhage is this?

- A. Concealed
- B. Primary
- C. Reactionary
- D. Secondary
- E. Venous

Q4. Ten minutes after starting a transfusion of red cells, a patient develops fever, rigors, loin pain and hypotension. What is the most important immediate action?

- A. Give intravenous paracetamol
- B. Slow the transfusion rate
- C. Start furosemide
- D. Stop the transfusion immediately
- E. Transfuse a second unit quickly

Q5. Which blood component carries the highest risk of bacterial contamination?

- A. Cryoprecipitate
- B. Fresh frozen plasma
- C. Packed red cells
- D. Platelet concentrate
- E. Whole blood stored at 4°C

Q6. A trauma patient receives 12 units of red cells in 4 hours. He develops perioral tingling, muscle twitching and prolonged QT interval. What is the cause?

- A. Hyperkalaemia
- B. Hypocalcaemia from citrate
- C. Hypoglycaemia
- D. Hypomagnesaemia
- E. Iron overload

Q7. A patient with fibrinogen of 0.8 g/L is bleeding during surgery. Which product is most appropriate?

- A. Albumin 20%
- B. Cryoprecipitate
- C. Packed red cells
- D. Platelets
- E. Vitamin K

Q8. After extraction in a patient on clopidogrel, which is the most appropriate local adjunct to reduce bleeding?

- A. Aspirin gargle
- B. Diclofenac for pain
- C. Hot salt-water rinses on day one
- D. Protamine sulphate
- E. Tranexamic acid 5% mouthwash

Answer Key & Explanations

1-A 2-B 3-D 4-D 5-D 6-B 7-B 8-E

Q1 — A. Delayed bleeding in a boy with an affected maternal uncle (X-linked inheritance), with isolated prolonged APTT, indicates haemophilia A (factor VIII deficiency) — the commonest haemophilia. Treatment is factor VIII replacement with local measures.

Q2 — B. Warfarin should not be stopped routinely for dental extraction because of the thrombotic risk. The INR is checked, ideally within 24 hours; if it is below 4, extraction can proceed with local haemostatic measures such as packing, suturing and tranexamic acid mouthwash.

Q3 — D. Secondary haemorrhage occurs at 7–14 days and is caused by infection eroding a vessel. Reactionary haemorrhage occurs within 24 hours, when BP recovers or a clot is dislodged.

Q4 — D. This is an acute haemolytic transfusion reaction, most often due to ABO incompatibility from a clerical error. The transfusion must be stopped at once, the line kept open with saline, the patient resuscitated, and the unit and samples sent to the blood bank.

Q5 — D. Platelets are stored at 20–24°C with agitation for only 5–7 days. Storage at room temperature allows bacterial growth, making contamination and septic reactions most likely with platelets.

Q6 — B. Stored blood contains citrate as an anticoagulant, which binds ionised calcium. In massive transfusion, citrate toxicity causes hypocalcaemia with tetany and a prolonged QT interval. IV calcium gluconate or chloride is given.

Q7 — B. Cryoprecipitate is rich in fibrinogen, factor VIII, von Willebrand factor and factor XIII. It is used when fibrinogen falls below about 1.5 g/L in a bleeding patient.

Q8 — E. Tranexamic acid inhibits fibrinolysis and stabilises the clot. As a 5% mouthwash it reduces bleeding after extraction. NSAIDs and aspirin increase bleeding, and protamine reverses heparin, not clopidogrel.

CHAPTER 4

Fluids, Electrolytes and Acid-Base Balance

Learning Objectives

- Describe the distribution of body water and daily fluid and electrolyte requirements.
- Compare the common intravenous fluids.
- Recognise and treat disorders of sodium, potassium and calcium.
- Interpret simple acid-base disturbances.

4.1 Body Fluid Compartments

Total body water is about **60% of body weight** in an adult man (about 42 L in a 70 kg man) and less in women and the elderly because of higher fat content.

Table 4.1 Distribution of body water (70 kg adult)

Compartment	Proportion	Volume	Main ions
Intracellular fluid (ICF)	2/3 (40% body weight)	28 L	K ⁺ , Mg ²⁺ , phosphate, proteins
Extracellular fluid (ECF)	1/3 (20% body weight)	14 L	Na ⁺ , Cl ⁻ , HCO ₃ ⁻
— Interstitial	3/4 of ECF	~10.5 L	
— Plasma (intravascular)	1/4 of ECF	~3.5 L	Plus plasma proteins

4.2 Daily Maintenance Requirements (Adult)

Table 4.2 Maintenance requirements

Item	Requirement per day
Water	25-30 mL/kg (about 2-2.5 L)
Sodium	1 mmol/kg
Potassium	1 mmol/kg
Glucose	50-100 g (to limit starvation ketosis)

Daily losses: urine ~1500 mL, insensible losses (skin and lungs) ~800 mL, faeces ~100 mL. Insensible losses rise by about 10% for every 1°C of fever. Abnormal losses (vomiting, nasogastric aspirate, drains, fistulae, diarrhoea) must be measured and **replaced in addition** to maintenance.

4.3 Intravenous Fluids

Table 4.3 Composition of common IV fluids (mmol/L)

Fluid	Na ⁺	K ⁺	Cl ⁻	Other	Use
0.9% sodium chloride (normal saline)	154	0	154	—	Resuscitation, replacing GI loss; excess causes hyperchloraemic acidosis
Hartmann's (Ringer's lactate)	131	5	111	Lactate 29, Ca ²⁺ 2	Resuscitation and replacement — most "physiological"
5% dextrose	0	0	0	Glucose 50 g/L	Free water; distributes to all compartments
Dextrose 4% / saline 0.18%	30	0	30	Glucose 40 g/L	Maintenance (add KCl)
Colloids (gelatin, albumin)	Variable			Large molecules	Stay in plasma longer; no proven survival benefit

★ EXAM PEARLS

- Only about **one quarter** of an infused crystalloid such as normal saline remains in the circulation; the rest moves to the interstitium.
- **5% dextrose is not a resuscitation fluid** — the glucose is metabolised and the water spreads throughout all body compartments.
- Never give potassium as a bolus; peripheral infusion should not normally exceed **10 mmol/hour**.

4.4 Disorders of Sodium

Hyponatraemia ($\text{Na}^+ < 135 \text{ mmol/L}$)

- **Causes:** excess hypotonic fluid (5% dextrose postoperatively), **SIADH** (pain, surgery, lung and head injury, drugs), diuretics, vomiting/diarrhoea with water replacement, heart, liver and renal failure, Addison's disease.
- **Clinical features:** nausea, headache, confusion, seizures and coma (cerebral oedema) when severe ($< 120 \text{ mmol/L}$) or rapid.
- **Investigations:** serum and urine osmolality, urine sodium, assessment of volume status, thyroid and adrenal function.
- **Management:** treat the cause; fluid restriction (SIADH, overload); isotonic saline (hypovolaemic); hypertonic saline for severe symptoms. Correct slowly — **not more than 10 mmol/L in 24 h** to avoid **osmotic demyelination** (central pontine myelinolysis).

Hypernatraemia ($\text{Na}^+ > 145 \text{ mmol/L}$)

- **Causes:** water loss exceeding sodium loss — inadequate intake (elderly, unconscious), fever, burns, diabetes insipidus, osmotic diuresis.
- **Features:** thirst, dry mucosa, confusion, seizures.
- **Management:** slow replacement of water (oral or 5% dextrose).

4.5 Disorders of Potassium

Table 4.4 Hypokalaemia versus hyperkalaemia

Feature	Hypokalaemia ($< 3.5 \text{ mmol/L}$)	Hyperkalaemia ($> 5.5 \text{ mmol/L}$)
Causes	Vomiting, nasogastric aspiration, diarrhoea, fistulae, diuretics, insulin, inadequate replacement	Renal failure, tissue damage (crush, burns), massive transfusion, acidosis, K-sparing drugs (ACE inhibitors, spironolactone), Addison's
Clinical	Muscle weakness, paralytic ileus , arrhythmias	Muscle weakness, cardiac arrest (asystole/VF)
ECG	Flat T waves, U waves , ST depression	Tall peaked T waves , wide QRS, loss of P waves, sine wave
Treatment	Oral K; IV KCl $\leq 10 \text{ mmol/h}$ peripherally; correct Mg^{2+}	See box below

Emergency Treatment of Hyperkalaemia

- **Protect the heart:** 10 mL of **10% calcium gluconate** IV over 5–10 minutes (repeat if ECG changes persist).
- **Shift K into cells:** **10 units soluble insulin in 50 mL of 50% dextrose** IV; nebulised salbutamol; sodium bicarbonate in acidosis.
- **Remove K:** calcium resonium (oral/rectal), loop diuretics, **haemodialysis** for refractory cases.
- Stop potassium-containing fluids and causative drugs; monitor ECG and glucose.

4.6 Disorders of Calcium

Hypocalcaemia

- **Surgical causes: after thyroidectomy or parathyroidectomy** (hypoparathyroidism, "hungry bone"), acute pancreatitis, massive transfusion, vitamin D deficiency, renal failure.
- **Features:** perioral and digital tingling (paraesthesia), muscle cramps, tetany, carpopedal spasm, laryngospasm, seizures, prolonged QT.
- **Signs: Chvostek's sign** (tapping the facial nerve in front of the ear causes twitching of the face) and **Trousseau's sign** (BP cuff above systolic for 3 minutes causes carpal spasm).
- **Treatment:** acute — **10 mL of 10% calcium gluconate IV** slowly, then infusion; chronic — oral calcium and vitamin D (alfacalcidol).

Hypercalcaemia

- **Causes: primary hyperparathyroidism** (commonest in outpatients) and **malignancy** (commonest in hospital patients).
- **Features:** "bones, stones, abdominal groans and psychic moans" — bone pain, renal stones, polyuria and thirst, constipation, peptic ulcer, pancreatitis, depression, confusion; short QT.
- **Treatment:** IV 0.9% saline rehydration (3–4 L/day), then **bisphosphonates** (zoledronic acid); treat the cause.

4.7 Acid-Base Balance

Table 4.5 Normal arterial blood gas values

Parameter	Normal range
pH	7.35–7.45
PaCO ₂	4.7–6.0 kPa (35–45 mmHg)
PaO ₂ (room air)	>10.6 kPa (80–100 mmHg)
HCO ₃ [−]	22–26 mmol/L
Base excess	−2 to +2 mmol/L
Lactate	<2 mmol/L

Simple approach to an ABG

- **Step 1 — pH:** <7.35 acidaemia; >7.45 alkalaemia.
- **Step 2 — Primary cause:** if PaCO₂ moves in the direction that explains the pH, the problem is **respiratory**; if HCO₃[−] explains it, the problem is **metabolic**.
- **Step 3 — Compensation:** the other system moves in the same direction to bring the pH towards normal.
- **Step 4 — Anion gap** in metabolic acidosis: $(\text{Na}^+ + \text{K}^+) - (\text{Cl}^- + \text{HCO}_3^-)$; normal about 10–16 mmol/L.

Table 4.6 The four primary acid-base disorders

Disorder	pH	Primary change	Common surgical causes
Metabolic acidosis	↓	↓ HCO_3^-	Shock (lactic acidosis) , diabetic ketoacidosis, renal failure, ischaemic bowel; normal gap: diarrhoea, fistula, excess saline
Metabolic alkalosis	↑	↑ HCO_3^-	Persistent vomiting / gastric outlet obstruction , nasogastric aspiration, diuretics, hypokalaemia
Respiratory acidosis	↓	↑ PaCO_2	Hypoventilation: opioids, residual anaesthesia, COPD, chest injury, airway obstruction
Respiratory alkalosis	↑	↓ PaCO_2	Hyperventilation: anxiety, pain, early sepsis, pulmonary embolism

★ EXAM PEARLS

- **Gastric outlet obstruction** (e.g. pyloric stenosis) causes **hypochloraemic, hypokalaemic metabolic alkalosis** with **paradoxical aciduria**. Treat with 0.9% saline plus potassium chloride.
- Raised **lactate** with metabolic acidosis in a surgical patient is shock or ischaemic bowel until proven otherwise.

4.8 Chapter Revision Table**Table 4.7 Fluids and electrolytes at a glance**

Point	Remember
Total body water	60% body weight; ICF 2/3, ECF 1/3
Daily water / Na / K	25–30 mL/kg; 1 mmol/kg; 1 mmol/kg
Hartmann's sodium content	131 mmol/L
Max peripheral KCl rate	10 mmol/hour
Rate of sodium correction	≤10 mmol/L per 24 h
Peaked T waves	Hyperkalaemia — give calcium gluconate first
U waves, ileus	Hypokalaemia
Chvostek and Trousseau signs	Hypocalcaemia (post-thyroidectomy)
Pyloric stenosis	Hypochloraemic hypokalaemic metabolic alkalosis

Chapter MCQs (One Best Answer)

Q1. On the first day after total thyroidectomy a woman complains of tingling around her mouth and fingers. Tapping in front of her ear causes twitching of the upper lip. What is the most appropriate immediate treatment?

- A. Intravenous 10% calcium gluconate
- B. Intravenous magnesium sulphate
- C. Oral levothyroxine
- D. Oral potassium chloride
- E. Re-exploration of the neck

Q2. A patient in renal failure has serum potassium of 7.2 mmol/L and tall peaked T waves on ECG. What should be given first?

- A. Calcium gluconate 10% intravenously
- B. Calcium resonium orally
- C. Furosemide intravenously
- D. Insulin-dextrose infusion
- E. Sodium bicarbonate

Q3. A 6-week-old boy with projectile non-bilious vomiting for 5 days is dehydrated. Which biochemical picture is expected?

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

Q4. A postoperative patient given 3 L of 5% dextrose daily becomes confused, with serum sodium of 121 mmol/L. What is the most important principle in correcting this?

- A. Correct within 6 hours to normal
- B. Give 8.4% sodium bicarbonate
- C. Increase dextrose infusion
- D. Raise sodium by no more than 10 mmol/L in 24 hours
- E. Restrict sodium intake

Q5. What is the approximate daily maintenance potassium requirement of a 70 kg adult?

- A. 10 mmol
- B. 20 mmol
- C. 70 mmol
- D. 150 mmol
- E. 200 mmol

Q6. After a long operation, a patient given morphine has a respiratory rate of 7/min. ABG: pH 7.25, PaCO_2 8.5 kPa, HCO_3^- 26 mmol/L. What is the disorder?

- A. Metabolic acidosis
- B. Metabolic alkalosis
- C. Mixed metabolic alkalosis
- D. Respiratory acidosis
- E. Respiratory alkalosis

Q7. Which intravenous fluid most closely resembles plasma in composition?

- A. 0.9% sodium chloride
- B. 5% dextrose
- C. Dextrose 4% with saline 0.18%
- D. Hartmann's solution
- E. Sodium bicarbonate 8.4%

Answer Key & Explanations

1-A 2-A 3-C 4-D 5-C 6-D 7-D

Q1 — A. Perioral paraesthesia and a positive Chvostek's sign after thyroidectomy indicate hypocalcaemia from parathyroid injury or devascularisation. Symptomatic patients receive 10 mL of 10% calcium gluconate IV slowly, followed by oral calcium and vitamin D.

Q2 — A. In hyperkalaemia with ECG changes, the first step is to protect the myocardium with IV calcium gluconate, which stabilises the cardiac membrane within minutes. Insulin-dextrose and salbutamol then shift potassium into cells.

Q3 — C. Infantile hypertrophic pyloric stenosis causes loss of gastric hydrochloric acid, leading to hypochloraemic, hypokalaemic metabolic alkalosis, often with paradoxical aciduria. It is corrected with 0.9% saline with added potassium before pyloromyotomy.

Q4 — D. Postoperative hyponatraemia from excess hypotonic fluid is common. Sodium must be corrected slowly, by no more than 10 mmol/L in 24 hours, to avoid osmotic demyelination (central pontine myelinolysis).

Q5 — C. Daily maintenance requirements are about 1 mmol/kg each of sodium and potassium, i.e. about 70 mmol of potassium for a 70 kg adult, with 25–30 mL/kg of water.

Q6 — D. Low pH with a high PaCO_2 and normal bicarbonate indicates acute respiratory acidosis due to opioid-induced hypoventilation. Treatment includes airway support, oxygen and naloxone.

Q7 — D. Hartmann's (Ringer's lactate) contains sodium 131, potassium 5, chloride 111, calcium 2 and lactate 29 mmol/L, close to plasma. Large volumes of 0.9% saline, with 154 mmol/L chloride, cause hyperchloraemic acidosis.

CHAPTER 5

Preoperative Assessment and Preparation

Learning Objectives

- Describe the aims and components of preoperative assessment.
- Use the ASA classification and select appropriate investigations.
- Prepare patients with diabetes, cardiac and respiratory disease, and those on anticoagulants or steroids.
- Explain informed consent, fasting and thromboprophylaxis.

5.1 Aims of Preoperative Assessment

- Confirm the **diagnosis** and the need for surgery.
- Identify **co-morbidities** and assess fitness for anaesthesia and surgery.
- **Optimise** the patient's condition (e.g. control of diabetes, hypertension, anaemia).
- Plan anaesthesia, postoperative care (HDU/ICU) and discharge.
- Obtain **informed consent** and give the patient information.

5.2 History and Examination

Table 5.1 Key points in the preoperative history

Area	Ask about
Cardiovascular	Chest pain, MI, heart failure, exercise tolerance (can climb two flights of stairs?), hypertension, valve disease, pacemaker
Respiratory	Asthma, COPD, smoking, recent chest infection, obstructive sleep apnoea
Endocrine	Diabetes (type, control, HbA1c), thyroid disease, steroid use
Bleeding	Previous excessive bleeding, family history, anticoagulants and antiplatelets
Anaesthetic	Previous problems, malignant hyperthermia or suxamethonium apnoea in the family, difficult intubation
Drugs and allergies	All medications, allergies (penicillin, latex, chlorhexidine)
Others	Liver and kidney disease, pregnancy, alcohol, loose teeth, crowns and dentures

Airway assessment is especially relevant in head and neck surgery: mouth opening (trismus), **Mallampati grade**, thyromental distance, neck movement, dentition and any swelling distorting the airway (e.g. Ludwig's angina, large goitre).

5.3 ASA Physical Status Classification

Table 5.2 ASA classification

ASA grade	Definition	Example
I	Normal healthy patient	Fit young adult
II	Mild systemic disease	Controlled hypertension, well-controlled diabetes, smoker, pregnancy
III	Severe systemic disease	Poorly controlled diabetes, COPD, morbid obesity, stable angina
IV	Severe systemic disease that is a constant threat to life	Recent MI (<3 months), severe heart failure, sepsis
V	Moribund; not expected to survive without the operation	Ruptured aortic aneurysm
VI	Brain-dead organ donor	—

The suffix "**E**" denotes an emergency operation (e.g. ASA III E).

5.4 Preoperative Investigations

Investigations should be **selective**, based on age, co-morbidity and the magnitude of surgery, not ordered routinely for every patient.

Table 5.3 Common preoperative tests and indications

Test	Indication
Full blood count	Major surgery, anaemia suspected, blood loss expected, elderly
Urea, creatinine, electrolytes	Renal disease, diabetes, hypertension, diuretics, ACE inhibitors, major surgery
Blood glucose and HbA1c	Diabetes or suspected diabetes
Coagulation screen	Anticoagulants, liver disease, bleeding history
Group and save / cross-match	Surgery with possible significant blood loss
ECG	Cardiovascular, renal or diabetic disease; older patients for major surgery
Chest X-ray	Cardiorespiratory disease or symptoms; not routine
Others	Thyroid function (thyroid surgery), viral markers (HBV, HCV, HIV), pregnancy test in women of child-bearing age, echocardiography, lung function

5.5 Specific Medical Problems

Diabetes mellitus

- Aim for good control: elective surgery preferably when **HbA1c <69 mmol/mol (8.5%)**.
- Place first on the operating list; avoid long fasting.
- Minor surgery with a short fast: adjust oral agents/insulin on the day and monitor capillary glucose.
- Major surgery or poor control: **variable-rate intravenous insulin infusion** (sliding scale) with glucose-potassium-containing fluid; target glucose 6–10 mmol/L.
- Risks: hypoglycaemia, infection, poor wound healing, silent myocardial ischaemia.

Cardiovascular disease

- **Hypertension:** continue antihypertensives; defer elective surgery if BP $\geq$ 180/110 mmHg.
- **Recent MI:** postpone elective surgery, ideally for at least **3 months** (risk of re-infarction is highest early).

- **Heart failure, arrhythmias, valve disease:** optimise with physician/cardiologist; echocardiography.
- **Infective endocarditis:** prophylaxis for high-risk patients according to local guidelines; dental clearance before valve surgery.

Respiratory disease

- Stop smoking (ideally 6–8 weeks before surgery); treat chest infection; optimise bronchodilators; physiotherapy and incentive spirometry.

Patients on steroids

- Long-term steroids suppress the adrenal response to stress. Give **perioperative hydrocortisone cover** (e.g. 50–100 mg IV at induction for major surgery) and continue usual dose to avoid an **Addisonian crisis**.

Anticoagulant and antiplatelet drugs (major surgery)

Table 5.4 Perioperative management of antithrombotics

Drug	Usual plan before major surgery
Warfarin	Stop 5 days before; check INR (<1.5) on the day before surgery; bridging with LMWH in high-risk patients (mechanical valve, recent VTE)
DOACs	Stop 24–72 h before depending on drug, renal function and bleeding risk
Clopidogrel	Stop 7 days before if bleeding risk is high (not in recent coronary stents without cardiology advice)
Aspirin	Usually continued

Other conditions

- **Jaundice:** vitamin K, good hydration (risk of hepatorenal syndrome), treat cholangitis.
- **Thyrotoxicosis:** make euthyroid before thyroid surgery to prevent thyroid storm.
- **Anaemia:** investigate and correct with iron; transfuse only if needed.
- **Malnutrition:** nutritional support (enteral preferred) for 7–10 days before major surgery.
- **Bisphosphonates:** risk of medication-related osteonecrosis of the jaw — complete dental treatment before starting.

5.6 Fasting Before Anaesthesia (Elective Adult)

Table 5.5 Preoperative fasting

Intake	Minimum fasting time
Solid food, milk	6 hours
Breast milk (infants)	4 hours
Clear fluids (water, black tea)	2 hours

Prolonged fasting causes dehydration, hypoglycaemia and discomfort and should be avoided. Patients with diabetes need a plan for their medication.

5.7 Informed Consent

- Must be given **voluntarily** by a patient with **capacity**, after receiving adequate **information**.
- Explain the diagnosis, the nature and purpose of the procedure, **material risks** and complications, alternatives (including no treatment) and the expected outcome.
- Obtained by the operating surgeon or a competent delegate; in a language the patient understands; documented and signed.

- For children, consent is given by a parent/guardian; in an emergency, a surgeon may act in the patient's best interests.

5.8 Thromboprophylaxis

Assess every surgical patient for the risk of **venous thromboembolism** (VTE) and bleeding.

- **High-risk factors:** age >60, major or pelvic/orthopaedic surgery, cancer, obesity, previous VTE, immobility, oral contraceptives, pregnancy.
- **Mechanical:** early mobilisation, adequate hydration, graduated compression stockings, intermittent pneumatic compression.
- **Pharmacological:** low-molecular-weight heparin (e.g. enoxaparin 40 mg SC daily) in moderate- and high-risk patients.

5.9 Day Before Surgery — Checklist

Preoperative Checklist

- Identity, consent form and **marking of the operative site** (side).
- Investigations reviewed; blood group and cross-match if needed.
- Fasting, medications adjusted, premedication.
- Removal of dentures, jewellery, nail polish; note loose or capped teeth.
- Thromboprophylaxis and antibiotic prophylaxis planned.
- WHO Surgical Safety Checklist completed in theatre (sign-in, time-out, sign-out).

5.10 Chapter Revision Table

Table 5.6 Preoperative assessment at a glance

Point	Remember
ASA II	Mild systemic disease
ASA IV	Constant threat to life
Fasting	Food 6 h, clear fluids 2 h
Elective surgery in diabetes	HbA1c <69 mmol/mol (8.5%)
Defer elective surgery	BP $\geq$ 180/110; MI within 3 months
Warfarin before major surgery	Stop 5 days; INR <1.5
Clopidogrel	Stop 7 days if needed
Long-term steroids	Hydrocortisone cover
Consent elements	Capacity, information, voluntariness

Chapter MCQs (One Best Answer)

- Q1.** A 45-year-old woman with well-controlled hypertension on one drug is listed for excision of a parotid lump. What is her ASA grade?
- A. ASA I
 - B. ASA II
 - C. ASA III
 - D. ASA IV
 - E. ASA V
- Q2.** A patient is scheduled for elective surgery at 2 pm. Until what time may he drink clear water?
- A. 6 am
 - B. 8 am
 - C. 10 am
 - D. 12 noon
 - E. 1.30 pm
- Q3.** A man who has taken prednisolone 20 mg daily for a year is listed for thyroidectomy. What is the most important preoperative measure related to his medication?
- A. Double the oral dose for a week before surgery
 - B. Give perioperative intravenous hydrocortisone cover
 - C. No change is needed
 - D. Stop prednisolone 1 week before surgery
 - E. Switch to inhaled steroids
- Q4.** A 58-year-old man had a myocardial infarction 4 weeks ago. He needs an elective excision of a benign submandibular gland. What is the best plan?
- A. Operate after 2 days of aspirin withdrawal
 - B. Operate immediately under general anaesthesia
 - C. Operate under local anaesthesia only, this week
 - D. Postpone surgery for at least 3 months
 - E. Postpone surgery for 1 week
- Q5.** A patient on warfarin for a previous DVT is listed for an elective total thyroidectomy. When should warfarin usually be stopped?
- A. 1 day before
 - B. 2 days before
 - C. 5 days before
 - D. 14 days before
 - E. Never; continue throughout
- Q6.** Which of the following is NOT an essential element of valid informed consent?
- A. Adequate information about risks
 - B. Patient has capacity
 - C. Patient's signature witnessed by a lawyer
 - D. Discussion of alternative treatments
 - E. Voluntary decision

Q7. Before elective surgery, a patient with type 2 diabetes is found to have HbA1c of 95 mmol/mol (10.8%). What is the most appropriate action?

- A. Cancel surgery permanently
- B. Give a single dose of insulin on the morning of surgery
- C. Postpone and refer to optimise glycaemic control
- D. Proceed and start a sliding scale
- E. Stop all diabetic medication

Answer Key & Explanations

1-B 2-D 3-B 4-D 5-C 6-C 7-C

Q1 — B. ASA II describes mild systemic disease without functional limitation, such as well-controlled hypertension or diabetes. ASA III is severe systemic disease with functional limitation.

Q2 — D. Clear fluids may be taken up to 2 hours before induction of anaesthesia. Solid food and milk require 6 hours of fasting. Unnecessarily long fasting causes dehydration and hypoglycaemia.

Q3 — B. Chronic steroid use suppresses the hypothalamic-pituitary-adrenal axis. The stress of surgery may precipitate an Addisonian crisis, so perioperative IV hydrocortisone is given in addition to the usual dose. Stopping steroids abruptly is dangerous.

Q4 — D. The risk of re-infarction and cardiac death is highest in the first months after MI. Elective, non-urgent surgery should be postponed, ideally for at least 3 months, with cardiology optimisation.

Q5 — C. For major surgery warfarin is usually stopped 5 days before, with INR checked the day before (target below 1.5). High-thrombotic-risk patients receive bridging LMWH. This differs from dental extraction, where warfarin is normally continued.

Q6 — C. Valid consent requires capacity, adequate information (including risks and alternatives) and a voluntary decision. A signed form documents consent, but a lawyer's witness is not required.

Q7 — C. Elective surgery is preferably undertaken when HbA1c is below 69 mmol/mol (8.5%). Poor control increases infection, wound complications and cardiovascular events, so surgery is deferred while control is optimised.

CHAPTER 6

Postoperative Care and Complications

Learning Objectives

- Describe routine postoperative care, including pain relief and fluids.
- Classify postoperative complications by time and system.
- Approach a patient with postoperative fever.
- Recognise and manage atelectasis, DVT, pulmonary embolism, wound dehiscence, urinary retention and paralytic ileus.

6.1 Routine Postoperative Care

- **Recovery room:** airway, breathing, circulation; oxygen; monitoring until fully awake and stable.
- **Observations:** pulse, BP, respiratory rate, SpO₂, temperature, urine output, drains, wound (early-warning scores).
- **Analgesia, fluids, antiemetics, thromboprophylaxis** and early mobilisation.
- **Early oral intake** where possible; chest physiotherapy; care of drains and catheters.

Postoperative pain relief

- **Multimodal analgesia:** regular paracetamol + NSAID (if no contraindication) + opioid for breakthrough pain.
- Local anaesthetic techniques: wound infiltration, nerve blocks, epidural; patient-controlled analgesia (PCA).
- Good analgesia allows deep breathing, coughing and mobilisation, reducing chest complications and DVT.

Enhanced Recovery After Surgery (ERAS)

A bundle of evidence-based measures to speed recovery: preoperative counselling, carbohydrate loading, minimal fasting, minimally invasive surgery, avoidance of routine drains and tubes, multimodal opioid-sparing analgesia, early feeding and early mobilisation.

6.2 Classification of Postoperative Complications

Table 6.1 Postoperative complications by timing

Timing	Examples
Immediate (within 24 h)	Primary or reactionary haemorrhage, airway obstruction, hypoxia, shock, anaesthetic complications, oliguria
Early (1–30 days)	Atelectasis, pneumonia, wound infection, DVT/PE, urinary retention and UTI, paralytic ileus, anastomotic leak, wound dehiscence, secondary haemorrhage, confusion
Late (after 30 days)	Incisional hernia, hypertrophic scar/keloid, adhesions and intestinal obstruction, recurrence of disease, chronic pain

Complications may also be **general** (any operation — chest, DVT, urinary) or **specific** to the operation (e.g. recurrent laryngeal nerve palsy after thyroidectomy, facial nerve palsy after parotidectomy).

6.3 Postoperative Fever

Table 6.2 Causes of postoperative fever by day ("the 5 Ws")

Day	Cause ("W")	Example
1–2	Wind	Atelectasis, aspiration; normal inflammatory response to surgery
3–5	Water	Urinary tract infection (catheter)
3–5	Walking / veins	Thrombophlebitis at cannula site, DVT
5–7	Wound	Surgical site infection, abscess, anastomotic leak
Any time	Wonder drugs	Drug reaction, transfusion reaction

Approach: examine the chest, wound, cannula sites, calves, urine and drains; FBC, CRP, cultures (blood, urine, sputum, wound), chest X-ray; ultrasound/CT for collections; treat the cause.

6.4 Respiratory Complications

Atelectasis (lung collapse)

- **Definition:** collapse of alveoli due to retained bronchial secretions and shallow breathing — the commonest postoperative chest complication.
- **Risk factors:** upper abdominal or thoracic incisions, pain, smoking, COPD, obesity, opioids.
- **Features:** within 48 h — mild fever, tachypnoea, tachycardia, reduced breath sounds and dullness at the bases.
- **Management:** **chest physiotherapy**, deep breathing, incentive spirometry, good analgesia, early mobilisation; bronchoscopy rarely.
- **Complication:** secondary infection → pneumonia.

Aspiration pneumonitis

Inhalation of gastric contents during anaesthesia (Mendelson's syndrome), usually affecting the right lower lobe. Prevented by fasting, rapid-sequence induction and cricoid pressure. In dental and maxillofacial surgery, throat packs must always be removed at the end of the procedure.

6.5 Deep Vein Thrombosis and Pulmonary Embolism

Virchow's triad: venous **stasis**, endothelial (vessel wall) **injury** and **hypercoagulability** — all are present after surgery.

Table 6.3 DVT and PE

	Deep vein thrombosis	Pulmonary embolism
Timing	Usually 7–10 days postoperatively	Often 7–14 days; may be sudden
Clinical	Calf pain, swelling, tenderness, warmth, mild fever; often silent	Sudden dyspnoea, pleuritic chest pain, haemoptysis, tachycardia, hypoxia, collapse
Investigations	D-dimer (rule-out test), duplex ultrasound (investigation of choice)	CT pulmonary angiography ; ECG (sinus tachycardia, S1Q3T3), ABG (hypoxia, hypocapnia), echo
Treatment	Therapeutic LMWH or DOAC; warfarin for 3 months (provoked)	Oxygen, LMWH; thrombolysis if massive PE with shock
Complications	PE, post-thrombotic syndrome	Death, pulmonary hypertension

6.6 Wound Complications

Wound dehiscence (burst abdomen)

- **Definition:** partial or complete separation of the layers of a wound; in the abdomen, the viscera may protrude (evisceration).
- **Timing:** usually **day 7–10**; heralded by a **serosanguinous ("salmon-pink") discharge**.
- **Causes:** poor technique (sutures too tight, too close to the edge), infection, raised intra-abdominal pressure (cough, ileus), malnutrition, anaemia, jaundice, uraemia, steroids, diabetes.
- **Management:** reassure, cover the bowel with sterile moist packs, analgesia, IV fluids, and return to theatre for mass closure.

Scars

Table 6.4 Hypertrophic scar versus keloid

Feature	Hypertrophic scar	Keloid
Extent	Confined to the wound	Extends beyond the wound margins
Onset	Within weeks	Months later; may continue to grow
Natural history	Often regresses	Rarely regresses
Sites	Across flexures, tension lines	Ear lobe, sternum, shoulder, chin
Groups	Any	Darker skin, young adults; familial
Recurrence after excision	Uncommon	Common (high)
Treatment	Pressure, silicone gel	Intralesional steroid (triamcinolone) , pressure, silicone; excision with steroid/radiotherapy

6.7 Urinary and Renal Complications

- **Acute urinary retention:** common after hernia and anorectal surgery, spinal anaesthesia, opioids, in elderly men with prostatic enlargement. Treatment: analgesia, help to stand, then catheterisation.
- **Oliguria** (<0.5 mL/kg/h): first check the catheter is not blocked; usually due to **hypovolaemia** — fluid challenge; monitor for acute kidney injury.
- **Urinary tract infection:** related to catheters — remove early.

6.8 Gastrointestinal Complications

- **Postoperative nausea and vomiting (PONV):** opioids, anaesthetic agents; treat with ondansetron, cyclizine, dexamethasone.
- **Paralytic ileus:** temporary loss of peristalsis after abdominal surgery. Features — distension, vomiting, absent bowel sounds, no flatus. Management — nil by mouth, nasogastric decompression, IV fluids, correct **hypokalaemia**, reduce opioids. Persistent ileus suggests intra-abdominal sepsis or obstruction.
- **Anastomotic leak:** fever, tachycardia, peritonitis around day 5–7; CT; usually re-operation.

6.9 Other Complications

- **Postoperative confusion (delirium):** hypoxia, sepsis, hypoglycaemia, electrolyte imbalance, drugs, alcohol withdrawal, urinary retention — look for the cause.
- **Pressure sores:** immobile patients; prevent by turning, pressure-relieving mattresses.
- **Bedside airway emergency after neck surgery:** a tense, expanding haematoma after thyroid or neck surgery must be opened at once (see Chapter 16).

6.10 Chapter Revision Table

Table 6.5 Postoperative complications at a glance

Point	Remember
Commonest chest complication	Atelectasis — physiotherapy
Fever day 1–2	Atelectasis (wind)
Fever day 5–7	Wound infection, anastomotic leak
Virchow's triad	Stasis, vessel injury, hypercoagulability
DVT investigation of choice	Duplex ultrasound
PE investigation of choice	CT pulmonary angiography
Burst abdomen warning sign	Salmon-pink discharge, day 7–10
Keloid	Extends beyond wound; intralesional steroid
Oliguria — first check	Catheter blockage, then hypovolaemia

Chapter MCQs (One Best Answer)

Q1. On the second day after an upper abdominal operation a smoker has a temperature of 37.9°C, respiratory rate 24/min and reduced breath sounds at both lung bases. What is the most likely diagnosis?

- A. Anastomotic leak
- B. Atelectasis
- C. Deep vein thrombosis
- D. Pulmonary embolism
- E. Wound infection

Q2. On the 8th day after laparotomy, a large amount of pink serous fluid soaks the dressing of a patient's midline wound. What does this most likely indicate?

- A. Anastomotic leak
- B. Impending wound dehiscence
- C. Lymphatic leak
- D. Normal healing
- E. Superficial wound infection

Q3. A young man develops a firm scar on his ear lobe after piercing, which has grown beyond the original wound over several months. What is the first-line treatment?

- A. Excision alone
- B. Intralesional triamcinolone injection
- C. Oral antibiotics
- D. Skin graft
- E. Topical antifungal

Q4. On the 9th postoperative day a woman develops sudden breathlessness, pleuritic chest pain and tachycardia, with SpO₂ of 88%. What is the investigation of choice?

- A. Chest X-ray
- B. CT pulmonary angiography
- C. D-dimer alone
- D. ECG
- E. Sputum culture

Q5. Six hours after inguinal hernia repair under spinal anaesthesia, an elderly man has lower abdominal pain and a palpable bladder but cannot pass urine. What is the appropriate management?

- A. Furosemide
- B. Immediate re-exploration of the hernia wound
- C. Intravenous fluids bolus
- D. Restrict fluids
- E. Urethral catheterisation

Q6. Four days after bowel resection, a patient has abdominal distension, absent bowel sounds and vomiting with no flatus. Serum potassium is 2.9 mmol/L. Which is the most important correctable factor?

- A. Anaemia
- B. Hypercalcaemia
- C. Hypokalaemia
- D. Hypernatraemia
- E. Hypoglycaemia

Q7. Which of the following is NOT part of Virchow's triad?

- A. Endothelial injury
- B. Hypercoagulability
- C. Hypertension
- D. Venous stasis
- E. All of the above are part of the triad

Answer Key & Explanations

1-B 2-B 3-B 4-B 5-E 6-C 7-C

Q1 — B. Low-grade fever within 48 hours with basal signs after an upper abdominal incision in a smoker is typical of atelectasis, the commonest postoperative chest complication. It is treated with physiotherapy, analgesia and mobilisation.

Q2 — B. A serosanguinous ("salmon-pink") discharge around day 7-10 is the classical warning sign of wound dehiscence (burst abdomen). The wound should be covered with moist sterile packs and the patient returned to theatre for closure.

Q3 — B. Growth beyond the wound margins indicates a keloid. Excision alone has a high recurrence rate. Intralesional corticosteroid (triamcinolone) is first-line, with pressure and silicone; excision is combined with steroid or radiotherapy.

Q4 — B. Sudden dyspnoea, pleuritic pain, tachycardia and hypoxia after surgery suggest pulmonary embolism. CT pulmonary angiography is the investigation of choice. D-dimer is non-specific after surgery and is used only to rule out low-probability cases.

Q5 — E. This is acute urinary retention, common after groin and anorectal surgery and spinal anaesthesia. If simple measures fail, urethral catheterisation relieves the obstruction.

Q6 — C. Paralytic ileus is prolonged by hypokalaemia, which impairs smooth-muscle function. Management includes nasogastric decompression, IV fluids and correction of potassium, along with reducing opioids.

Q7 — C. Virchow's triad consists of stasis of blood flow, damage to the vessel wall and hypercoagulability. Hypertension is not a component. All three elements are present after major surgery.

PART II

The Oral Cavity and Jaws

Cleft Lip & Palate • Oral and Odontogenic Infections • Oral Mucosal and Premalignant Lesions • Oral Cancer • Cysts and Tumours of the Jaws

CHAPTER 7

Cleft Lip and Palate

Learning Objectives

- Explain the embryological basis of cleft lip and palate.
- Classify clefts and list the problems faced by the child.
- Outline the multidisciplinary management and timing of surgery.
- Describe the complications of cleft surgery and the role of the dental team.

7.1 Definition and Incidence

Cleft lip and palate is a congenital defect resulting from failure of fusion of the facial processes and palatal shelves during embryonic development. It is the **commonest congenital anomaly of the head and neck**.

- Cleft lip $\pm$ palate: about **1 in 700** live births; more common in **males** and on the **left side**.
- Isolated cleft palate: about 1 in 2000; more common in **females**; more often associated with syndromes.
- Distribution: cleft lip and palate together $\sim$ 45%, isolated cleft palate $\sim$ 35%, isolated cleft lip $\sim$ 20%.

7.2 Embryology

Table 7.1 Embryological basis

Structure	Formation	Failure leads to
Upper lip and primary palate (premaxilla, anterior to incisive foramen)	Fusion of the medial nasal process with the maxillary process (4th–7th week)	Cleft lip $\pm$ alveolus
Secondary palate (behind incisive foramen)	Fusion of the palatal shelves of the maxillary processes with each other and the nasal septum (8th–12th week)	Cleft palate

The **incisive foramen** is the dividing landmark between the primary and secondary palate.

Aetiology

- **Multifactorial**: genetic predisposition with environmental triggers.
- Family history (risk to a sibling $\sim$ 4%; higher if a parent is affected).
- Maternal factors: smoking, alcohol, **folic acid deficiency**, anticonvulsants (phenytoin, sodium valproate), steroids, retinoids, diabetes.
- Syndromes: **Pierre Robin sequence** (micrognathia, glossoptosis, U-shaped cleft palate, airway obstruction), **van der Woude syndrome** (lower lip pits), 22q11 deletion (velocardiofacial).

7.3 Classification

Table 7.2 Veau classification of clefts

Group	Description
Veau I	Cleft of the soft palate only
Veau II	Cleft of the hard and soft palate up to the incisive foramen (secondary palate)
Veau III	Unilateral complete cleft of lip, alveolus and palate
Veau IV	Bilateral complete cleft of lip, alveolus and palate

- Clefts may be **complete** (through the full thickness into the nostril) or **incomplete; unilateral** or **bilateral**.
- **Submucous cleft palate:** triad of **bifid uvula**, notch in the posterior hard palate and a translucent midline zone (zona pellucida); may present later with nasal speech.
- The **LAHSHAL** system records the Lip, Alveolus, Hard palate, Soft palate on each side.

7.4 Clinical Problems

Table 7.3 Problems of the cleft child

Area	Problem
Feeding	Cannot create negative pressure to suck; nasal regurgitation; aspiration; poor weight gain
Airway	Obstruction in Pierre Robin sequence (tongue falls back)
Speech	Hypernasality due to velopharyngeal insufficiency ; nasal escape; compensatory articulation
Hearing	Otitis media with effusion ("glue ear") — abnormal insertion of tensor and levator veli palatini impairs Eustachian tube function
Dental	Missing (lateral incisor), supernumerary and malformed teeth; crossbite; collapse of alveolar segments; malocclusion
Growth	Maxillary hypoplasia (partly due to scarring from surgery) — class III malocclusion
Appearance and psychology	Nasal deformity, scars, low self-esteem, parental anxiety

7.5 Investigations and Diagnosis

- Often diagnosed **antenatally** on the 18–20-week anomaly ultrasound scan (cleft lip; isolated palate is often missed).
- At birth: full examination including palpation of the palate (to detect a cleft palate and submucous cleft).
- Look for associated anomalies (cardiac, syndromic features); genetic assessment if indicated.
- Hearing assessment, speech assessment (nasendoscopy, videofluoroscopy) later; dental records and radiographs.

7.6 Management — the Cleft Team

Management is by a **multidisciplinary team**: cleft surgeon, specialist cleft nurse, paediatrician, anaesthetist, speech and language therapist, ENT surgeon/audiologist, **orthodontist**, paediatric and restorative dentist, psychologist and geneticist.

Immediate care

- Counsel parents; **feeding** with special squeeze bottles and teats; positioning upright.
- Airway management in Pierre Robin sequence (prone positioning, nasopharyngeal airway, rarely tongue-lip adhesion or mandibular distraction).
- **Presurgical orthopaedics** (e.g. nasoalveolar moulding) in selected wide clefts.

Table 7.4 Timing of cleft treatment

Age	Treatment
Birth onwards	Feeding support, counselling, presurgical orthopaedics
3 months	Cleft lip repair (with primary nasal correction). Classical "rule of 10s": 10 weeks, 10 lb weight, Hb 10 g/dL
6-12 months	Cleft palate repair — before speech develops
Pre-school / early school	Speech therapy; surgery for velopharyngeal insufficiency (pharyngoplasty); grommets for glue ear
8-11 years	Alveolar bone grafting (cancellous bone from iliac crest) — before eruption of the permanent canine
Adolescence	Orthodontics; orthognathic surgery (maxillary advancement) after growth; secondary rhinoplasty and lip revision

Surgical techniques

- **Lip: Millard rotation-advancement** repair (commonest), Tennison-Randall triangular flap; repair of the orbicularis oris muscle is essential.
- **Palate: von Langenbeck** (bipedicled mucoperiosteal flaps), **Veau-Wardill-Kilner** V-Y pushback, **Furlow** double-opposing Z-plasty; **intravelar veloplasty** to reconstruct the levator sling.

7.7 Complications of Cleft Surgery

Table 7.5 Complications

Early	Late
Airway obstruction (tongue swelling, after palate repair)	Oronasal fistula
Haemorrhage	Velopharyngeal insufficiency — hypernasal speech
Infection, wound dehiscence	Maxillary hypoplasia and malocclusion
Feeding difficulty	Lip and nasal deformity, scarring; hearing loss

★ EXAM PEARLS

- Lip repair at ~3 months; palate repair at 6-12 months (before speech); alveolar bone graft at **8-11 years** (before canine eruption).
- **Bifid uvula** should raise suspicion of a submucous cleft palate — avoid adenoidectomy, which can unmask velopharyngeal insufficiency.
- The commonest missing tooth in cleft patients is the **maxillary lateral incisor** on the cleft side.

7.8 Chapter Revision Table

Table 7.6 Cleft lip and palate at a glance

Point	Remember
Cleft lip embryology	Failure of medial nasal + maxillary process fusion
Landmark for primary/secondary palate	Incisive foramen
CL ± P	Commoner in males, left side
Isolated cleft palate	Commoner in females, syndromic
Pierre Robin sequence	Micrognathia, glossoptosis, cleft palate, airway obstruction
Lip repair	~3 months — Millard
Palate repair	6–12 months
Alveolar bone graft	8–11 years, iliac crest
Ear problem	Otitis media with effusion

Chapter MCQs (One Best Answer)

Q1. A newborn has a complete unilateral cleft of the lip, alveolus and palate. Failure of fusion of which embryological structures produced the lip component of this deformity?

- A. Lateral nasal process and maxillary process
- B. Mandibular processes
- C. Medial nasal process and maxillary process
- D. Palatal shelves with each other
- E. Palatal shelves with the nasal septum

Q2. At what age is primary repair of a cleft palate usually performed?

- A. At birth
- B. 3 weeks
- C. 6–12 months
- D. 5 years
- E. 9–11 years

Q3. A 9-year-old with a repaired unilateral cleft lip and palate has a residual alveolar cleft. The permanent canine is about to erupt. Which procedure is indicated now?

- A. Alveolar bone grafting
- B. Furlow palatoplasty
- C. Le Fort I maxillary advancement
- D. Millard lip revision
- E. Pharyngoplasty

Q4. A 4-year-old with a repaired cleft palate has hypernasal speech with nasal escape of air. What is the underlying problem?

- A. Adenoid hypertrophy
- B. Hearing loss alone
- C. Macroglossia
- D. Tongue-tie
- E. Velopharyngeal insufficiency

Q5. A newborn has a small mandible, a tongue that falls backwards, a U-shaped cleft palate and episodes of noisy breathing and cyanosis. What is the most likely diagnosis?

- A. Down syndrome
- B. Pierre Robin sequence
- C. Treacher Collins syndrome
- D. van der Woude syndrome
- E. 22q11 deletion syndrome

Q6. A child with a cleft palate has recurrent hearing loss. What is the most likely cause?

- A. Cholesteatoma
- B. Ossicular malformation
- C. Otitis media with effusion
- D. Sensorineural deafness
- E. Wax impaction

Q7. Which of the following is a recognised maternal risk factor for cleft lip and palate?

- A. Folic acid supplementation
- B. Maternal hypothyroidism treated with thyroxine
- C. Phenytoin therapy
- D. Regular antenatal care
- E. Vitamin D supplementation

Answer Key & Explanations

1-C 2-C 3-A 4-E 5-B 6-C 7-C

Q1 — C. The upper lip and primary palate form by fusion of the medial nasal process with the maxillary process during weeks 4-7. Failure produces cleft lip and alveolus. The secondary palate forms from fusion of the palatal shelves.

Q2 — C. Palate repair is done between 6 and 12 months of age, before the child develops speech, to allow normal velopharyngeal function. Lip repair is earlier (around 3 months), and alveolar bone grafting is done at 8-11 years.

Q3 — A. Secondary alveolar bone grafting with cancellous iliac crest bone at 8-11 years, before canine eruption, stabilises the maxillary arch, closes oronasal fistulae and allows the canine to erupt through bone.

Q4 — E. Velopharyngeal insufficiency occurs when the soft palate cannot close against the posterior pharyngeal wall, allowing air into the nose during speech. It is assessed by nasendoscopy and videofluoroscopy and treated by speech therapy or pharyngoplasty.

Q5 — B. Pierre Robin sequence comprises micrognathia, glossoptosis and cleft palate, causing airway obstruction and feeding difficulty. Initial management includes prone positioning and a nasopharyngeal airway.

Q6 — C. Abnormal insertion of the tensor and levator veli palatini muscles impairs opening of the Eustachian tube, causing otitis media with effusion (glue ear). Many children need ventilation tubes (grommets).

Q7 — C. Anticonvulsants such as phenytoin and valproate, maternal smoking, alcohol, retinoids and folic acid deficiency increase the risk. Folic acid supplementation may reduce the risk.

CHAPTER 8

Oral and Odontogenic Infections

Learning Objectives

- Describe the spread of odontogenic infection into the fascial spaces of the face and neck.
- Recognise and manage Ludwig's angina and other deep neck space infections, with priority to the airway.
- Outline osteomyelitis, osteoradionecrosis and medication-related osteonecrosis of the jaws.
- List the life-threatening complications of facial infections.

8.1 Odontogenic Infection — Basic Principles

- Most facial and deep neck infections in adults arise from **infected teeth** (periapical abscess, pericoronitis of the lower third molar).
- Organisms are **mixed aerobic and anaerobic** oral flora: viridans streptococci, *Prevotella*, *Fusobacterium*, *Peptostreptococcus*.
- Pus follows the path of least resistance through bone, then into the soft tissues according to **muscle attachments** (buccinator, mylohyoid).

Table 8.1 Spread of infection from mandibular teeth

Relation of root apex to mylohyoid line	Teeth	Space involved
Above the mylohyoid attachment	Incisors, canines, premolars, first molar	Sublingual space
Below the mylohyoid attachment	Second and third molars	Submandibular space
Mandibular incisors (apex below mentalis)	Lower incisors	Submental space

Principles of management

- **Airway assessment first** — trismus, dysphagia, drooling, voice change, stridor.
- Remove the cause (extraction or root canal treatment) and **drain pus**.
- Antibiotics: **amoxicillin/co-amoxiclav** or benzylpenicillin + **metronidazole**; clindamycin if allergic to penicillin.
- Hydration, analgesia, control of diabetes.

8.2 Ludwig's Angina

Definition: a rapidly spreading, bilateral cellulitis (not an abscess in early stages) of the **submandibular, sublingual and submental spaces**, which displaces the tongue upward and backward and threatens the airway.

- **Cause:** in about 80–90% of cases, infection of the **lower second or third molar**; also floor-of-mouth trauma, sialadenitis.
- **Predisposing:** diabetes, immunosuppression, poor dental hygiene, alcohol.

Clinical features

- Painful, **board-like ("brawny") induration** of the submandibular region and floor of mouth, bilaterally; usually **no fluctuation**.
- **Tongue elevated and protruded**; floor of mouth raised; **drooling**, dysphagia, odynophagia, "hot-potato" voice.
- **Trismus**, fever, toxæmia; **stridor** and difficulty breathing are late, ominous signs.

Investigations

- Diagnosis is clinical. Do **not** send a patient with airway compromise for imaging unaccompanied.
- FBC, CRP, glucose, urea and electrolytes, blood culture.
- **Contrast-enhanced CT** of the neck (in a stable patient) to show the extent and any collection; OPG for the dental source.

Management

- **1. Secure the airway** — the priority. Senior anaesthetist and surgeon; **awake fiberoptic intubation** or **tracheostomy under local anaesthesia**; be prepared for emergency cricothyroidotomy.
- **2. IV antibiotics:** high-dose co-amoxiclav or benzylpenicillin + metronidazole ($\pm$ clindamycin).
- **3. Surgical decompression and drainage** of the involved spaces through submandibular and submental incisions, with drains; **extraction of the causative tooth**.
- **4. Supportive:** IV fluids, analgesia, control of diabetes; IV dexamethasone may reduce oedema.

Complications

- **Airway obstruction and asphyxia** (main cause of death).
- Spread to parapharyngeal and retropharyngeal spaces → **mediastinitis**.
- Necrotising fasciitis of the neck, septicaemia, aspiration pneumonia, jugular vein thrombosis.

★ EXAM PEARLS

- Ludwig's angina: **bilateral**, three spaces (submandibular, sublingual, submental), **brawny induration, elevated tongue, airway first**.
- Commonest source: **lower second and third molars**, whose roots lie below the mylohyoid line.

8.3 Other Deep Neck Space Infections

Table 8.2 Deep neck infections

Infection	Source	Key features	Treatment
Peritonsillar abscess (quinsy)	Tonsillitis	Trismus, "hot-potato" voice, uvula deviated to the opposite side	Aspiration or incision, antibiotics
Parapharyngeal abscess	Teeth, tonsils, parotid	Swelling behind the angle of the jaw, trismus, medial bulging of tonsil and lateral pharyngeal wall	External drainage, antibiotics
Retropharyngeal abscess	Children: suppurative lymph nodes; adults: trauma, TB (cold abscess)	Neck stiffness, dysphagia, stridor; widened prevertebral soft tissue on lateral X-ray	Intraoral or external drainage; airway care
Masticator / buccal space	Molars	Severe trismus (masticator), cheek swelling (buccal)	Drainage, extraction

Cavernous sinus thrombosis

Infection of the upper lip, nose (the "danger area" of the face) or maxillary teeth can spread through the valveless **facial and ophthalmic veins** (or pterygoid plexus) to the cavernous sinus. Features: fever, **proptosis**, **chemosis**, periorbital oedema, ophthalmoplegia (CN III, IV, VI), loss of corneal sensation (V1) — initially on one side, then both. Treatment: high-dose IV antibiotics, drainage of the source, anticoagulation in selected cases.

8.4 Osteomyelitis of the Jaws

Definition: inflammation of the bone and marrow, usually due to bacterial infection. The **mandible** is affected far more often than the maxilla because of its dense cortex and poorer blood supply (inferior alveolar artery).

- **Causes:** dental infection, extraction, fractures; predisposed by diabetes, malnutrition, immunosuppression, irradiation, bone diseases (Paget's, osteopetrosis).
- **Clinical features:** deep pain, fever, swelling, loosening of teeth, pus discharge, sinuses, **paraesthesia of the lower lip** (Vincent's sign — inferior alveolar nerve involvement).
- **Investigations:** OPG — "moth-eaten" radiolucency, **sequestrum** (dense dead bone) and **involucrum** (new bone) in chronic cases; CT; pus and bone culture; biopsy to exclude malignancy.
- **Management:** long course of antibiotics guided by culture; drainage; removal of the source; **sequestrectomy**, saucerisation or decortication; resection and reconstruction in extensive disease.

8.5 Osteoradionecrosis and MRONJ

Table 8.3 Non-healing exposed jaw bone

Feature	Osteoradionecrosis (ORN)	Medication-related osteonecrosis (MRONJ)
Cause	Radiotherapy (usually >60 Gy) → hypovascular, hypocellular, hypoxic bone	Bisphosphonates (especially IV zoledronic acid), denosumab , anti-angiogenic drugs
Trigger	Dental extraction after radiotherapy	Dental extraction, trauma
Site	Mandible > maxilla	Mandible > maxilla
Definition	Irradiated bone exposed and not healing for ≥3 months, without tumour	Exposed bone for >8 weeks in a patient on these drugs, no jaw radiation
Prevention	Dental assessment and extractions before radiotherapy (ideally 10–14 days before); fluoride; oral hygiene	Complete dental treatment before starting the drug; avoid extractions during therapy if possible
Treatment	Conservative (antiseptic rinses, antibiotics, pentoxifylline-tocopherol), sequestrectomy, resection with free flap	Chlorhexidine, antibiotics, conservative debridement; resection for advanced cases

8.6 Chapter Revision Table

Table 8.4 Oral infections at a glance

Point	Remember
Ludwig's angina spaces	Bilateral submandibular, sublingual, submental
Commonest source	Lower 2nd/3rd molar
First priority	Airway (awake fiberoptic intubation / tracheostomy)
Antibiotics for odontogenic infection	Penicillin/co-amoxiclav + metronidazole
Quinsy	Uvula deviated to opposite side
Dangerous area of face	Upper lip and nose → cavernous sinus thrombosis
Vincent's sign	Lower lip numbness in mandibular osteomyelitis
ORN prevention	Dental clearance before radiotherapy
MRONJ drugs	Bisphosphonates, denosumab

Chapter MCQs (One Best Answer)

- Q1.** A 40-year-old diabetic man has a painful lower third molar for a week. He now has bilateral firm swelling under the jaw, an elevated tongue, drooling and a muffled voice. His respiratory rate is 28/min. What is the first priority?
- A. CT scan of the neck
 - B. Extraction of the tooth in the dental chair
 - C. Intravenous antibiotics and review in 24 hours
 - D. Securing the airway
 - E. Ultrasound-guided aspiration
- Q2.** Infection from the root apex of the mandibular second molar most commonly spreads into which space?
- A. Buccal
 - B. Canine
 - C. Sublingual
 - D. Submandibular
 - E. Submental
- Q3.** A man squeezes a boil on his upper lip. Three days later he has fever, swelling of both eyelids, proptosis and inability to move the right eye. Which route of spread is most likely?
- A. Lymphatics to submandibular nodes
 - B. Parotid duct
 - C. Through the facial and ophthalmic veins
 - D. Through the maxillary sinus
 - E. Via the inferior alveolar canal
- Q4.** A patient with chronic osteomyelitis of the mandible complains of numbness of the lower lip. What is this sign called?
- A. Battle's sign
 - B. Chvostek's sign
 - C. Trousseau's sign
 - D. Vincent's sign
 - E. Tinel's sign
- Q5.** A patient who received 66 Gy of radiotherapy to the oral cavity two years ago has exposed necrotic mandibular bone after an extraction that has not healed for 4 months. What is the best preventive measure that could have avoided this?
- A. Antibiotic prophylaxis after radiotherapy only
 - B. Bisphosphonate therapy
 - C. Dental assessment and necessary extractions before radiotherapy
 - D. Extraction immediately after radiotherapy
 - E. Using chlorhexidine for one week
- Q6.** A 70-year-old woman receiving intravenous zoledronic acid for bone metastases needs a lower molar extracted. What complication is she at particular risk of?
- A. Alveolar osteitis only
 - B. Cavernous sinus thrombosis
 - C. Ludwig's angina
 - D. Medication-related osteonecrosis of the jaw
 - E. Osteoradionecrosis

Q7. A young adult has severe sore throat, trismus, a muffled voice and the uvula pushed to the left. What is the most likely diagnosis?

- A. Acute epiglottitis
- B. Left peritonsillar abscess
- C. Ludwig's angina
- D. Retropharyngeal abscess
- E. Right peritonsillar abscess

Answer Key & Explanations

1-D 2-D 3-C 4-D 5-C 6-D 7-E

Q1 — D. This is Ludwig's angina with impending airway obstruction. The first priority is a secure airway, by awake fiberoptic intubation or tracheostomy under local anaesthesia, followed by IV antibiotics, surgical decompression and removal of the tooth.

Q2 — D. The roots of the second and third molars lie below the mylohyoid line, so pus that perforates the lingual cortex enters the submandibular space. Infection from anterior teeth, with roots above the mylohyoid, enters the sublingual space.

Q3 — C. The upper lip and nose drain via the facial vein and valveless ophthalmic veins (and pterygoid plexus) to the cavernous sinus. Cavernous sinus thrombosis causes proptosis, chemosis and ophthalmoplegia, and is life-threatening.

Q4 — D. Vincent's sign is paraesthesia or anaesthesia of the lower lip due to involvement of the inferior alveolar nerve by an inflammatory or neoplastic process in the mandible, such as osteomyelitis.

Q5 — C. This is osteoradionecrosis. Irradiated bone is hypovascular and hypoxic, so post-radiation extractions heal poorly. The key prevention is a thorough dental assessment with extraction of teeth of poor prognosis 10–14 days before radiotherapy, and lifelong oral care.

Q6 — D. IV bisphosphonates and denosumab reduce bone turnover and can cause medication-related osteonecrosis of the jaw after extraction, defined as exposed bone for more than 8 weeks without prior jaw irradiation.

Q7 — E. A peritonsillar abscess (quinsy) pushes the soft palate and uvula towards the opposite side. Deviation to the left therefore indicates a right-sided quinsy, treated by needle aspiration or incision and antibiotics.

CHAPTER 9

Oral Mucosal and Premalignant Lesions

Learning Objectives

- Define oral potentially malignant disorders and list them in order of risk.
- Describe leukoplakia, erythroplakia, oral submucous fibrosis and lichen planus.
- Approach a patient with an oral ulcer, and know when to biopsy.
- Understand the role of tobacco, areca nut and alcohol in oral disease in our population.

9.1 Oral Potentially Malignant Disorders (OPMD)

The WHO uses the term **oral potentially malignant disorders** for clinical presentations that carry a risk of developing into oral cancer. The key microscopic predictor of risk is **epithelial dysplasia** (mild, moderate, severe/carcinoma in situ).

Table 9.1 Oral potentially malignant disorders

Disorder	Relative risk of malignant change
Erythroplakia	Highest — most show dysplasia or carcinoma at biopsy
Proliferative verrucous leukoplakia	Very high (often multifocal, elderly women)
Non-homogeneous (speckled) leukoplakia	High
Oral submucous fibrosis	Significant — important in South Asia
Homogeneous leukoplakia	Low to moderate
Oral lichen planus (erosive)	Low
Others	Actinic cheilitis (lower lip), chronic hyperplastic candidiasis, palatal lesions of reverse smoking

9.2 Leukoplakia

Definition (WHO): a predominantly **white plaque** of questionable risk, having excluded other known diseases or disorders that carry no increased risk of cancer. It is a **clinical** term, not a histological diagnosis.

- **Aetiology: tobacco** (smoked and smokeless — naswar, gutka), areca nut, alcohol, chronic friction, candida; many are idiopathic.
- **Types: homogeneous** (flat, uniformly white, thin, fissured) and **non-homogeneous** (speckled red-and-white, nodular, verrucous) — non-homogeneous lesions carry a higher risk.
- **High-risk features:** non-homogeneous appearance, **floor of mouth and ventrolateral tongue** site, size >2 cm, female sex, idiopathic (non-smoker) lesion, dysplasia on biopsy.
- **Differential diagnosis:** frictional keratosis, lichen planus, candidiasis (wipes off), white sponge naevus, hairy leukoplakia (EBV, lateral tongue, HIV).

Investigations

- Remove suspected irritants and review in 2–4 weeks.
- **Incisional biopsy** of the most suspicious (red, nodular) area to grade dysplasia.
- Adjuncts: toluidine blue staining, autofluorescence and brush cytology — they guide but do not replace biopsy.

Management

- **Stop tobacco, areca nut and alcohol** — the most important measure.
- Treat candida; smooth sharp teeth and ill-fitting dentures.

- **Excision** (surgical or CO₂ laser) of lesions with moderate/severe dysplasia or high-risk features.
- **Long-term surveillance** of all patients — recurrence and new lesions are common, and cancer may arise even after excision.

9.3 Erythroplakia

- **Definition:** a fiery **red patch** that cannot be characterised clinically or pathologically as any other definable disease.
- Velvety, well-demarcated; floor of mouth, soft palate, ventral tongue.
- Carries the **highest risk** of all OPMDs — most show severe dysplasia, carcinoma in situ or invasive carcinoma.
- **Management:** always **biopsy**; complete excision; close follow-up.

9.4 Oral Submucous Fibrosis (OSMF)

Definition: a chronic, insidious, progressive disease in which the oral mucosa becomes stiff due to **juxta-epithelial fibrosis** of the lamina propria and submucosa, leading to **progressive restriction of mouth opening**.

- **Cause:** chewing **areca nut (supari)** — in paan, gutka and mainpuri. The alkaloid arecoline stimulates fibroblasts, and tannins and flavonoids inhibit collagen breakdown. Chilli and nutritional deficiencies may contribute.
- **Population:** South Asians — common in Pakistan, India and among migrants; increasingly in young people using gutka.

Clinical features

- Early: **burning sensation** with spicy food, vesicles, ulceration, dry mouth.
- Later: **blanching** (marble-like pallor) of mucosa, **palpable vertical fibrous bands** in the buccal mucosa and soft palate, shrunken uvula, depapillated tongue with reduced movement.
- **Progressive trismus** → difficulty eating, speaking and maintaining oral hygiene; hearing problems (Eustachian tube); dysphagia if pharynx involved.
- Malignant transformation to squamous cell carcinoma in a significant minority of patients.

Investigations

- Clinical diagnosis; measure **inter-incisal mouth opening** to grade and follow up.
- Biopsy of any ulcerated, red or nodular area to exclude dysplasia and carcinoma.
- FBC (anaemia, iron and B12 deficiency).

Management

- **Stop areca nut** — essential; counselling.
- Nutritional support: iron, vitamins, antioxidants (lycopene).
- **Intralesional injections** of steroids (dexamethasone/triamcinolone) with or without hyaluronidase; pentoxifylline.
- **Physiotherapy:** mouth-opening exercises, ice-cream stick / Therabite devices.
- **Surgery** for severe trismus: release of fibrous bands, coronoidotomy, reconstruction with nasolabial or buccal fat pad flaps, or free flaps.
- Lifelong **surveillance** for malignant change.

★ EXAM PEARLS

- OSMF = **areca nut + blanching + fibrous bands + progressive trismus**. It is irreversible but its progression can be halted by stopping the habit.

9.5 Oral Lichen Planus

- **Definition:** chronic T-cell-mediated inflammatory disease of skin and mucosa; middle-aged women.
- **Types:** **reticular** (white lace-like **Wickham's striae**, bilateral buccal mucosa, asymptomatic), plaque, atrophic, **erosive** (painful).
- Skin: purple, polygonal, pruritic papules on flexor wrists. Lichenoid reactions follow amalgam contact or drugs (NSAIDs, antihypertensives).
- **Investigations:** biopsy for atypical or erosive lesions.
- **Management:** reassurance, avoid irritants; topical steroids (betamethasone mouthwash, clobetasol) for symptomatic disease; long-term review because erosive lesions carry a small risk of malignant change.

9.6 Oral Ulcers

Table 9.2 Causes of oral ulcers

Cause	Key features
Traumatic	Related to sharp tooth, denture or bite; heals within 2 weeks of removing cause
Recurrent aphthous stomatitis	Small, painful, round, yellow-grey base with red halo, recurrent; non-keratinised mucosa; heals in 1–2 weeks
Infective	Herpes simplex (vesicles), TB (undermined edge, tongue), syphilis (chancre, snail-track ulcers, gumma)
Systemic	Behçet's, Crohn's, coeliac disease, haematinic deficiency, neutropenia
Malignant	Squamous cell carcinoma — non-healing , indurated, everted (rolled) edges , bleeds; may be painless initially

The Golden Rule

- **Any oral ulcer that does not heal within 3 weeks** after removing obvious causes must be **biopsied** to exclude malignancy.
- Refer urgently any red or red-and-white patch, or unexplained lump, especially in a tobacco or areca nut user.

9.7 Chapter Revision Table

Table 9.3 Mucosal lesions at a glance

Lesion	Remember
Leukoplakia	White plaque, diagnosis of exclusion; biopsy, stop tobacco
Erythroplakia	Red patch — highest malignant potential
High-risk sites	Floor of mouth, ventrolateral tongue
OSMF	Areca nut, fibrous bands, trismus
Lichen planus	Wickham's striae, bilateral buccal mucosa
Candidal plaque	Wipes off (pseudomembranous)
Hairy leukoplakia	EBV, lateral tongue, HIV
Ulcer >3 weeks	Biopsy

Chapter MCQs (One Best Answer)

- Q1.** A 28-year-old man who has chewed gutka daily for 10 years complains of a burning sensation with spicy food and progressive difficulty opening his mouth. The buccal mucosa is pale with palpable vertical bands. What is the most likely diagnosis?
- A. Erythroplakia
 - B. Lichen planus
 - C. Oral submucous fibrosis
 - D. Scleroderma
 - E. Tetanus
- Q2.** Which of the following oral lesions carries the highest risk of malignant transformation?
- A. Erythroplakia
 - B. Frictional keratosis
 - C. Homogeneous leukoplakia
 - D. Recurrent aphthous ulcer
 - E. Reticular lichen planus
- Q3.** A 55-year-old smoker has a 2.5 cm speckled red-and-white patch on the floor of the mouth. What is the most appropriate next step?
- A. Apply topical steroid and review in 6 months
 - B. Incisional biopsy of the red area
 - C. Reassure, as it is likely frictional
 - D. Start antifungal and discharge
 - E. Toluidine blue staining alone
- Q4.** A 50-year-old woman has asymptomatic bilateral white lace-like striae on the buccal mucosa and itchy purple papules on her wrists. What is the most likely diagnosis?
- A. Candidiasis
 - B. Homogeneous leukoplakia
 - C. Lichen planus
 - D. Oral submucous fibrosis
 - E. White sponge naevus
- Q5.** A patient has a painless ulcer on the lateral border of the tongue for 6 weeks. It has a firm base and rolled edges and did not heal after smoothing a sharp tooth. What should be done next?
- A. Biopsy of the ulcer
 - B. Chlorhexidine mouthwash for 2 more weeks
 - C. Course of antiviral drugs
 - D. Reassurance
 - E. Topical steroid
- Q6.** What is the single most important measure in the management of oral leukoplakia and oral submucous fibrosis?
- A. Antifungal therapy
 - B. Cessation of tobacco and areca nut use
 - C. Laser excision of all lesions
 - D. Radiotherapy
 - E. Vitamin A supplements

Q7. An HIV-positive man has painless, corrugated white lesions on both lateral borders of the tongue that cannot be wiped off. Which organism is associated?

- A. *Candida albicans*
- B. Cytomegalovirus
- C. Epstein-Barr virus
- D. Herpes simplex virus
- E. Human papillomavirus

Answer Key & Explanations

1-C 2-A 3-B 4-C 5-A 6-B 7-C

Q1 — C. Burning sensation, blanched mucosa, palpable fibrous bands and progressive trismus in an areca nut (gutka) user are characteristic of oral submucous fibrosis, a potentially malignant disorder common in South Asia.

Q2 — A. Erythroplakia has the highest malignant potential; most lesions show severe dysplasia, carcinoma in situ or invasive carcinoma at biopsy. It must always be biopsied and excised.

Q3 — B. A speckled (non-homogeneous) leukoplakia on the floor of the mouth larger than 2 cm in a smoker has several high-risk features. An incisional biopsy of the most suspicious red area is needed to grade dysplasia or detect carcinoma. Adjuncts do not replace biopsy.

Q4 — C. Bilateral reticular white striae (Wickham's striae) on the buccal mucosa with pruritic, purple, polygonal papules on the flexor wrists are typical of lichen planus.

Q5 — A. Any ulcer persisting beyond 3 weeks after removal of local causes, especially if indurated with everted edges, must be biopsied to exclude squamous cell carcinoma.

Q6 — B. Stopping tobacco, areca nut and alcohol is the most important measure; some lesions regress, and the risk of progression and cancer falls. Excision is used for dysplastic or high-risk lesions, with long-term surveillance.

Q7 — C. Oral hairy leukoplakia is caused by Epstein-Barr virus, appears on the lateral tongue, cannot be wiped off and is associated with immunosuppression, particularly HIV. It is not considered premalignant.

CHAPTER 10

Oral Cancer

Learning Objectives

- List the risk factors for oral squamous cell carcinoma, especially those common in Pakistan.
- Describe the clinical presentation and spread of oral cancer.
- Plan investigations and stage the disease (TNM).
- Outline surgical, reconstructive and radiotherapy management, and the dentist's role before and after treatment.

10.1 Definition and Epidemiology

- More than **90%** of oral cancers are **squamous cell carcinomas (SCC)** arising from the mucosal epithelium. Others: minor salivary gland tumours, melanoma, lymphoma, sarcoma, metastases.
- Oral cancer is among the **commonest cancers in Pakistan** and South Asia, due to widespread use of smokeless tobacco and areca nut.
- In the West the commonest site is the **lateral border of the tongue** and floor of the mouth; in South Asia the **buccal mucosa** and gingivobuccal sulcus are most often affected (where the quid is kept).
- Most patients are over 40 years old, with a male predominance, though younger patients are increasingly seen.

10.2 Aetiology and Risk Factors

Table 10.1 Risk factors for oral cancer

Category	Examples
Tobacco	Smoking (cigarettes, bidi, huqqa), smokeless tobacco (naswar, gutka, chewing tobacco), reverse smoking
Areca nut	Paan, supari, gutka, mainpuri — also causes OSMF
Alcohol	Synergistic with tobacco
Infection	HPV-16 (mainly oropharynx — tonsil and base of tongue), syphilis, chronic candidiasis
Potentially malignant disorders	Leukoplakia, erythroplakia, OSMF, lichen planus
Others	Chronic trauma from sharp teeth and dentures (co-factor), poor oral hygiene, diet low in fruit and vegetables, immunosuppression, Plummer-Vinson syndrome, sunlight (lower lip)

10.3 Clinical Features

- **Non-healing ulcer** with **raised, everted (rolled) edges**, indurated base, that bleeds on touch; or an exophytic growth, or a red/white patch.
- Pain (often late); **referred otalgia** (via lingual nerve and auriculotemporal branch of V3).
- Loosening of teeth, non-healing extraction socket, ill-fitting denture; difficulty with speech and swallowing; reduced tongue mobility (ankyloglossia).
- **Trismus** — infiltration of the pterygoid muscles (posterior extension).
- Numbness of the lower lip — inferior alveolar nerve involvement.
- **Neck swelling** — hard, painless, later fixed lymph nodes (level I–III most often).
- Late: fungation, orocutaneous fistula, weight loss, cachexia, aspiration, haemorrhage.

Spread

- **Local:** to adjacent mucosa, muscle, bone (mandible via the occlusal surface in edentulous jaws, or periosteum), nerves (perineural).
- **Lymphatic** (main route): submandibular and upper deep cervical (jugulodigastric) nodes. Tongue tip drains to submental nodes; lesions near the midline drain **bilaterally**. Tongue cancer may "skip" to level IV.
- **Blood-borne** (late): lungs, liver, bones.
- **Field cancerisation:** risk of synchronous or metachronous second primary tumours in the upper aerodigestive tract.

10.4 Investigations

Table 10.2 Investigation of suspected oral cancer

Purpose	Investigation
Tissue diagnosis	Incisional (punch/wedge) biopsy from the edge of the lesion
Neck nodes	Ultrasound ± FNAC of nodes
Local extent and nodes	CT (bone involvement) and/or MRI (soft tissue, tongue depth of invasion)
Mandible	OPG, CT
Distant metastasis	CT chest; PET-CT for advanced disease or unknown primary
Second primary	Examination under anaesthesia and panendoscopy in selected patients
Fitness	FBC, LFT, renal function, ECG, nutritional assessment, dental assessment

10.5 TNM Staging (Oral Cavity, AJCC/UICC 8th Edition — Simplified)

Table 10.3 T stage

T	Description
T1	≤2 cm and depth of invasion (DOI) ≤5 mm
T2	≤2 cm with DOI >5 mm, or 2–4 cm with DOI ≤10 mm
T3	>4 cm, or DOI >10 mm
T4a	Moderately advanced: invades through cortical bone of mandible or maxilla, maxillary sinus, or skin of the face
T4b	Very advanced: masticator space, pterygoid plates, skull base, or encases the internal carotid artery

Table 10.4 Clinical N stage (simplified)

N	Description
N0	No regional node metastasis
N1	Single ipsilateral node ≤3 cm, no extranodal extension (ENE)
N2a / N2b / N2c	Single ipsilateral 3–6 cm / multiple ipsilateral ≤6 cm / bilateral or contralateral ≤6 cm (all ENE negative)
N3a / N3b	Node >6 cm / any node with clinical extranodal extension

★ EXAM PEARLS

- **Depth of invasion** (DOI) is now part of the T stage because it predicts nodal spread. A DOI greater than about 3–4 mm is an indication for **elective neck dissection** in the clinically N0 neck.
- Superficial erosion of bone or tooth socket alone by a gingival primary does **not** make a tumour T4.

10.6 Management

Treatment is planned in a **multidisciplinary tumour board**. For oral cavity SCC, **surgery is the primary treatment**, with postoperative radiotherapy or chemoradiotherapy when indicated.

Surgery of the primary

- **Wide local excision** with about **1 cm clinical margin** (aim for ≥ 5 mm clear histological margin).
- Tongue: partial glossectomy, hemiglossectomy, total glossectomy.
- Mandible: **marginal (rim) mandibulectomy** when the tumour abuts but does not invade bone; **segmental mandibulectomy** when there is gross bone invasion.
- Maxilla: partial or total maxillectomy with obturator or flap reconstruction.

Management of the neck

- **Clinically positive nodes (N+)**: therapeutic **neck dissection** (modified radical or comprehensive).
- **Clinically N0 neck: elective selective neck dissection** (levels I-III, supra-omohyoid; I-IV for tongue) when the risk of occult metastasis is significant (DOI $>3-4$ mm, T2 or above); sentinel node biopsy in selected centres.
- See Chapter 14 for neck dissection.

Reconstruction

Table 10.5 Reconstructive options

Defect	Options
Small mucosal	Primary closure, split-skin graft, healing by secondary intention
Moderate soft tissue	Local flaps (nasolabial, buccal fat pad, facial artery musculomucosal)
Large soft tissue (tongue, floor of mouth)	Radial forearm free flap , anterolateral thigh flap; pectoralis major myocutaneous flap (pedicled, where free flaps not possible)
Mandible (segmental)	Fibula free flap (bone + skin), iliac crest (DCIA), scapula; reconstruction plate

Radiotherapy and chemotherapy

- **Postoperative (adjuvant) radiotherapy** for T3-T4 tumours, positive nodes, close margins, perineural or lymphovascular invasion.
- **Chemoradiotherapy** (with cisplatin) for **positive margins** or **extranodal extension**.
- Primary radiotherapy/chemoradiotherapy for unresectable disease, unfit patients and many oropharyngeal cancers; palliative treatment for advanced disease.

Lip cancer

- Usually SCC of the **lower lip** (sun exposure, pipe smoking); basal cell carcinoma more often on the upper lip skin.
- Lymph spread is late; **prognosis is good**.
- Treatment: **V or W (wedge) excision** with primary closure for defects up to one-third of the lip; larger defects need flaps (Abbe, Estlander, Karapandzic); vermilionectomy for actinic cheilitis.

10.7 Complications

Table 10.6 Complications of treatment

Treatment	Complications
Surgery	Haemorrhage, airway obstruction (temporary tracheostomy often used), infection, flap failure, orocutaneous fistula, speech and swallowing problems, facial deformity, nerve injury (marginal mandibular, lingual, hypoglossal, accessory)
Radiotherapy	Mucositis, xerostomia , loss of taste, radiation caries , candidiasis, trismus , osteoradionecrosis , skin fibrosis, hypothyroidism
Disease	Recurrence (mostly within 2 years), second primary tumour, distant metastasis

Role of the Dentist

- **Early detection:** examine the whole mouth of every patient; biopsy/refer non-healing ulcers and red/white patches.
- **Before radiotherapy:** full dental assessment, extraction of teeth with poor prognosis 10–14 days before treatment, scaling, fluoride trays.
- **After treatment:** lifelong fluoride, oral hygiene, management of xerostomia and trismus, careful extractions (ORN risk), prostheses and obturators.
- **Prevention:** counselling against tobacco, areca nut and alcohol.

★ EXAM PEARLS

- Five-year survival is about **80% for stage I** but falls to about **30–40% for stage IV** — early detection by dentists saves lives.
- The single most important prognostic factor in oral SCC is the presence of **cervical lymph node metastasis** (especially with extranodal extension).

10.8 Chapter Revision Table

Table 10.7 Oral cancer at a glance

Point	Remember
Commonest histology	Squamous cell carcinoma (>90%)
Commonest site in South Asia	Buccal mucosa / gingivobuccal sulcus
Commonest site in the West	Lateral border of tongue
Referred pain	Ear (otalgia)
Diagnosis	Incisional biopsy
Primary treatment	Surgery ± postoperative (chemo)radiotherapy
Margin	~1 cm clinical
Mandible reconstruction	Fibula free flap
Chemoradiotherapy indications	Positive margins, extranodal extension
Most important prognostic factor	Nodal metastasis

Chapter MCQs (One Best Answer)

- Q1.** A 52-year-old man who has kept naswar in his lower vestibule for 25 years has a 3 cm ulceroproliferative lesion of the left buccal mucosa and gingivobuccal sulcus. What is the most appropriate first investigation?
- A. Excisional biopsy with 1 cm margin
 - B. FNAC of the lesion
 - C. Incisional biopsy from the edge of the lesion
 - D. PET-CT scan
 - E. Toluidine blue staining
- Q2.** A patient with a squamous cell carcinoma of the lateral border of the tongue complains of pain in the ipsilateral ear. Through which nerve is this pain referred?
- A. Facial nerve
 - B. Glossopharyngeal nerve via the tympanic branch only
 - C. Hypoglossal nerve
 - D. Mandibular nerve (lingual and auriculotemporal branches)
 - E. Vagus nerve via the recurrent laryngeal
- Q3.** A 2.5 cm carcinoma of the lateral tongue has a depth of invasion of 7 mm. The neck is clinically and radiologically normal. What is the most appropriate management of the neck?
- A. Bilateral radical neck dissection
 - B. Chemotherapy alone
 - C. Elective selective neck dissection
 - D. No treatment, observe only
 - E. Radiotherapy to the neck only after recurrence
- Q4.** After resection of an oral carcinoma, histology shows a positive surgical margin and extranodal extension in one cervical node. What is the most appropriate adjuvant treatment?
- A. Brachytherapy only
 - B. Observation
 - C. Postoperative chemoradiotherapy with cisplatin
 - D. Postoperative radiotherapy alone
 - E. Targeted therapy alone
- Q5.** A carcinoma of the floor of the mouth has grossly invaded the body of the mandible on CT. Which surgical procedure is required for the mandible?
- A. Coronoidectomy
 - B. Extraction of adjacent teeth only
 - C. Marginal mandibulectomy
 - D. Segmental mandibulectomy
 - E. Sequestrectomy
- Q6.** A 65-year-old farmer has a 1.5 cm ulcer on the vermilion of the lower lip. Biopsy shows well-differentiated SCC. The neck is clinically negative. What is the best treatment?
- A. Abbe flap reconstruction after total lip excision
 - B. Chemotherapy
 - C. Radical neck dissection with lip excision
 - D. Topical 5-fluorouracil
 - E. Wedge (V) excision with primary closure

- Q7.** What is the single most important prognostic factor in oral squamous cell carcinoma?
- A. Age of patient
 - B. Cervical lymph node metastasis
 - C. Histological grade
 - D. Sex of patient
 - E. Site within the oral cavity
- Q8.** Which complication of radiotherapy for oral cancer is most directly prevented by dental extraction of hopeless teeth before treatment?
- A. Hypothyroidism
 - B. Mucositis
 - C. Osteoradionecrosis
 - D. Skin erythema
 - E. Taste loss

Answer Key & Explanations

1-C 2-D 3-C 4-C 5-D 6-E 7-B 8-C

Q1 — C. A suspected oral carcinoma needs tissue diagnosis by incisional biopsy from the edge, including normal and abnormal tissue. Excision before staging would compromise definitive surgery; imaging follows diagnosis.

Q2 — D. The anterior two-thirds of the tongue is supplied by the lingual nerve, a branch of the mandibular division (V3), which also supplies the ear via the auriculotemporal nerve. Referred otalgia therefore signals tongue involvement. Posterior tongue lesions refer pain via the glossopharyngeal and vagus nerves.

Q3 — C. With a depth of invasion above about 3–4 mm, the risk of occult nodal metastasis is significant. An elective selective neck dissection (levels I–III or I–IV for tongue) is recommended to stage and treat the N0 neck.

Q4 — C. Positive margins and extranodal extension are the two major high-risk pathological features. Concurrent cisplatin-based chemoradiotherapy improves locoregional control and survival over radiotherapy alone.

Q5 — D. Gross invasion of the mandible requires segmental resection, usually reconstructed with a fibula free flap. Marginal (rim) mandibulectomy is suitable only when tumour abuts or minimally erodes the alveolar margin without medullary invasion.

Q6 — E. Small lower lip cancers (up to one-third of the lip) are treated by full-thickness wedge excision with primary closure. Nodal spread is uncommon and late, and prognosis is good.

Q7 — B. Cervical nodal metastasis roughly halves survival, and extranodal extension worsens it further. This is why careful assessment and treatment of the neck is central to management.

Q8 — C. Extractions after radiotherapy in hypovascular irradiated bone carry a high risk of osteoradionecrosis. Removing teeth of poor prognosis 10–14 days before radiotherapy allows healing and reduces this risk.

CHAPTER 11

Cysts and Tumours of the Jaws

Learning Objectives

- Define a cyst and classify cysts of the jaws and oral soft tissues.
- Describe radicular, dentigerous and odontogenic keratocysts, including radiological features.
- Compare enucleation and marsupialisation.
- Recognise ameloblastoma and the soft-tissue cysts (mucocele, ranula, dermoid).

11.1 Definition and Classification

A **cyst** is a pathological cavity having fluid, semi-fluid or gaseous contents, which is **not created by the accumulation of pus**, and is usually (but not always) lined by epithelium.

Table 11.1 Classification of jaw cysts (based on WHO)

Group	Cysts
Odontogenic — inflammatory	Radicular (periapical) cyst — commonest; residual cyst; paradental cyst
Odontogenic — developmental	Dentigerous cyst; odontogenic keratocyst (OKC) ; lateral periodontal cyst; gingival cyst; eruption cyst; glandular odontogenic cyst
Non-odontogenic	Nasopalatine (incisive canal) duct cyst ; nasolabial cyst
Pseudocysts (no epithelial lining)	Simple (solitary/traumatic) bone cyst; aneurysmal bone cyst; Stafne bone cavity
Soft-tissue cysts	Mucocele, ranula, dermoid cyst, lymphoepithelial cyst

11.2 General Clinical Features and Investigations

- Often **asymptomatic** and found on routine radiographs; grow slowly by expansion.
- Painless bony swelling; buccal expansion more than lingual (except OKC, which grows along the bone).
- Thinned cortex gives "**eggshell crackling**"; when bone is lost, fluctuation and a bluish colour may appear.
- Displacement or mobility of teeth; missing tooth (dentigerous); pain and discharge if infected; **pathological fracture**.
- **Investigations:** **OPG** and periapical/occlusal films; **CT/CBCT** for large lesions; **tooth vitality testing**; aspiration (straw-coloured fluid with cholesterol crystals, or keratin in OKC); **biopsy** for definitive diagnosis.

Radiological appearance: a well-defined, round or oval **radiolucency** with a smooth, **corticated (sclerotic) margin**. Multilocular lesions suggest OKC or ameloblastoma.

11.3 Radicular (Periapical) Cyst

- **Commonest jaw cyst** (about half of all jaw cysts).
- **Pathogenesis:** pulp necrosis from caries → periapical granuloma → proliferation of the **epithelial rests of Malassez** → cyst.
- **Features:** at the apex of a **non-vital** tooth; often maxillary anterior region; slow, painless swelling.
- **X-ray:** round radiolucency at the root apex with loss of lamina dura.
- **Treatment:** root canal treatment ± apicectomy, or extraction with **enucleation** of the cyst. A cyst left behind after extraction is a **residual cyst**.

11.4 Dentigerous (Follicular) Cyst

- **Second commonest** jaw cyst; the commonest developmental odontogenic cyst.
- **Pathogenesis:** fluid accumulates between the reduced enamel epithelium and the crown of an **unerupted tooth**.
- **Sites:** **mandibular third molar**, then **maxillary canine**, second premolars, supernumerary teeth.
- **X-ray:** unilocular radiolucency **surrounding the crown** of an unerupted tooth and attached at the **cemento-enamel junction**.
- **Treatment:** enucleation with removal of the tooth; **marsupialisation** in children to allow the tooth to erupt, or for very large cysts.
- **Eruption cyst:** a soft-tissue variant over an erupting tooth — bluish gingival swelling; usually resolves as the tooth erupts.

11.5 Odontogenic Keratocyst (OKC)

- Arises from remnants of the **dental lamina**; lined by thin, parakeratinised epithelium with a palisaded basal layer; contains **keratin** (cheesy material). Classified by WHO as a cyst again (previously keratocystic odontogenic tumour).
- **Site:** **posterior body and ramus of the mandible**.
- **Behaviour:** grows along the medullary bone with **little expansion**, so it may be very large at diagnosis; **high recurrence rate** (thin friable lining, daughter cysts).
- **X-ray:** unilocular or **multilocular** radiolucency with scalloped margins.
- **Gorlin-Goltz syndrome** (naevoid basal cell carcinoma syndrome; *PTCH1* mutation): **multiple OKCs**, multiple basal cell carcinomas, **bifid ribs**, calcified falx cerebri, palmar pits, frontal bossing.
- **Treatment:** enucleation with **peripheral ostectomy** and/or **Carnoy's solution** (or modified Carnoy's); marsupialisation first for large lesions; resection for recurrent aggressive cases; **long-term follow-up** (5–10 years).

11.6 Other Jaw Cysts

Table 11.2 Other cysts of the jaws

Cyst	Key features
Nasopalatine duct cyst	Commonest non-odontogenic cyst; midline anterior maxilla; heart-shaped radiolucency between vital central incisors; swelling of the incisive papilla
Lateral periodontal cyst	Lateral surface of a vital root, lower premolar–canine region
Simple (solitary) bone cyst	Pseudocyst in young people, mandible; empty cavity; radiolucency scalloping between roots ; heals after surgical exploration
Aneurysmal bone cyst	Blood-filled pseudocyst; rapid expansion; young patients; curettage
Stafne bone cavity	Depression in the lingual mandible below the inferior alveolar canal containing salivary tissue; no treatment

11.7 Principles of Treatment: Enucleation versus Marsupialisation

Table 11.3 Surgical options for jaw cysts

Feature	Enucleation	Marsupialisation (decompression)
Technique	Complete removal of the cyst lining; primary closure	Window made in the cyst wall, lining sutured to oral mucosa; cavity kept open with a plug/obturator
Advantages	Complete histology; one operation; cavity heals	Simple; preserves vital structures (teeth, IAN, antrum); allows eruption of teeth
Disadvantages	Risk to adjacent teeth, nerve, fracture in large cysts	Lining left behind (incomplete histology); long follow-up; second operation often needed
Indications	Most cysts	Very large cysts, children with unerupted teeth, unfit patients

11.8 Ameloblastoma

Definition: a benign but **locally aggressive** epithelial odontogenic tumour, arising from the enamel organ / dental lamina remnants. It is the commonest clinically significant odontogenic tumour.

- **Age and site:** 30–50 years; **80% in the mandible**, mostly the **posterior body and ramus** (molar–ramus region).
- **Clinical:** slowly growing, painless, hard swelling with expansion of buccal and lingual cortices; eggshell crackling; displaced and loose teeth; rarely paraesthesia.
- **X-ray:** **multilocular "soap-bubble" or "honeycomb"** radiolucency, with **knife-edge root resorption**; may be unilocular (unicystic type, younger patients, often with an unerupted third molar — mimics a dentigerous cyst).
- **Investigations:** OPG, CT, incisional biopsy.
- **Histology:** follicular and plexiform patterns; peripheral palisading of columnar cells with reverse polarity.
- **Treatment:** **resection with 1–1.5 cm margin of normal bone** (marginal or segmental mandibulectomy) and reconstruction (fibula flap); curettage alone has a high recurrence rate. Unicystic ameloblastoma may be treated more conservatively.
- Rare malignant variants: metastasising ameloblastoma and ameloblastic carcinoma.

Table 11.4 Multilocular radiolucencies of the mandible

Lesion	Clue
Ameloblastoma	Adult, posterior mandible, soap-bubble, root resorption, expansion
Odontogenic keratocyst	Growth along bone with minimal expansion; Gorlin syndrome
Central giant cell granuloma	Young, anterior mandible, crosses midline
Odontogenic myxoma	"Tennis-racket" or step-ladder septa
Cherubism	Children, bilateral symmetrical swelling of the jaws

Odontome is the commonest odontogenic tumour overall (a hamartoma of dental tissues): **compound** (many small tooth-like structures, anterior maxilla) or **complex** (irregular mass, posterior mandible); often prevents tooth eruption; treated by enucleation.

11.9 Soft-Tissue Cysts of the Mouth

Table 11.5 Soft-tissue cysts

Cyst	Features	Treatment
Mucocele (mucous extravasation cyst)	Trauma to a minor salivary gland duct; lower lip commonest; soft, bluish, fluctuant; may burst and recur	Excision with the underlying minor salivary glands
Ranula	Mucous extravasation from the sublingual gland ; bluish translucent swelling in the floor of the mouth ("frog's belly"), lateral to the midline	Excision of the sublingual gland with the ranula (marsupialisation has high recurrence)
Plunging ranula	Extends through or behind the mylohyoid into the neck → submandibular/submental swelling	Excision of the sublingual gland (intraoral approach); drainage of the cervical part
Dermoid cyst	Midline floor of mouth; doughy, contains keratin; sublingual (above geniohyoid) or submental (below)	Surgical excision

11.10 Chapter Revision Table

Table 11.6 Cysts and tumours at a glance

Point	Remember
Commonest jaw cyst	Radicular (non-vital tooth)
Cyst around crown of unerupted tooth	Dentigerous (attached at CEJ)
High recurrence, posterior mandible, keratin	Odontogenic keratocyst
Multiple OKCs + BCCs + bifid ribs	Gorlin-Goltz syndrome
Heart-shaped midline maxillary radiolucency	Nasopalatine duct cyst
Soap-bubble with root resorption	Ameloblastoma
Ameloblastoma treatment	Resection with 1–1.5 cm margin
Lower lip bluish swelling	Mucocele
Floor of mouth "frog's belly"	Ranula — excise sublingual gland

Chapter MCQs (One Best Answer)

Q1. A 25-year-old man has a painless swelling of the left mandible. OPG shows a well-defined unilocular radiolucency around the crown of an unerupted lower third molar, attached at the cemento-enamel junction. What is the most likely diagnosis?

- A. Ameloblastoma
- B. Dentigerous cyst
- C. Nasopalatine duct cyst
- D. Radicular cyst
- E. Simple bone cyst

Q2. A 35-year-old woman has had a recurrent cyst of the mandibular ramus removed twice. Chest X-ray shows bifid ribs and skull X-ray a calcified falx cerebri. She has several basal cell carcinomas. What is the cyst?

- A. Aneurysmal bone cyst
- B. Dentigerous cyst
- C. Lateral periodontal cyst
- D. Odontogenic keratocyst
- E. Radicular cyst

Q3. A 40-year-old man has a slow-growing hard swelling of the posterior mandible. OPG shows a multilocular "soap-bubble" radiolucency with knife-edge resorption of adjacent molar roots. Biopsy confirms a follicular ameloblastoma. What is the best treatment?

- A. Curettage alone
- B. Marsupialisation
- C. Radiotherapy
- D. Resection with 1–1.5 cm margin of normal bone
- E. Observation

Q4. A periapical radiolucency is seen at the apex of an upper lateral incisor that does not respond to vitality testing. What is the most likely lesion?

- A. Dentigerous cyst
- B. Nasopalatine duct cyst
- C. Odontogenic keratocyst
- D. Radicular cyst
- E. Stafne bone cavity

Q5. A 9-year-old child has a large dentigerous cyst around an unerupted lower second premolar. What is the treatment of choice?

- A. Enucleation with extraction of the premolar
- B. Marsupialisation to allow eruption of the tooth
- C. Radiotherapy
- D. Resection of the mandible
- E. Sclerotherapy

Q6. A young woman has a painless, bluish, translucent swelling in the floor of the mouth on one side of the midline. It recurred after marsupialisation. What is the most appropriate treatment?

- A. Aspiration only
- B. Excision of the sublingual gland with the lesion
- C. Excision of the submandibular gland
- D. Radiotherapy
- E. Repeat marsupialisation

Q7. A heart-shaped radiolucency is seen in the midline of the anterior maxilla between the roots of vital central incisors. What is the most likely diagnosis?

- A. Globulomaxillary cyst
- B. Nasopalatine duct cyst
- C. Radicular cyst
- D. Residual cyst
- E. Simple bone cyst

Q8. Which radiological feature most helps distinguish an odontogenic keratocyst from other jaw cysts of similar size?

- A. Attachment at the cemento-enamel junction
- B. Growth along the medullary bone with little cortical expansion
- C. Heart-shaped outline
- D. Radiopaque flecks
- E. Situation at the apex of a non-vital tooth

Answer Key & Explanations

1-B 2-D 3-D 4-D 5-B 6-B 7-B 8-B

Q1 — B. A radiolucency enclosing the crown of an unerupted tooth and attached at the cemento-enamel junction is the classic picture of a dentigerous cyst, most often associated with the mandibular third molar and maxillary canine.

Q2 — D. Multiple, recurrent odontogenic keratocysts with basal cell carcinomas, bifid ribs and calcified falx form Gorlin-Goltz (naevoid basal cell carcinoma) syndrome due to PTCH1 mutation.

Q3 — D. Solid/multicystic ameloblastoma is locally aggressive and infiltrates cancellous bone beyond its radiological margin. Curettage has a high recurrence rate; resection with a 1–1.5 cm bony margin and reconstruction is recommended.

Q4 — D. A radicular (periapical) cyst develops from epithelial rests of Malassez stimulated by inflammation from a non-vital tooth. It is the commonest jaw cyst and is treated by root canal therapy with apicectomy or extraction with enucleation.

Q5 — B. In a child, marsupialisation (decompression) of a dentigerous cyst relieves pressure, shrinks the cavity and allows the unerupted tooth to erupt, preserving it and adjacent structures.

Q6 — B. This is a ranula, a mucous extravasation cyst arising from the sublingual gland. Recurrence is common after marsupialisation; excision of the sublingual gland of origin gives the lowest recurrence rate.

Q7 — B. The nasopalatine (incisive canal) duct cyst is the commonest non-odontogenic jaw cyst. It lies in the midline of the anterior maxilla and appears heart-shaped because of superimposition of the anterior nasal spine; the incisors are vital.

Q8 — B. The odontogenic keratocyst characteristically extends anteroposteriorly through the medullary cavity of the mandible with minimal buccolingual expansion, so it may be very large before it is noticed.

PART III

The Neck

Neck Swellings • Cervical Lymphadenopathy • Neck Dissection • Thyroid • Thyroid
Cancer • Parathyroid

CHAPTER 12

Neck Swellings and Congenital Lesions of the Neck

Learning Objectives

- Use a systematic approach (age, site, features) to a lump in the neck.
- Describe thyroglossal cyst, branchial cyst, sinus and fistula, and cystic hygroma.
- Distinguish these lesions from other common neck swellings.
- Explain the principles of their surgical treatment.

12.1 Clinical Approach to a Neck Lump

Surgical anatomy

- The **sternocleidomastoid** divides each side into an **anterior triangle** (midline, mandible, SCM) and a **posterior triangle** (SCM, trapezius, clavicle).
- The anterior triangle is subdivided into submental, submandibular (digastric), carotid and muscular triangles.

Table 12.1 Common neck swellings by site

Site	Swellings
Midline	Thyroglossal cyst, thyroid isthmus swelling, submental lymph node, sublingual dermoid, plunging ranula, laryngocele (lateral to midline)
Submandibular	Submandibular gland (sialadenitis, stone, tumour), lymph nodes (level Ib)
Anterior triangle	Lymph nodes (commonest), branchial cyst , thyroid lobe, carotid body tumour , carotid aneurysm, parotid tail, laryngocele
Posterior triangle	Lymph nodes, cystic hygroma , cervical rib, subclavian aneurysm, lipoma, neurofibroma
Anywhere	Sebaceous cyst, lipoma, abscess, haemangioma

Age is a powerful clue

Table 12.2 Likely causes by age

Age group	Most likely causes
Children	Reactive (inflammatory) lymph nodes, congenital lesions (thyroglossal cyst, cystic hygroma, dermoid), TB
Young adults (20–40)	Reactive nodes, TB, branchial cyst , thyroid swellings, lymphoma
Older adults (>40)	Malignancy must be excluded — metastatic SCC, lymphoma, thyroid cancer

★ EXAM PEARLS

- **"Rule of 80"** in adults: about 80% of non-thyroid neck lumps over the age of 40 are neoplastic; of these, 80% are malignant; 80% of these are metastatic; and 80% of the primaries are **above the clavicle**.
- A **midline swelling that moves on swallowing** is thyroid or thyroglossal; one that also moves on **protruding the tongue** is a thyroglossal cyst.
- Never perform an **open biopsy** of a neck node in an adult before a full head and neck examination and FNAC — it may seed tumour and compromise later treatment.

Investigations of a neck lump

- **Ultrasound** (first-line imaging) with **FNAC** (or core biopsy).

- Full ENT and oral examination, including nasendoscopy.
- CT/MRI of the neck; PET-CT for unknown primary; thyroid function for thyroid swellings.
- Excision biopsy of a node only when FNAC suggests **lymphoma** or is non-diagnostic after a full search for a primary.

12.2 Thyroglossal Cyst

Definition: a cystic remnant of the **thyroglossal duct**, the tract along which the thyroid descends from the **foramen caecum** of the tongue to the front of the neck. It is the **commonest congenital midline neck swelling**.

- **Site:** midline or slightly to the left; **subhyoid** (commonest), at the hyoid, suprahyoid, or at the level of the thyroid cartilage.
- **Age:** usually children and young adults, but may appear at any age.

Clinical features

- Smooth, round, painless, cystic midline swelling; may transilluminate (if thin-walled).
- **Moves upward on swallowing** (attached to larynx via the pretracheal fascia) **and on protrusion of the tongue** (attached to the foramen caecum via the tract).
- May become **infected** → painful red swelling; incision or rupture produces a **thyroglossal fistula** (always **acquired**, never congenital), with a crescentic "hood" of skin.

Investigations

- **Ultrasound** of the neck — confirms the cyst and, importantly, the **presence of a normal thyroid gland**.
- Thyroid function tests; isotope scan if ultrasound does not show normal thyroid (to exclude **ectopic thyroid**, which may be the patient's only functioning thyroid tissue).
- FNAC if a solid component is present.

Management

- **Sistrunk's operation** — excision of the cyst together with the whole tract and the **central part of the body of the hyoid bone**, following the tract up to the foramen caecum.
- Simple excision of the cyst alone gives a high recurrence rate.
- Treat infection with antibiotics first; operate once inflammation has settled.

Complications

- Infection, abscess, fistula, recurrence (if hyoid not removed), and rarely **carcinoma** (usually papillary) in the cyst wall.

12.3 Branchial Cyst

Definition: a cyst arising from remnants of the **second branchial cleft** (cervical sinus of His). An alternative theory suggests cystic degeneration of lymphoid tissue (lymphoepithelial cyst).

- **Age:** young adults, typically **20-30 years**.
- **Site:** deep to the **anterior border of the sternocleidomastoid** at the junction of its **upper third and lower two-thirds**.
- **Clinical:** smooth, oval, soft or fluctuant swelling; does **not** transilluminate well (thick turbid fluid); may enlarge after an upper respiratory infection or become infected.
- **Aspirate:** turbid fluid containing **cholesterol crystals**; the lining is squamous epithelium with lymphoid tissue in the wall.
- **Investigations:** ultrasound, FNAC; in adults over 35-40, **exclude a cystic metastasis** (HPV-positive oropharyngeal SCC, papillary thyroid cancer) with CT/MRI and full ENT examination.

- **Treatment:** complete surgical **excision** through a transverse neck incision, avoiding the accessory, hypoglossal and marginal mandibular nerves.

12.4 Branchial Sinus and Fistula

- **Congenital** (unlike thyroglossal fistula), from persistence of the second branchial cleft and pouch; may be bilateral.
- **External opening:** at the **lower third of the anterior border of the sternocleidomastoid**, discharging mucus from infancy.
- **Course of a complete fistula:** passes up through the carotid sheath area, **between the internal and external carotid arteries**, superficial to the glossopharyngeal and hypoglossal nerves, to open into the **tonsillar fossa**.
- **Treatment:** complete excision of the tract (step-ladder incisions), often with tonsillectomy.

12.5 Cystic Hygroma (Macrocystic Lymphatic Malformation)

- **Definition:** a congenital lymphatic malformation formed from sequestered lymphatic sacs.
- **Age and site:** present at birth or in early childhood; typically the **posterior triangle**, lower third; may extend into the floor of mouth, axilla or mediastinum.
- **Clinical:** soft, lobulated, **partially compressible**, fluctuant swelling that is **brilliantly transilluminant**; may enlarge suddenly with infection or haemorrhage.
- **Complications:** airway obstruction, feeding difficulty, infection.
- **Investigations:** antenatal ultrasound, postnatal USG and **MRI** to define extent.
- **Treatment:** **sclerotherapy** (OK-432, bleomycin, doxycycline) — especially for macrocystic lesions; surgical excision for localised or residual disease (difficult — infiltrates around vessels and nerves); airway support if needed.

12.6 Other Lesions to Remember

Table 12.3 Other neck swellings

Lesion	Key features
Dermoid cyst	Midline, sublingual or submental; contains keratin; does not move with tongue protrusion
Carotid body tumour (paraganglioma)	Slow-growing at the carotid bifurcation ; moves side to side but not up and down ; may be pulsatile; "lyre sign" (splaying of ICA and ECA) on angiography; never biopsy ; CT/MR angiography; excision
Sternomastoid tumour	Infant; firm lump in SCM after birth trauma; torticollis; physiotherapy
Laryngocele	Air-filled dilatation of laryngeal saccule; swells on blowing (trumpet players); associated with laryngeal cancer
Cervical rib	Hard swelling in posterior triangle; thoracic outlet syndrome

12.7 Chapter Revision Table

Table 12.4 Congenital neck lesions compared

Feature	Thyroglossal cyst	Branchial cyst	Cystic hygroma
Origin	Thyroglossal duct	2nd branchial cleft	Lymphatic sacs
Age	Children, young adults	20–30 years	Infancy
Site	Midline (subhyoid)	Anterior border SCM, upper 1/3	Posterior triangle
Special sign	Moves with swallowing and tongue protrusion	Cholesterol crystals in aspirate	Brilliant transillumination
Treatment	Sistrunk's operation	Excision	Sclerotherapy / excision

Chapter MCQs (One Best Answer)

Q1. An 8-year-old girl has a painless 2 cm midline swelling just below the hyoid bone, which moves upward when she swallows and when she protrudes her tongue. What investigation is essential before surgery?

- A. Barium swallow
- B. Chest X-ray
- C. Excision biopsy
- D. Serum calcium
- E. Ultrasound of the neck to confirm a normal thyroid gland

Q2. What is the operation of choice for a thyroglossal cyst?

- A. Aspiration and sclerotherapy
- B. Hemithyroidectomy
- C. Incision and drainage
- D. Simple excision of the cyst
- E. Sistrunk's operation

Q3. A 24-year-old man has a smooth, fluctuant swelling deep to the anterior border of the right sternocleidomastoid at the junction of its upper and middle thirds. Aspiration yields turbid fluid with cholesterol crystals. What is the diagnosis?

- A. Branchial cyst
- B. Carotid body tumour
- C. Cold abscess
- D. Cystic hygroma
- E. Thyroglossal cyst

Q4. A complete branchial fistula opens externally on the lower anterior border of the sternocleidomastoid. Where does its internal opening lie?

- A. Foramen caecum
- B. Piriform fossa
- C. Tonsillar fossa
- D. Vallecula
- E. Wharton's duct

Q5. A 6-month-old infant has a soft, lobulated, compressible swelling in the lower posterior triangle that transilluminates brilliantly. What is the most likely diagnosis?

- A. Branchial cyst
- B. Cystic hygroma
- C. Lipoma
- D. Sternomastoid tumour
- E. Tuberculous lymphadenitis

Q6. A 45-year-old smoker presents with a painless, firm 3 cm lump in the upper anterior triangle of the neck. What is the most appropriate first step after full head and neck examination?

- A. Antibiotics for 6 months
- B. Excision biopsy of the node
- C. Incisional biopsy of the node
- D. Radiotherapy to the neck
- E. Ultrasound-guided FNAC

Q7. A slowly growing lump at the angle of the jaw moves from side to side but not vertically, and a bruit is heard over it. What must be avoided?

- A. CT angiography
- B. Doppler ultrasound
- C. MRI
- D. Open or needle biopsy without imaging
- E. Referral to a vascular surgeon

Answer Key & Explanations

1-E 2-E 3-A 4-C 5-B 6-E 7-D

Q1 — E. This is a thyroglossal cyst. Before excision, ultrasound (or isotope scan) must confirm that a normally located thyroid gland is present, so that ectopic thyroid tissue — which may be the only functioning thyroid — is not removed.

Q2 — E. Sistrunk's operation removes the cyst, the entire tract and the central portion of the body of the hyoid bone up to the foramen caecum. Simple excision has a high recurrence rate.

Q3 — A. A branchial cyst presents in young adults at the junction of the upper third and lower two-thirds of the anterior border of the SCM. The aspirate contains cholesterol crystals. Treatment is excision.

Q4 — C. A second branchial cleft fistula passes between the internal and external carotid arteries, superficial to the hypoglossal and glossopharyngeal nerves, to open into the tonsillar fossa.

Q5 — B. Cystic hygroma (macrocytic lymphatic malformation) contains clear lymph and is brilliantly transilluminant. It typically presents in infancy in the posterior triangle. Sclerotherapy or excision are the treatments.

Q6 — E. In an adult over 40, a neck lump is malignant until proven otherwise, usually a metastasis from a head and neck primary. After examination, ultrasound-guided FNAC is the correct initial test. Open biopsy may seed tumour and should be avoided.

Q7 — D. This is a carotid body tumour (paraganglioma) at the carotid bifurcation. Biopsy can cause severe haemorrhage. Diagnosis is made with Doppler ultrasound, CT/MR angiography, and treatment is surgical excision.

CHAPTER 13

Cervical Lymphadenopathy

Learning Objectives

- Describe the levels of cervical lymph nodes and their drainage areas.
- Classify the causes of cervical lymphadenopathy.
- Describe tuberculous lymphadenitis, lymphoma and metastatic nodes.
- Plan the investigation of a metastatic node with an unknown primary.

13.1 Levels of Cervical Lymph Nodes

Table 13.1 Lymph node levels and drainage

Level	Boundaries / name	Main drainage
Ia	Submental — between anterior bellies of digastric	Lower lip, tip of tongue, anterior floor of mouth, chin
Ib	Submandibular triangle	Oral cavity, lips, cheek, nose, submandibular gland
II	Upper jugular — skull base to hyoid (IIa/IIb divided by accessory nerve)	Oral cavity, oropharynx , nasopharynx, larynx, parotid
III	Middle jugular — hyoid to cricoid	Oral cavity, oropharynx, larynx , hypopharynx
IV	Lower jugular — cricoid to clavicle	Hypopharynx, thyroid , cervical oesophagus, larynx
V	Posterior triangle	Nasopharynx , oropharynx, scalp, posterior neck skin
VI	Central compartment — hyoid to sternum, between carotids	Thyroid , larynx (glottis/subglottis), trachea, cervical oesophagus
VII	Superior mediastinum	Thyroid, oesophagus

★ EXAM PEARLS

- The **jugulodigastric (tonsillar) node** in level II is the commonest node enlarged in tonsillitis and in oral/oropharyngeal cancer.
- **Virchow's node** — an enlarged **left supraclavicular** node (**Troisier's sign**) — suggests an abdominal malignancy such as stomach cancer, via the thoracic duct.

13.2 Causes of Cervical Lymphadenopathy

Table 13.2 Causes

Group	Examples
Infective — acute	Bacterial: tonsillitis, dental infection , scalp infection; viral: URTI, infectious mononucleosis (EBV), measles; toxoplasmosis
Infective — chronic	Tuberculosis (commonest chronic cause in Pakistan), atypical mycobacteria, HIV, actinomycosis, syphilis, cat-scratch disease
Neoplastic — primary	Lymphoma (Hodgkin and non-Hodgkin), leukaemia
Neoplastic — secondary	Metastatic SCC (oral cavity, pharynx, larynx), thyroid carcinoma, melanoma, salivary tumours, infraclavicular primaries (stomach, lung, breast)
Others	Sarcoidosis, Kikuchi disease, drugs (phenytoin)

Table 13.3 Clinical clues from node characteristics

Feature	Inflammatory	Tuberculous	Lymphoma	Metastatic
Tenderness	Tender	Mild/none	Non-tender	Non-tender
Consistency	Soft-firm	Firm, matted	Rubbery	Stony hard
Mobility	Mobile	Matted, adherent	Mobile, discrete	Fixed (late)
Associated	Obvious source, fever	Cold abscess, sinus, evening fever	B symptoms, other node groups, spleen	Primary tumour in head and neck

13.3 Tuberculous Cervical Lymphadenitis

Definition: chronic granulomatous infection of the cervical lymph nodes by *Mycobacterium tuberculosis* (rarely *M. bovis* from unpasteurised milk). It is the commonest form of extrapulmonary TB and a very common cause of neck swelling in Pakistan.

- **Route:** usually through the tonsils (upper deep cervical, level II nodes most affected), or haematogenous/lymphatic spread from the lungs.
- **Age:** children and young adults; associated with poverty, overcrowding, malnutrition, HIV.

Table 13.4 Stages of tuberculous lymphadenitis

Stage	Features
1. Lymphadenitis	Enlarged, firm, discrete, mobile nodes
2. Periadenitis	Nodes become matted together
3. Cold abscess	Caseation → fluctuant swelling, not hot, red or tender
4. Collar-stud abscess	Pus breaks through deep fascia into the subcutaneous space — two communicating cavities
5. Sinus formation	Discharging sinus with undermined, bluish edges

Investigations

- **FNAC:** epithelioid granulomas with **caseous necrosis**, Langhans giant cells; **Ziehl-Neelsen stain** for acid-fast bacilli; **GeneXpert (CBNAAT)** for TB and rifampicin resistance; culture.
- Ultrasound (matting, necrosis); chest X-ray (active or healed TB); ESR (raised); Mantoux test / IGRA; HIV test.
- Excision biopsy if FNAC is inconclusive.

Management

- **Antituberculous therapy for 6 months:** 2 months of isoniazid, rifampicin, pyrazinamide and ethambutol (**2HRZE**), then 4 months of isoniazid and rifampicin (**4HR**); pyridoxine with isoniazid.
- Nodes may enlarge or new ones appear during treatment (**paradoxical reaction**) — does not mean failure.
- **Cold abscess:** aspirate through a **non-dependent** point (to avoid a persistent sinus); **do not incise**.
- **Surgery** (excision of residual nodes, sinus tract) for persistent disease, diagnostic doubt or atypical mycobacteria.

★ EXAM PEARLS

- A cold abscess is aspirated through healthy skin from a **non-dependent** site with a wide-bore needle — incision leads to a chronic discharging sinus.
- **Atypical (non-tuberculous) mycobacteria** in young children: unilateral, violaceous skin; treated by **surgical excision**.

13.4 Lymphoma

Table 13.5 Hodgkin versus non-Hodgkin lymphoma

Feature	Hodgkin lymphoma	Non-Hodgkin lymphoma
Age	Bimodal: young adults (20–30) and elderly	Usually older adults
Spread	Contiguous, predictable, node to node	Non-contiguous; extranodal common (Waldeyer's ring, GIT)
Histology	Reed-Sternberg cells (owl-eye)	Monoclonal B- or T-cells; no RS cells
Nodes	Painless, rubbery , cervical; pain with alcohol (rare)	Rubbery, multiple sites
Prognosis	Good (high cure rate)	Variable by type

- **B symptoms:** fever $>38^{\circ}\text{C}$, drenching night sweats, weight loss $>10\%$ in 6 months; pruritus.
- **Investigations:** FNAC may suggest lymphoma, but **excision biopsy** (or core biopsy) of a whole node is required for architecture and typing; FBC, LDH, ESR; **PET-CT** for staging (**Ann Arbor** stages I–IV); bone marrow biopsy in selected cases.
- **Treatment:** chemotherapy (ABVD for Hodgkin; R-CHOP for diffuse large B-cell lymphoma) $\pm$ radiotherapy. The surgeon's role is mainly **diagnostic biopsy**.

13.5 Metastatic Lymph Nodes

- **Features:** stony-hard, painless, progressively enlarging, later fixed to deep structures or skin; adult smoker or tobacco/areca user.
- The **level** of the node points to the likely primary (see Table 13.1).
- **Cystic metastases** in level II occur with HPV-positive oropharyngeal SCC and papillary thyroid cancer — may mimic a branchial cyst.

Metastatic node with an unknown primary — work-up

- Full examination of the oral cavity, oropharynx, nasopharynx, larynx and skin; **flexible nasendoscopy**.
- **Ultrasound-guided FNAC** or core biopsy; immunohistochemistry: **p16/HPV** (oropharynx), **EBV** (nasopharynx), thyroglobulin/TTF-1 (thyroid).
- **PET-CT** before endoscopy to direct biopsies; CT/MRI neck and CT chest.
- **Panendoscopy** under anaesthesia with targeted biopsies, ipsilateral or bilateral **tonsillectomy** and tongue-base mucosectomy.
- If no primary is found: neck dissection $\pm$ radiotherapy to the neck and potential primary sites.

13.6 Chapter Revision Table

Table 13.6 Lymphadenopathy at a glance

Point	Remember
Level Ia drains	Lower lip, tip of tongue, floor of mouth
Level VI	Central compartment — thyroid
Virchow's node	Left supraclavicular; abdominal primary
Matted nodes, cold abscess	Tuberculosis
TB treatment	6 months: 2HRZE + 4HR
Cold abscess	Aspirate from non-dependent site; do not incise
Rubbery nodes + B symptoms	Lymphoma — excision biopsy
Reed–Sternberg cells	Hodgkin lymphoma
Stony-hard fixed node, adult smoker	Metastatic SCC

Chapter MCQs (One Best Answer)

Q1. A 19-year-old student has matted, non-tender nodes in the right upper deep cervical region with a soft fluctuant swelling that is not warm. He has evening fever and weight loss. FNAC shows caseating granulomas. What is the correct treatment of the fluctuant swelling, alongside drug therapy?

- A. Aspiration through a non-dependent site
- B. Incision and drainage at the most dependent point
- C. Leave it alone and start steroids
- D. Radical neck dissection
- E. Radiotherapy

Q2. What is the standard duration of antituberculous therapy for tuberculous cervical lymphadenitis?

- A. 2 weeks
- B. 6 weeks
- C. 3 months
- D. 6 months
- E. 24 months

Q3. A 25-year-old woman has painless rubbery cervical lymph nodes, night sweats and itching. FNAC is suspicious for lymphoma. What is the next diagnostic step?

- A. Antibiotic trial
- B. Bone marrow biopsy
- C. Excision biopsy of a whole lymph node
- D. Mantoux test
- E. Repeat FNAC

Q4. A 60-year-old man has a hard, painless lump in the left supraclavicular fossa. Which primary site is most likely?

- A. Lower lip
- B. Nasopharynx
- C. Parotid
- D. Stomach
- E. Tip of tongue

Q5. A carcinoma of the tip of the tongue is most likely to spread first to which lymph node level?

- A. Level Ia (submental)
- B. Level III
- C. Level IV
- D. Level V
- E. Level VI

Q6. A 50-year-old man has a 3 cm cystic node in level II. Examination of the mouth and throat is unremarkable. FNAC shows squamous cell carcinoma that is p16 positive. Where is the primary tumour most likely to be?

- A. Buccal mucosa
- B. Lower lip
- C. Oropharynx (tonsil or base of tongue)
- D. Parotid gland
- E. Thyroid

Q7. Which cell is characteristic of Hodgkin lymphoma?

- A. Epithelioid cell
- B. Langhans giant cell
- C. Reed-Sternberg cell
- D. Signet-ring cell
- E. Tingible body macrophage

Answer Key & Explanations

1-A 2-D 3-C 4-D 5-A 6-C 7-C

Q1 — A. This is a tuberculous cold abscess. It is aspirated through healthy skin from a non-dependent site while antituberculous therapy is given. Incision and dependent drainage produce a chronic discharging sinus.

Q2 — D. Tuberculous lymphadenitis is treated with a 6-month regimen: 2 months of isoniazid, rifampicin, pyrazinamide and ethambutol, followed by 4 months of isoniazid and rifampicin.

Q3 — C. Lymphoma diagnosis and subtyping require assessment of nodal architecture, so an excision (or core) biopsy of a whole node is needed. Staging with PET-CT follows.

Q4 — D. An enlarged left supraclavicular node (Virchow's node, Troisier's sign) suggests a malignancy below the clavicle, classically gastric carcinoma, spreading via the thoracic duct.

Q5 — A. The tip of the tongue, lower lip and anterior floor of mouth drain to the submental (level Ia) nodes, often bilaterally. The lateral tongue drains to levels Ib-III and may skip to level IV.

Q6 — C. p16 positivity indicates HPV-associated SCC, which arises in the oropharynx (tonsil, base of tongue). These primaries are often small and hidden and present with cystic level II nodes. PET-CT and panendoscopy with tonsillectomy help find them.

Q7 — C. Reed-Sternberg cells, large binucleate cells with prominent "owl-eye" nucleoli, are characteristic of Hodgkin lymphoma. Langhans giant cells and epithelioid cells are seen in tuberculosis.

CHAPTER 14

Neck Dissection

Learning Objectives

- Define and classify neck dissection.
- State the indications for therapeutic and elective neck dissection.
- List the structures removed and preserved in each type.
- Describe the complications of neck dissection, especially nerve injuries and chyle leak.

14.1 Definition

Neck dissection is the systematic removal of the cervical lymph nodes and the fibrofatty tissue containing them, en bloc, from defined levels of the neck, for the treatment or staging of metastatic cancer. It was first described by **George Crile (1906)** as the radical neck dissection.

14.2 Classification (Robbins / AAO-HNS)

Table 14.1 Types of neck dissection

Type	Levels removed	Non-lymphatic structures
Radical neck dissection (RND)	I-V	Removes spinal accessory nerve (SAN), internal jugular vein (IJV) and sternocleidomastoid (SCM)
Modified radical (MRND)	I-V	Preserves one or more of SAN, IJV, SCM (Type I — SAN; Type II — SAN + IJV; Type III — all three, "functional")
Selective (SND)	Fewer than I-V	Preserves SAN, IJV and SCM
Extended	RND or MRND plus	Additional nodes (retropharyngeal, VI, VII) or structures (skin, carotid, hypoglossal nerve)

Table 14.2 Common selective neck dissections

Name	Levels	Typical use
Supraomohyoid	I-III	Oral cavity cancer with N0 neck (I-IV for tongue)
Lateral	II-IV	Larynx, hypopharynx, oropharynx
Posterolateral	II-V (+ suboccipital)	Posterior scalp skin cancer, melanoma
Central compartment	VI	Thyroid cancer (papillary, medullary)

14.3 Indications

- **Therapeutic neck dissection:** clinically or radiologically positive nodes (N+) — usually MRND or comprehensive dissection; RND when nodes involve the SAN, IJV or SCM.
- **Elective (prophylactic) neck dissection:** clinically N0 neck with a risk of occult metastasis greater than about **20%** (e.g. oral cancer with depth of invasion >3–4 mm) — usually a selective dissection, which also **stages** the neck.
- **Salvage neck dissection:** residual or recurrent nodal disease after radiotherapy or chemoradiotherapy.
- Access for free-flap vessels during reconstruction.

14.4 Preoperative Assessment and Operation

- Clinical examination, ultrasound $\pm$ FNAC, CT/MRI, PET-CT; fitness for anaesthesia; dental assessment if radiotherapy is likely.
- **Incisions:** apron (transverse) incision, hockey-stick, MacFee (two parallel transverse incisions — useful after radiotherapy); avoid trifurcate incisions in irradiated skin.
- Subplatysmal flaps are raised, preserving the **marginal mandibular nerve** (by dissecting deep to the investing fascia over the submandibular gland, or ligating the facial vein and reflecting it upward — **Hayes Martin manoeuvre**).
- Nodal tissue is removed en bloc, level by level; suction drains are placed.

14.5 Structures at Risk

Table 14.3 Nerve injuries in neck dissection

Nerve	Effect of injury
Marginal mandibular (VII)	Drooping of the corner of the mouth, asymmetric smile
Spinal accessory (XI)	Shoulder syndrome: pain, drooping shoulder, weakness of abduction above 90° (trapezius paralysis), scapular winging
Hypoglossal (XII)	Deviation of the tongue to the same side on protrusion; dysarthria, dysphagia
Lingual	Numbness of the tongue
Vagus (X)	Hoarseness (vocal cord palsy), aspiration
Phrenic	Paralysis of the hemidiaphragm
Cervical sympathetic chain	Horner's syndrome (ptosis, miosis, anhidrosis, enophthalmos)
Great auricular, cervical plexus	Numbness of ear lobe and neck skin

14.6 Complications

Table 14.4 Complications of neck dissection

Timing	Complications
Intraoperative	Haemorrhage (IJV tear — risk of air embolism), nerve injury, pneumothorax, thoracic duct injury
Early	Haematoma (airway compromise), chyle leak , seroma, wound infection, flap necrosis, facial and cerebral oedema (after bilateral IJV ligation), raised ICP, SIADH
Late	Shoulder dysfunction, hypertrophic scar, lymphoedema, neck stiffness and fibrosis, carotid blow-out (especially after radiotherapy and fistula), recurrence

Chyle leak

- Usually on the **left side** (thoracic duct enters the junction of the left IJV and subclavian vein, level IV).
- **Features:** milky drain fluid that increases after enteral feeding; fluid **triglycerides** **>1.1 mmol/L** and chylomicrons.
- **Management:** low-output leaks — pressure dressing, **medium-chain triglyceride (MCT) diet** or nil by mouth with parenteral nutrition, octreotide; high-output (>500–1000 mL/day) or persistent leaks — surgical exploration and ligation, or thoracic duct embolisation.
- Risks: dehydration, electrolyte loss, malnutrition, lymphopenia (immunosuppression), chylothorax.

★ **EXAM PEARLS**

- RND removes three non-lymphatic structures: **SAN, IJV and SCM** ("SIS").
- The most troublesome morbidity of RND is **shoulder dysfunction** from accessory nerve sacrifice — the reason for MRND and selective dissection.
- **Bilateral** internal jugular veins should not be ligated at the same operation (stage the procedures) — risk of facial and cerebral oedema.

14.7 Chapter Revision Table

Table 14.5 Neck dissection at a glance

Point	Remember
First described	Crile, 1906 (radical)
RND removes	Levels I–V + SAN + IJV + SCM
MRND	Levels I–V, preserves ≥ 1 of SAN, IJV, SCM
Supraomohyoid	Levels I–III — oral cavity N0
Central compartment	Level VI — thyroid cancer
Elective dissection threshold	Occult node risk >20%
Shoulder drop	Accessory nerve injury
Milky drain, left neck	Chyle leak — thoracic duct
Tongue deviates to the same side	Hypoglossal nerve injury

Chapter MCQs (One Best Answer)

Q1. Which structures, in addition to levels I-V lymph nodes, are removed in a classical radical neck dissection?

- A. Facial nerve, parotid and digastric
- B. Internal jugular vein, sternocleidomastoid and spinal accessory nerve
- C. Phrenic nerve, carotid artery and vagus
- D. Submandibular gland only
- E. Vagus nerve, carotid artery and hypoglossal nerve

Q2. Three months after a neck dissection, a patient complains of shoulder pain, drooping of the shoulder and inability to abduct the arm above 90°. Which nerve was injured?

- A. Axillary nerve
- B. Long thoracic nerve
- C. Phrenic nerve
- D. Spinal accessory nerve
- E. Suprascapular nerve

Q3. On the second day after a left neck dissection, the drain output becomes milky and increases after the patient starts eating. What is the first-line management?

- A. Immediate re-exploration in all cases
- B. Increase the oral fat intake
- C. Medium-chain triglyceride diet and pressure dressing
- D. Radiotherapy to the neck
- E. Remove the drain

Q4. A patient with a T2N0 squamous cell carcinoma of the buccal mucosa is to undergo surgery. Which type of neck dissection is most appropriate?

- A. Central compartment dissection
- B. No neck surgery
- C. Posterolateral neck dissection
- D. Radical neck dissection
- E. Supraomohyoid (levels I-III) selective neck dissection

Q5. After neck dissection a patient's tongue deviates to the right on protrusion. Which nerve was injured?

- A. Left hypoglossal
- B. Left lingual
- C. Right glossopharyngeal
- D. Right hypoglossal
- E. Right lingual

Q6. Which nerve is protected by dissecting deep to the investing fascia over the submandibular gland and reflecting the ligated facial vein upward (Hayes Martin manoeuvre)?

- A. Great auricular nerve
- B. Hypoglossal nerve
- C. Lingual nerve
- D. Marginal mandibular branch of the facial nerve
- E. Spinal accessory nerve

Q7. What is the typical selective neck dissection for papillary carcinoma of the thyroid with clinically involved central nodes?

- A. Level I-III
- B. Level II-V
- C. Level V only
- D. Level VI (central compartment)
- E. Radical neck dissection

Answer Key & Explanations

1-B 2-D 3-C 4-E 5-D 6-D 7-D

Q1 — B. A radical neck dissection removes all lymph node levels I-V together with the spinal accessory nerve, internal jugular vein and sternocleidomastoid muscle. The carotid artery, vagus, hypoglossal and phrenic nerves are preserved.

Q2 — D. Injury to the spinal accessory nerve paralyses the trapezius, producing shoulder syndrome: pain, drooping, scapular displacement and weakness of abduction above 90°.

Q3 — C. A milky output on the left after feeding suggests chyle leak from thoracic duct injury. Low-output leaks are managed conservatively with an MCT diet or parenteral nutrition, pressure dressing and possibly octreotide. Persistent high-output leaks need surgical ligation.

Q4 — E. For oral cavity cancer with a clinically N0 neck and a significant risk of occult metastasis, a supraomohyoid selective neck dissection (levels I-III) is used to stage and treat the neck while preserving the SAN, IJV and SCM.

Q5 — D. The genioglossus of the healthy side pushes the tongue towards the paralysed side. Deviation to the right indicates a right hypoglossal nerve injury.

Q6 — D. The marginal mandibular nerve runs superficial to the facial vein in the investing fascia. Ligating the vein low and reflecting it upward protects the nerve; injury causes drooping of the angle of the mouth.

Q7 — D. Papillary thyroid cancer spreads first to the central compartment (level VI), so a central compartment neck dissection is performed with total thyroidectomy when these nodes are involved. Lateral dissection (II-V) is added for lateral nodal disease.

CHAPTER 15

The Thyroid Gland: Goitre, Thyrotoxicosis and Thyroiditis

Learning Objectives

- Revise the surgical anatomy and investigations of the thyroid.
- Classify goitre and manage a multinodular goitre and a solitary thyroid nodule.
- Describe the diagnosis and treatment of thyrotoxicosis, including preoperative preparation.
- Compare the types of thyroiditis.

15.1 Surgical Anatomy

- Two lobes joined by the **isthmus**, which lies over the **2nd-4th tracheal rings**; a **pyramidal lobe** may extend upward (remnant of thyroglossal duct).
- Enclosed in the **pretracheal fascia**, attached to the larynx — so the thyroid **moves on swallowing**.
- **Arteries: superior thyroid** (first branch of external carotid), **inferior thyroid** (thyrocervical trunk of subclavian), thyroidea ima (occasional). **Veins: superior, middle and inferior thyroid veins**.
- **Nerves at risk: recurrent laryngeal nerve (RLN)** in the tracheo-oesophageal groove, related to the inferior thyroid artery (supplies all intrinsic laryngeal muscles except cricothyroid); **external branch of the superior laryngeal nerve (EBSLN)** close to the superior thyroid vessels (supplies cricothyroid).
- Four **parathyroid glands** lie on the posterior surface; their blood supply is mainly from the inferior thyroid artery.

★ EXAM PEARLS

- Ligate the **superior thyroid pedicle close to the gland** (to protect the EBSLN) and the **inferior thyroid artery branches close to the gland** (to protect the RLN and parathyroid blood supply).
- A non-recurrent laryngeal nerve occurs on the **right** side (about 0.5–1%), with an aberrant subclavian artery.

15.2 Investigations of Thyroid Disease

Table 15.1 Thyroid investigations

Test	Purpose
TSH (first-line), free T4, free T3	Thyroid status: low TSH = hyperthyroid; high TSH = hypothyroid
Antibodies	TSH receptor antibodies (TRAb) — Graves'; anti-TPO and anti-thyroglobulin — Hashimoto's
Ultrasound	Nodule size and features (U1-U5 or TIRADS), nodes; guides FNAC
FNAC	Cytology of nodules — Bethesda (or Thy1-Thy5) categories
Isotope scan (Tc-99m / I-123)	Hyperthyroid patients with nodules: "hot" (functioning) vs "cold" nodules; ectopic thyroid
CT neck and chest (non-contrast if RAI planned)	Retrosternal goitre, tracheal compression, invasion
Laryngoscopy	Vocal cord movement — before and after thyroid surgery
Others	Serum calcium, calcitonin (medullary), thyroglobulin (follow-up of differentiated cancer)

Table 15.2 Bethesda system for thyroid cytology

Category	Meaning	Usual action
I	Non-diagnostic	Repeat FNAC under ultrasound
II	Benign	Clinical/ultrasound follow-up
III	Atypia of undetermined significance	Repeat FNAC, molecular testing or lobectomy
IV	Follicular neoplasm	Diagnostic lobectomy
V	Suspicious for malignancy	Surgery
VI	Malignant	Surgery (lobectomy or total thyroidectomy)

15.3 Classification of Goitre

Goitre means enlargement of the thyroid gland.

Table 15.3 Classification of thyroid swellings

Group	Examples
Simple (non-toxic)	Diffuse hyperplastic (physiological — puberty, pregnancy; iodine deficiency), multinodular goitre
Toxic	Graves' disease (diffuse toxic), toxic multinodular goitre , toxic adenoma
Neoplastic	Benign (follicular adenoma), malignant (see Chapter 16)
Inflammatory	Hashimoto's, de Quervain's (subacute), Riedel's, acute suppurative thyroiditis
Others	Amyloid, TB, sarcoid (rare)

15.4 Simple (Non-toxic) Multinodular Goitre

- **Cause: iodine deficiency** (endemic in northern mountainous areas of Pakistan), goitrogens (cabbage, cassava), dyshormonogenesis. Low thyroid hormone → TSH stimulation → diffuse hyperplasia → nodules from repeated cycles of hyperplasia and involution.
- **Clinical:** painless nodular swelling that moves on swallowing; usually **euthyroid**; slow growth; may become toxic in later life.
- **Pressure symptoms:** dyspnoea, stridor (tracheal compression), dysphagia; hoarseness is unusual and suggests malignancy.
- **Retrosternal goitre:** lower border not palpable; tracheal deviation; **Pemberton's sign** (raising both arms causes facial congestion and stridor — thoracic inlet obstruction); CT confirms.
- **Complications:** tracheal compression, secondary thyrotoxicosis, haemorrhage into a nodule (sudden painful enlargement), malignancy (uncommon).

Management

- **Prevention:** iodised salt.
- Small asymptomatic euthyroid goitre: **observation** with ultrasound.
- **Indications for surgery (total thyroidectomy):** **pressure symptoms**, **retrosternal extension**, **suspicion of malignancy** (FNAC), **toxicity**, and **cosmetic** concern.
- Radioactive iodine may reduce size in elderly patients unfit for surgery.

15.5 Solitary Thyroid Nodule

- Most are benign (colloid nodules, cysts, adenomas), but about **5-10% are malignant**.
- **Suspicious features:** extremes of age, male sex, history of **neck irradiation**, family history, rapid growth, hard fixed nodule, **hoarseness** (RLN palsy), lymphadenopathy.
- **Work-up: TSH** → if low, isotope scan (hot nodule is rarely malignant); if normal or high, **ultrasound + FNAC** → manage by Bethesda category.
- **Ultrasound features of malignancy:** solid hypoechoic, irregular margins, **microcalcification**, taller-than-wide shape, central vascularity, abnormal nodes.

15.6 Thyrotoxicosis

Definition: the clinical state resulting from excess circulating thyroid hormones. **Hyperthyroidism** refers to overactivity of the gland itself.

Table 15.4 Features of thyrotoxicosis

System	Features
General	Weight loss despite good appetite, heat intolerance, sweating, fatigue
Cardiovascular	Tachycardia (sleeping pulse raised), palpitations, atrial fibrillation , heart failure, wide pulse pressure
Neuromuscular	Tremor, anxiety, irritability, proximal myopathy, brisk reflexes
GI / reproductive	Diarrhoea; oligomenorrhoea, infertility
Eyes (all types)	Lid retraction, lid lag
Graves' specific	Exophthalmos , ophthalmoplegia, chemosis; pretibial myxoedema ; thyroid acropachy; diffuse goitre with bruit

Table 15.5 Causes of thyrotoxicosis

Cause	Features
Graves' disease (commonest)	Autoimmune — TRAb stimulate TSH receptor; young women; diffuse goitre, eye signs; uniform uptake on scan
Toxic multinodular goitre	Older patients with long-standing goitre; cardiac features dominate; patchy uptake
Toxic adenoma (Plummer's)	Single "hot" nodule with suppressed rest of gland
Thyroiditis, drugs	Transient (de Quervain's, postpartum); amiodarone, excess levothyroxine — low uptake

Treatment options

Table 15.6 Treatment of thyrotoxicosis

Treatment	Notes
β-blockers (propranolol)	Rapid symptom control (tachycardia, tremor) in all patients
Antithyroid drugs	Carbimazole (or methimazole); propylthiouracil in the first trimester of pregnancy and in thyroid storm. 12–18 months for Graves' — about half relapse. Major side effect: agranulocytosis — stop drug and check FBC if sore throat or fever
Radioactive iodine (I-131)	Effective, simple; contraindicated in pregnancy and breastfeeding ; may worsen active eye disease ; causes hypothyroidism
Surgery	Total thyroidectomy for Graves' (large goitre, eye disease, relapse, patient choice, suspicious nodule); lobectomy for toxic adenoma; total thyroidectomy for toxic MNG

Preoperative preparation of the toxic patient

- Make the patient **euthyroid** with antithyroid drugs (usually 6–8 weeks), plus β -blockers.
- **Lugol's iodine** (potassium iodide) for about **10 days** before surgery in Graves' disease — reduces gland vascularity and hormone release.
- Laryngoscopy for vocal cord status; check calcium and vitamin D.

Thyroid Storm (Thyrotoxic Crisis)

- Life-threatening exacerbation: hyperpyrexia, extreme tachycardia/AF, agitation, delirium, vomiting, heart failure.
- Precipitated by surgery or RAI in an unprepared patient, infection, trauma, **dental extraction** in uncontrolled hyperthyroidism.
- Treatment: ICU, cooling, IV fluids, **propranolol**, **propylthiouracil**, then **Lugol's iodine** (1 hour after PTU), **hydrocortisone**, treat the precipitant.

15.7 Thyroiditis

Table 15.7 Types of thyroiditis

Type	Cause / features	Thyroid status	Treatment
Hashimoto's (chronic lymphocytic)	Autoimmune; middle-aged women; firm, rubbery diffuse goitre; anti-TPO positive; risk of thyroid lymphoma	Hypothyroid (may be transiently toxic)	Levothyroxine
de Quervain's (subacute granulomatous)	Post-viral; painful tender goitre , fever, raised ESR; low isotope uptake	Transient thyrotoxicosis → hypothyroid → recovery	NSAIDs, steroids, β -blockers
Riedel's	IgG4-related fibrosis; woody hard goitre fixed to neck structures; mimics anaplastic cancer	Usually euthyroid	Steroids, tamoxifen; isthmusectomy to relieve trachea
Acute suppurative	Bacterial; children (pyriform sinus fistula)	Euthyroid	Antibiotics, drainage

15.8 Dental Relevance

- Uncontrolled thyrotoxicosis: avoid elective treatment; limit adrenaline in local anaesthetic; stress or infection may precipitate a storm.
- Hypothyroidism: delayed eruption of teeth in children, macroglossia; sensitivity to sedatives.
- **Lingual thyroid** (failure of descent) presents as a midline mass at the foramen caecum at the back of the tongue — **never excise without confirming thyroid tissue elsewhere** (isotope scan).

15.9 Chapter Revision Table

Table 15.8 Thyroid at a glance

Point	Remember
First-line thyroid test	TSH
Graves' antibody	TSH receptor antibody (TRAb)
Indications for MNG surgery	Pressure, retrosternal, malignancy suspicion, toxicity, cosmetic
Pemberton's sign	Retrosternal goitre
Carbimazole danger	Agranulocytosis — sore throat
Antithyroid drug in 1st trimester	Propylthiouracil
Lugol's iodine	10 days before surgery for Graves'

Point	Remember
Painful tender goitre after flu	de Quervain's thyroiditis
Woody hard goitre	Riedel's thyroiditis
Hashimoto's risk	Thyroid lymphoma

Chapter MCQs (One Best Answer)

Q1. A 30-year-old woman has weight loss, palpitations, a diffuse goitre with a bruit and bilateral exophthalmos. Which antibody is most specific for her condition?

- A. Anti-nuclear antibody
- B. Anti-thyroglobulin antibody
- C. Anti-TPO antibody
- D. Rheumatoid factor
- E. TSH receptor antibody

Q2. A patient taking carbimazole for 3 weeks develops a severe sore throat and fever. What is the most appropriate immediate action?

- A. Add propranolol
- B. Continue the drug and give antibiotics
- C. Double the dose of carbimazole
- D. Start radioactive iodine
- E. Stop carbimazole and check a full blood count urgently

Q3. A 55-year-old woman with a long-standing multinodular goitre develops facial congestion and stridor when she raises both arms above her head. What does this indicate?

- A. Anaplastic transformation
- B. Bilateral RLN palsy
- C. Retrosternal extension of the goitre
- D. Superior vena cava thrombosis from lung cancer
- E. Thyroid storm

Q4. A woman with Graves' disease, made euthyroid with carbimazole, is scheduled for total thyroidectomy. What is given for about 10 days before surgery to reduce gland vascularity?

- A. Calcium carbonate
- B. Levothyroxine
- C. Lugol's iodine
- D. Prednisolone
- E. Radioactive iodine

Q5. Two weeks after a flu-like illness, a 35-year-old woman develops a painful, tender thyroid swelling, fever, raised ESR and mild thyrotoxicosis. Isotope uptake is very low. What is the diagnosis?

- A. Graves' disease
- B. Hashimoto's thyroiditis
- C. Riedel's thyroiditis
- D. Subacute (de Quervain's) thyroiditis
- E. Toxic adenoma

Q6. A pregnant woman in her first trimester is diagnosed with Graves' disease. Which drug is preferred?

- A. Carbimazole
- B. Levothyroxine
- C. Lugol's iodine long term
- D. Propylthiouracil
- E. Radioactive iodine

- Q7.** A 40-year-old woman has a 2.5 cm solitary thyroid nodule. TSH is normal. What is the most appropriate next investigation?
- A. CT scan of the neck
 - B. Isotope scan
 - C. Open biopsy
 - D. Serum calcitonin only
 - E. Ultrasound with FNAC
- Q8.** During thyroidectomy, ligating the superior thyroid vessels far from the gland risks injury to which nerve, causing loss of high-pitched voice?
- A. External branch of superior laryngeal nerve
 - B. Hypoglossal nerve
 - C. Internal branch of superior laryngeal nerve
 - D. Recurrent laryngeal nerve
 - E. Vagus nerve

Answer Key & Explanations

1-E 2-E 3-C 4-C 5-D 6-D 7-E 8-A

Q1 — E. This is Graves' disease. Stimulating TSH receptor antibodies (TRAb) cause the hyperthyroidism and are specific for Graves'. Anti-TPO antibodies are typical of Hashimoto's thyroiditis but may be present in Graves' too.

Q2 — E. Sore throat or fever on carbimazole may indicate agranulocytosis, a rare but life-threatening side effect. The drug is stopped immediately and an urgent white cell count is checked.

Q3 — C. Pemberton's sign — facial plethora, distended neck veins and stridor on raising the arms — indicates obstruction of the thoracic inlet by a retrosternal goitre. It is an indication for thyroidectomy after CT assessment.

Q4 — C. Lugol's iodine (potassium iodide) given for about 10 days preoperatively reduces the vascularity and size of the Graves' gland and inhibits hormone release (Wolff-Chaikoff effect), making surgery safer.

Q5 — D. De Quervain's thyroiditis follows a viral infection and causes a painful, tender goitre with raised ESR. Release of stored hormone produces transient thyrotoxicosis with low uptake on scan. Treatment is anti-inflammatory drugs, steroids and β -blockers.

Q6 — D. Propylthiouracil is preferred in the first trimester because carbimazole is associated with congenital abnormalities. Radioactive iodine is contraindicated in pregnancy. After the first trimester, many switch to carbimazole because of PTU liver toxicity.

Q7 — E. For a solitary nodule with normal TSH, ultrasound assessment with FNAC is the key investigation. An isotope scan is useful mainly when TSH is suppressed, to identify a hot nodule.

Q8 — A. The external branch of the superior laryngeal nerve runs close to the superior thyroid vessels and supplies the cricothyroid, which tenses the vocal cords. Injury causes voice fatigue and loss of high pitch, important for singers and teachers.

CHAPTER 16

Thyroid Cancer and Complications of Thyroidectomy

Learning Objectives

- Classify thyroid cancers and compare their features.
- Outline the management of differentiated, medullary and anaplastic thyroid cancer.
- Describe the MEN syndromes relevant to the thyroid and their oral signs.
- List and manage the complications of thyroidectomy, especially a neck haematoma.

16.1 Classification and Risk Factors

Table 16.1 Types of thyroid cancer

Type	Approx. frequency	Cell of origin
Papillary	70-80%	Follicular cells (differentiated)
Follicular	10-15%	Follicular cells (differentiated)
Medullary	5-8%	Parafollicular C cells (calcitonin)
Anaplastic	<5%	Undifferentiated follicular cells
Lymphoma	<5%	Lymphocytes (on background of Hashimoto's)

- **Risk factors:** **ionising radiation to the neck** in childhood (papillary), family history and **RET** mutation (medullary, MEN 2), iodine deficiency (follicular, anaplastic), Hashimoto's thyroiditis (lymphoma).
- **Presentation:** thyroid nodule, cervical lymphadenopathy, hoarseness (RLN invasion), dysphagia, stridor, rapidly growing mass (anaplastic, lymphoma).

16.2 Papillary Carcinoma

- Commonest; young adults, women; radiation exposure.
- Often **multifocal**; spreads by **lymphatics** to central (VI) then lateral neck nodes — may present with a neck node (sometimes cystic).
- **Histology:** papillae, "**Orphan Annie eye**" (**ground-glass**) **nuclei**, nuclear grooves and inclusions, **psammoma bodies**. **FNAC is diagnostic**.
- **Prognosis:** excellent — 10-year survival >90%.

16.3 Follicular Carcinoma

- Middle-aged, iodine-deficient areas; usually solitary.
- Spreads via the **bloodstream** to **bones** (pathological fracture) and **lungs**; nodal spread is uncommon.
- **FNAC cannot distinguish** follicular adenoma from carcinoma (Bethesda IV); the diagnosis requires histological evidence of **capsular or vascular invasion** → **diagnostic hemithyroidectomy**.
- Prognosis good, slightly worse than papillary.

Management of differentiated thyroid cancer (papillary and follicular)

- **Surgery:** **lobectomy** for low-risk tumours ≤ 4 cm confined to the gland; **total thyroidectomy** for tumours >4 cm, extrathyroidal extension, nodal or distant metastases, previous neck irradiation, or bilateral disease.

- **Neck:** therapeutic central (VI) and lateral (II–V) neck dissection for involved nodes.
- **Radioactive iodine (I-131) ablation** after total thyroidectomy for higher-risk disease — destroys remnant thyroid and micro-metastases.
- **TSH suppression** with levothyroxine in higher-risk patients (TSH stimulates tumour growth).
- **Follow-up:** serum **thyroglobulin** (tumour marker after total thyroidectomy) and neck ultrasound.

16.4 Medullary Carcinoma

- Arises from **parafollicular C cells**; secretes **calcitonin** and **CEA** (tumour markers); amyloid stroma on histology.
- 75–80% sporadic; 20–25% familial (**RET proto-oncogene**): **MEN 2A**, **MEN 2B**, familial MTC.
- May cause **diarrhoea** and flushing (calcitonin, prostaglandins); early nodal spread.
- **Before surgery, always exclude pheochromocytoma** (plasma/urinary metanephrines) — remove the pheochromocytoma first.
- **Treatment: total thyroidectomy with central neck dissection** ($\pm$ lateral). **Not responsive to radioactive iodine** or TSH suppression. **Prophylactic thyroidectomy** in childhood for **RET** mutation carriers.

Table 16.2 Multiple endocrine neoplasia (MEN) syndromes

Syndrome	Components	Gene
MEN 1	Parathyroid hyperplasia, pancreatic endocrine tumours, pituitary adenoma ("3 Ps")	MEN1 (menin)
MEN 2A	Medullary thyroid cancer , pheochromocytoma, parathyroid hyperplasia	RET
MEN 2B	Medullary thyroid cancer , pheochromocytoma, mucosal neuromas (lips, tongue), marfanoid habitus , intestinal ganglioneuromatosis	RET

★ EXAM PEARLS

- **Dental relevance:** multiple **mucosal neuromas** on the lips and anterior tongue ("bumpy lips") in a tall, thin young patient suggest **MEN 2B** — refer urgently, as medullary thyroid cancer in MEN 2B is aggressive and appears early.

16.5 Anaplastic Carcinoma

- Elderly patients, often with a long-standing goitre; **rapidly growing**, hard, fixed mass with local invasion — stridor, dysphagia, hoarseness.
- Very poor prognosis (median survival measured in **months**).
- **Diagnosis:** core biopsy; test for **BRAF** mutation.
- **Treatment:** mostly palliative — radiotherapy, chemotherapy, targeted therapy (BRAF/MEK inhibitors); surgery only for resectable disease; airway management (tracheal stent; tracheostomy is difficult and often avoided).

16.6 Thyroid Lymphoma

- Older women with **Hashimoto's thyroiditis**; rapidly enlarging goitre with compressive symptoms — mimics anaplastic carcinoma.
- Diagnosis by core biopsy; treated by **chemotherapy $\pm$ radiotherapy** (not surgery); good response.

16.7 Comparison of Thyroid Cancers

Table 16.3 Thyroid cancers at a glance

Feature	Papillary	Follicular	Medullary	Anaplastic
Age	Young	Middle-aged	Any (young in MEN)	Elderly
Spread	Lymphatic	Blood (bone, lung)	Lymphatic and blood	Local invasion
FNAC	Diagnostic	Cannot diagnose	Diagnostic (calcitonin stain)	Diagnostic / core biopsy
Marker	Thyroglobulin	Thyroglobulin	Calcitonin, CEA	—
RAI	Responds	Responds	No	No
Prognosis	Excellent	Good	Intermediate	Very poor

16.8 Complications of Thyroidectomy

Table 16.4 Complications of thyroidectomy

Timing	Complication
Immediate / early	Reactionary haemorrhage → neck haematoma and airway obstruction; laryngeal oedema; RLN palsy (unilateral or bilateral); EBSLN injury; hypocalcaemia ; thyroid storm; tracheomalacia (rare); pneumothorax; wound infection
Late	Hypothyroidism ; permanent hypoparathyroidism; recurrent goitre or hyperthyroidism (subtotal surgery); hypertrophic scar or keloid; voice changes

Neck haematoma — an airway emergency

Usually within the first **6–24 hours**. Bleeding deep to the strap muscles compresses the veins, causing **laryngeal oedema** and airway obstruction even with a modest haematoma.

SCOOP — bedside management of a tense neck haematoma with airway compromise

- **S** — Skin exposure (remove dressings).
- **C** — Cut skin sutures/clips.
- **O** — Open the skin.
- **O** — Open the strap muscles (cut the muscle sutures) to evacuate clot.
- **P** — Pack the wound and return to **theatre** for haemostasis; call for anaesthetic help.

Recurrent laryngeal nerve injury

Table 16.5 Effects of laryngeal nerve injury

Injury	Effect	Management
Unilateral RLN	Hoarse, weak voice; weak cough; aspiration; cord in paramedian position	Often recovers (neuropraxia); speech therapy; medialisation (injection laryngoplasty) if permanent
Bilateral RLN	Both cords near midline → stridor and airway obstruction after extubation; voice may be fairly good	Re-intubation / tracheostomy ; later cordotomy or arytenoidectomy
EBSLN	Loss of high-pitched voice, voice fatigue (cricothyroid paralysis)	Speech therapy

Hypocalcaemia

- Due to **parathyroid injury, devascularisation or removal** after total thyroidectomy; usually within 24–48 hours; transient in most, permanent in a few (<2–3%).
- Features and treatment as in Chapter 4: perioral tingling, Chvostek and Trousseau signs; **IV calcium gluconate** for symptomatic patients, oral calcium and **alfacalcidol**.

- Check serum calcium or PTH on the first postoperative day; inadvertently removed parathyroids can be **autotransplanted** into the sternocleidomastoid.

★ EXAM PEARLS

- After total thyroidectomy every patient needs **lifelong levothyroxine**.
- Always record **vocal cord function by laryngoscopy before thyroid surgery** — a pre-existing cord palsy suggests malignancy and changes surgical planning.

16.9 Chapter Revision Table

Table 16.6 Thyroid cancer at a glance

Point	Remember
Commonest thyroid cancer	Papillary — lymphatic spread, psammoma bodies
FNAC cannot diagnose	Follicular carcinoma (needs capsular/vascular invasion)
Calcitonin and CEA	Medullary carcinoma
Exclude before MTC surgery	Phaeochromocytoma
Mucosal neuromas of lips/tongue	MEN 2B
Rapid hard mass in elderly	Anaplastic (or lymphoma)
Hashimoto's → rapid goitre	Lymphoma — chemotherapy
Follow-up marker for DTC	Thyroglobulin
Stridor after thyroidectomy (no haematoma)	Bilateral RLN palsy
Tense neck haematoma	Open wound at bedside (SCOOP)

Chapter MCQs (One Best Answer)

Q1. A 26-year-old woman who had neck irradiation in childhood has a thyroid nodule and an enlarged ipsilateral jugular node. FNAC shows cells with ground-glass nuclei, nuclear grooves and psammoma bodies. What is the diagnosis?

- A. Anaplastic carcinoma
- B. Follicular carcinoma
- C. Lymphoma
- D. Medullary carcinoma
- E. Papillary carcinoma

Q2. FNAC of a 3 cm thyroid nodule is reported as Bethesda IV (follicular neoplasm). What is the most appropriate management?

- A. Diagnostic hemithyroidectomy (lobectomy)
- B. External beam radiotherapy
- C. Radioactive iodine ablation
- D. Repeat FNAC in 1 year
- E. TSH suppression only

Q3. A 22-year-old tall, thin man has multiple small nodules on his lips and the tip of his tongue, and a thyroid nodule. Serum calcitonin is markedly raised. What must be excluded before thyroid surgery?

- A. Carcinoid tumour
- B. Hyperparathyroidism
- C. Pheochromocytoma
- D. Pituitary adenoma
- E. Pancreatic insulinoma

Q4. A 78-year-old woman has a rapidly enlarging, hard, fixed thyroid mass over 4 weeks, with stridor and hoarseness. What is the most likely diagnosis?

- A. Anaplastic carcinoma
- B. Colloid goitre
- C. Follicular adenoma
- D. Graves' disease
- E. Papillary microcarcinoma

Q5. Four hours after thyroidectomy, a patient becomes restless with stridor, and the neck is tense and swollen. What is the immediate action?

- A. Arrange an urgent CT scan
- B. Give IV calcium gluconate
- C. Give nebulised adrenaline and observe
- D. Open the skin and strap muscle sutures at the bedside
- E. Perform laryngoscopy in clinic next day

Q6. Immediately after extubation following total thyroidectomy, a patient develops stridor and respiratory distress; her voice is relatively normal. There is no neck swelling. What is the most likely cause?

- A. Bilateral recurrent laryngeal nerve palsy
- B. External branch of superior laryngeal nerve injury
- C. Hypocalcaemia
- D. Thyroid storm
- E. Unilateral recurrent laryngeal nerve palsy

Q7. Which tumour marker is used to detect recurrence after total thyroidectomy and radioiodine ablation for papillary carcinoma?

- A. Alpha-fetoprotein
- B. CA 19-9
- C. Calcitonin
- D. Serum thyroglobulin
- E. TSH receptor antibody

Q8. Medullary carcinoma of the thyroid arises from which cells?

- A. Chief cells of the parathyroid
- B. Follicular cells
- C. Hürthle cells
- D. Lymphocytes
- E. Parafollicular C cells

Answer Key & Explanations

1-E 2-A 3-C 4-A 5-D 6-A 7-D 8-E

Q1 — E. Papillary carcinoma is the commonest thyroid cancer, associated with childhood irradiation, spreads to lymph nodes, and shows Orphan Annie (ground-glass) nuclei, nuclear grooves and psammoma bodies. FNAC is diagnostic.

Q2 — A. Cytology cannot distinguish follicular adenoma from carcinoma; carcinoma is defined by capsular or vascular invasion on histology. A diagnostic lobectomy is therefore performed, with completion thyroidectomy if carcinoma is confirmed and the risk profile requires it.

Q3 — C. Mucosal neuromas, marfanoid habitus and medullary thyroid carcinoma indicate MEN 2B. A coexisting pheochromocytoma must be excluded and removed first, otherwise anaesthesia and surgery may provoke a fatal hypertensive crisis.

Q4 — A. Rapid growth of a hard, fixed mass with compressive and invasive symptoms in an elderly patient suggests anaplastic carcinoma, which has a very poor prognosis. Thyroid lymphoma is the main differential and must be excluded by core biopsy.

Q5 — D. A tense neck haematoma after thyroidectomy causes venous congestion, laryngeal oedema and airway obstruction. The wound must be opened at the bedside (skin and strap muscles) to evacuate the clot, then the patient returned to theatre for haemostasis.

Q6 — A. Bilateral RLN palsy leaves both vocal cords in the paramedian position, narrowing the glottis and causing stridor, while the voice may be surprisingly good. Re-intubation or tracheostomy is required.

Q7 — D. After total thyroidectomy and ablation there should be no thyroid tissue producing thyroglobulin. A rising serum thyroglobulin indicates recurrent or metastatic differentiated thyroid cancer. Calcitonin is the marker for medullary carcinoma.

Q8 — E. Medullary carcinoma arises from neural-crest-derived parafollicular C cells, which secrete calcitonin. It does not take up iodine, so radioactive iodine and TSH suppression are ineffective.

CHAPTER 17

The Parathyroid Glands

Learning Objectives

- Revise the embryology, anatomy and physiology of the parathyroid glands.
- Classify hyperparathyroidism into primary, secondary and tertiary.
- Describe the clinical features, including jaw manifestations, investigation and treatment of primary hyperparathyroidism.
- Recognise and treat hypoparathyroidism.

17.1 Anatomy and Physiology

- Usually **four glands** (2 superior, 2 inferior), each about 5 × 3 mm, yellow-brown; supernumerary glands in about 10%.
- **Superior parathyroids** develop from the **4th pharyngeal pouch**; constant position near the cricothyroid junction, posterior to the RLN.
- **Inferior parathyroids** develop from the **3rd pharyngeal pouch** with the **thymus** — they descend further and are more variable in position (may lie in the thymus or mediastinum).
- Blood supply mainly from the **inferior thyroid artery**.

Table 17.1 Actions of parathyroid hormone (PTH)

Target	Action	Net effect
Bone	Stimulates osteoclastic resorption	↑ Calcium and phosphate release
Kidney	↑ Calcium reabsorption; ↓ phosphate reabsorption (phosphaturia); activates vitamin D (1α-hydroxylation)	↑ Serum Ca, ↓ serum phosphate
Gut (via vitamin D)	↑ Calcium absorption	↑ Serum Ca

17.2 Primary Hyperparathyroidism

Definition: autonomous overproduction of PTH from one or more parathyroid glands, causing **hypercalcaemia**. It is the commonest cause of hypercalcaemia in outpatients; middle-aged and elderly women are mostly affected.

Table 17.2 Causes of primary hyperparathyroidism

Cause	Frequency	Note
Single adenoma	80–85%	Focused (minimally invasive) surgery possible
Multigland hyperplasia	10–15%	MEN 1 and MEN 2A; needs exploration of all glands
Double adenoma	2–5%	
Carcinoma	<1%	Very high calcium, palpable neck mass

Clinical features

- Many are **asymptomatic**, found on routine serum calcium.
- **"Bones, stones, abdominal groans, psychic moans and fatigue overtones":**
- **Bones:** pain, osteoporosis, fractures; **osteitis fibrosa cystica** (severe disease).
- **Stones:** renal calculi, nephrocalcinosis, polyuria and polydipsia.
- **Abdominal groans:** constipation, nausea, peptic ulcer, **acute pancreatitis**.
- **Psychic moans:** depression, lethargy, poor concentration, confusion.
- Others: hypertension, short QT interval, muscle weakness.

Jaw and dental features (dental relevance)

- **Loss of the lamina dura** around the teeth on periapical radiographs.
- **Brown tumour** — a radiolucent giant-cell lesion (osteoclastoma-like) of the jaw, histologically identical to central giant cell granuloma; regresses after parathyroidectomy.
- Generalised "ground-glass" appearance of the jaws; loosening of teeth.

★ EXAM PEARLS

- A **giant cell lesion of the jaw** in an adult should prompt a check of **serum calcium and PTH** to exclude a brown tumour of hyperparathyroidism.

Investigations

Table 17.3 Investigations in primary hyperparathyroidism

Test	Finding
Serum calcium (adjusted)	Raised
Serum PTH	Raised or inappropriately normal (should be suppressed in hypercalcaemia)
Serum phosphate	Low or normal
24-hour urinary calcium	Raised/normal — a very low value suggests familial hypocalciuric hypercalcaemia (FHH), which needs no surgery
Vitamin D, renal function	To exclude secondary causes
Bone density (DEXA), renal ultrasound	Osteoporosis, stones
Localisation (only after biochemical diagnosis)	Ultrasound neck + Tc-99m sestamibi scan ; 4D-CT or choline PET in difficult cases
X-rays	Subperiosteal resorption of the radial borders of the middle phalanges, "pepper-pot" skull, loss of lamina dura

Management

- **Parathyroidectomy** is the only cure.
- **Indications:** all **symptomatic** patients; asymptomatic patients with serum calcium >0.25 mmol/L (1 mg/dL) above the upper limit, **age <50**, osteoporosis or fragility fracture, eGFR <60 mL/min, renal stones or hypercalciuria.
- **Operation: focused (minimally invasive) parathyroidectomy** when imaging localises a single adenoma (intraoperative PTH falls by >50% within 10 minutes); **bilateral neck exploration** for non-localised or multigland disease (subtotal 3½-gland excision or total with autotransplantation in hyperplasia).
- **Medical:** hydration; cinacalcet (calcimimetic) and bisphosphonates for patients unfit for surgery.
- **Hypercalcaemic crisis:** IV 0.9% saline, then IV bisphosphonate; calcitonin; urgent surgery.

Complications of parathyroidectomy

- **Hypocalcaemia**, including "**hungry bone syndrome**" (rapid uptake of calcium into demineralised bone) — needs large doses of calcium and alfacalcidol.
- RLN injury, haematoma, persistent or recurrent hyperparathyroidism (missed or ectopic gland).

17.3 Secondary and Tertiary Hyperparathyroidism

Table 17.4 Types of hyperparathyroidism

Type	Cause	Calcium	PTH	Phosphate
Primary	Adenoma, hyperplasia, carcinoma	↑	↑	↓
Secondary	Physiological response to low calcium — chronic kidney disease , vitamin D deficiency, malabsorption	↓ or normal	↑	↑ in CKD; ↓ in vitamin D deficiency
Tertiary	Autonomous glands after long-standing secondary HPT (e.g. after renal transplant)	↑	↑↑	Variable

- **Secondary:** treat the cause — vitamin D, phosphate binders, calcimimetics (cinacalcet); parathyroidectomy if refractory (renal osteodystrophy, calciphylaxis).
- **Tertiary:** parathyroidectomy (subtotal or total with autotransplantation).

17.4 Hypoparathyroidism

- **Causes:** after thyroid or parathyroid surgery (commonest), autoimmune, DiGeorge syndrome (absent 3rd and 4th pouch derivatives), hypomagnesaemia, infiltration.
- **Features of hypocalcaemia:** perioral and digital paraesthesia, cramps, **tetany, carpopedal spasm**, laryngospasm, seizures, prolonged QT; **Chvostek's and Trousseau's signs**. Chronic: cataracts, basal ganglia calcification; in children — **enamel hypoplasia** and delayed eruption.
- **Investigations:** low calcium, high phosphate, **low or inappropriately normal PTH**, magnesium.
- **Treatment:** acute — **10 mL of 10% calcium gluconate IV** slowly; long-term — oral calcium and **activated vitamin D (alfacalcidol or calcitriol)**; correct magnesium; recombinant PTH in refractory cases.

17.5 Chapter Revision Table

Table 17.5 Parathyroid at a glance

Point	Remember
Superior parathyroid origin	4th pharyngeal pouch
Inferior parathyroid origin	3rd pouch (with thymus) — more variable
Commonest cause of primary HPT	Single adenoma (80–85%)
Biochemistry of primary HPT	↑ Ca, ↑ PTH, ↓ phosphate
Jaw signs	Loss of lamina dura, brown tumour
Exclude before surgery	Familial hypocalciuric hypercalcaemia (low urine Ca)
Localisation	Ultrasound + sestamibi scan
Secondary HPT	CKD, low/normal Ca, high PTH
Postoperative severe hypocalcaemia	Hungry bone syndrome
Commonest cause of hypoparathyroidism	Thyroid/parathyroid surgery

Chapter MCQs (One Best Answer)

- Q1.** A 50-year-old woman has recurrent renal stones, constipation and depression. Serum calcium is 2.9 mmol/L, phosphate low and PTH raised. What is the most likely cause?
- A. Familial hypocalciuric hypercalcaemia
 - B. Multiple myeloma
 - C. Parathyroid carcinoma
 - D. Parathyroid hyperplasia
 - E. Single parathyroid adenoma
- Q2.** An OPG of a 45-year-old woman shows a well-defined radiolucency in the mandible and generalised loss of lamina dura. Biopsy shows a giant-cell lesion. Which blood test is most important next?
- A. Alkaline phosphatase only
 - B. Full blood count
 - C. Serum calcium and PTH
 - D. Serum calcitonin
 - E. Thyroid function tests
- Q3.** A patient with chronic kidney disease on dialysis has a low-normal serum calcium, high phosphate and markedly raised PTH. What is the diagnosis?
- A. Hypoparathyroidism
 - B. Primary hyperparathyroidism
 - C. Pseudohypoparathyroidism
 - D. Secondary hyperparathyroidism
 - E. Tertiary hyperparathyroidism
- Q4.** After biochemical confirmation of primary hyperparathyroidism, which combination of tests is used to localise an adenoma before focused surgery?
- A. Barium swallow and chest X-ray
 - B. CT abdomen and bone scan
 - C. MRI brain and pituitary scan
 - D. Neck ultrasound and Tc-99m sestamibi scan
 - E. Thyroid isotope scan and FNAC
- Q5.** Inferior parathyroid glands are more variable in position than the superior glands because they develop from which structure?
- A. First pharyngeal arch
 - B. Fourth pharyngeal pouch
 - C. Second pharyngeal cleft
 - D. Third pharyngeal pouch, together with the thymus
 - E. Thyroglossal duct
- Q6.** Two days after removal of a large parathyroid adenoma, a patient with severe bone disease has profound hypocalcaemia that is difficult to correct. What is the explanation?
- A. Bilateral RLN palsy
 - B. Hungry bone syndrome
 - C. Missed second adenoma
 - D. Recurrent hyperparathyroidism
 - E. Thyroid storm

Q7. A patient with hypercalcaemia and mildly raised PTH has a very low 24-hour urinary calcium and a family history of similar findings. What is the best management?

- A. Bisphosphonates for life
- B. Bilateral neck exploration
- C. Focused parathyroidectomy
- D. No surgery; reassurance
- E. Radiotherapy to the neck

Answer Key & Explanations

1-E 2-C 3-D 4-D 5-D 6-B 7-D

Q1 — E. Hypercalcaemia with raised PTH and low phosphate is primary hyperparathyroidism, caused in 80–85% of cases by a single adenoma. Symptoms include stones, abdominal groans and psychic moans.

Q2 — C. A jaw giant-cell lesion with loss of lamina dura suggests a brown tumour of hyperparathyroidism. Serum calcium and PTH confirm the diagnosis; the lesion often regresses after parathyroidectomy.

Q3 — D. In CKD, phosphate retention and reduced vitamin D activation lower serum calcium, stimulating the parathyroids. Raised PTH with low or normal calcium and high phosphate indicates secondary hyperparathyroidism. Tertiary HPT has high calcium.

Q4 — D. Ultrasound and sestamibi scintigraphy localise parathyroid adenomas, allowing focused minimally invasive parathyroidectomy. Localisation studies are used only after the diagnosis has been made biochemically.

Q5 — D. The inferior parathyroids arise from the third pharyngeal pouch with the thymus and descend further, so they may be found anywhere from the angle of the jaw to the mediastinum. The superior glands arise from the fourth pouch and have a more constant position.

Q6 — B. After parathyroidectomy in patients with marked bone disease, demineralised bone rapidly takes up calcium and phosphate, causing severe, prolonged hypocalcaemia (hungry bone syndrome). Large doses of calcium and activated vitamin D are needed.

Q7 — D. Familial hypocalciuric hypercalcaemia (an inactivating calcium-sensing receptor mutation) mimics primary hyperparathyroidism but has low urinary calcium. It is benign and parathyroidectomy does not cure it.

PART IV

The Salivary Glands

Inflammatory and Obstructive Disorders • Salivary Gland Tumours

CHAPTER 18

Salivary Glands: Inflammatory and Obstructive Disorders

Learning Objectives

- Revise the surgical anatomy of the parotid, submandibular and sublingual glands.
- Choose investigations for salivary gland swellings.
- Describe sialolithiasis, acute and chronic sialadenitis, mumps, Sjögren's syndrome and sialosis.
- Manage a patient with salivary colic.

18.1 Surgical Anatomy

Table 18.1 The major salivary glands

Feature	Parotid	Submandibular	Sublingual
Secretion	Serous	Mixed (mainly serous)	Mainly mucous
Duct	Stensen's duct — opens opposite the upper second molar	Wharton's duct — opens at the sublingual papilla beside the frenulum	Ducts of Rivinus (many small) ± Bartholin's duct
Key relations	Facial nerve divides within the gland (between superficial and deep lobes); retromandibular vein; external carotid artery	Lingual nerve hooks under the duct; hypoglossal nerve; marginal mandibular nerve; facial artery and vein	Lingual nerve, Wharton's duct
Contribution to resting saliva	~25% (most when stimulated)	~ 70%	~5%

- The facial nerve leaves the **stylomastoid foramen**, enters the parotid and divides (pes anserinus) into **five branches**: temporal, zygomatic, buccal, marginal mandibular and cervical.
- Secretomotor (parasympathetic) supply: parotid — glossopharyngeal nerve via the otic ganglion and **auriculotemporal nerve**; submandibular and sublingual — facial nerve via chorda tympani and submandibular ganglion.
- About 600–1000 **minor salivary glands** line the oral cavity, especially the palate, lips and buccal mucosa.

18.2 Investigation of Salivary Disease

Table 18.2 Salivary investigations

Investigation	Use
Ultrasound	First-line: stones, duct dilatation, abscess, tumours; guides FNAC/core biopsy
Plain X-ray (lower occlusal , OPG)	Radio-opaque stones (most submandibular stones)
Sialography	Duct anatomy, strictures, stones, sialectasis ("snowstorm" or "fruit-laden tree") — contraindicated in acute infection
MRI (MR sialography)	Tumours (deep lobe, extent, perineural spread); duct system
CT	Stones, abscess, bone invasion
FNAC / core biopsy	Diagnosis of masses. Open incisional biopsy of the parotid is avoided (seeding, facial nerve injury)
Sialendoscopy	Diagnosis and treatment of stones and strictures
Special	Schirmer test, anti-Ro/La antibodies and labial minor salivary gland biopsy (Sjögren's)

18.3 Sialolithiasis (Salivary Calculi)

Definition: formation of calculi (calcium phosphate and carbonate on an organic matrix) within the salivary ducts or gland.

- **80-90%** occur in the **submandibular gland** because its saliva is more **alkaline**, more **viscous** (mucin), richer in calcium, and its long duct runs **uphill** against gravity.
- About 80% of submandibular stones are **radio-opaque**; most parotid stones are **radiolucent**.

Clinical features

- **Meal-time syndrome (salivary colic):** pain and swelling of the gland at the sight, smell or taste of food, subsiding over 1–2 hours.
- Stone may be **palpable bimanually** in the floor of the mouth along the duct; pus may be expressed from the orifice.
- Recurrent infection → chronic sialadenitis with a firm, enlarged gland.

Investigations

- **Lower occlusal radiograph** (stone in duct), ultrasound (stones in gland, duct dilatation), sialography or sialendoscopy; CT for difficult cases.

Management

- Acute episode: hydration, analgesia, sialogogues (lemon drops), massage, antibiotics if infected.
- **Stone in the anterior duct (palpable): intraoral removal** by incising the duct over the stone (a suture placed behind the stone prevents it slipping back); protect the **lingual nerve**.
- **Stone at the hilum or within the gland** / chronically damaged gland: **sialendoscopy** ($\pm$ lithotripsy), or **excision of the submandibular gland**.
- Parotid stones: sialendoscopy; parotidectomy rarely.

★ EXAM PEARLS

- Submandibular gland excision risks three nerves: **marginal mandibular** (lip droop), **lingual** (tongue numbness) and **hypoglossal** (tongue weakness).

18.4 Acute Suppurative Parotitis

- **Cause:** ascending bacterial infection (***Staphylococcus aureus***, streptococci, anaerobes) when salivary flow is reduced.
- **At risk:** elderly, **dehydrated**, postoperative and debilitated patients, poor oral hygiene, drugs reducing saliva (anticholinergics), stones or strictures.
- **Clinical:** painful, tender, red swelling over the parotid; fever; trismus; **pus expressed from Stensen's duct** on massage. Fluctuation is **late** because of the tough parotid fascia.
- **Investigations:** pus for culture, ultrasound/CT to detect abscess.
- **Management:** **rehydration**, oral hygiene, sialogogues, IV antibiotics (flucloxacillin or co-amoxiclav); **drainage** of an abscess (ultrasound-guided aspiration, or open drainage through a parotidectomy-type incision with blunt dissection parallel to facial nerve branches).
- **Prevention:** adequate hydration and oral care of postoperative patients.

18.5 Viral Parotitis — Mumps

- Paramyxovirus; children (5–15 years); spread by droplets; incubation 2–3 weeks.
- Fever, malaise, **bilateral** (sometimes unilateral) painful parotid swelling; the duct orifice is red but there is **no pus**; raised serum amylase.
- **Complications: orchitis** (post-pubertal males — may cause subfertility), oophoritis, pancreatitis, aseptic meningitis, encephalitis, sensorineural deafness.
- **Treatment:** symptomatic; isolation. **Prevention:** MMR vaccination.

18.6 Chronic and Recurrent Sialadenitis

- **Chronic sialadenitis:** recurrent painful swelling due to obstruction (stones, strictures) and infection; duct ectasia on sialography. Treat the cause, sialendoscopy, gland excision if refractory.
- **Juvenile recurrent parotitis:** recurrent unilateral or bilateral parotid swelling in children, sialectasis; usually resolves by puberty.
- **HIV-associated salivary disease:** bilateral parotid swelling from **lymphoepithelial cysts**; dry mouth.

18.7 Sjögren's Syndrome

- **Definition:** chronic autoimmune lymphocytic infiltration of exocrine glands. **Primary:** dry eyes and mouth (sicca); **secondary:** with a connective tissue disease (rheumatoid arthritis, SLE).
- Middle-aged **women**; **xerostomia** (dental caries, candidiasis, difficulty with dentures), **xerophthalmia**, bilateral parotid enlargement, arthralgia.
- **Investigations: anti-Ro (SS-A) and anti-La (SS-B) antibodies**, rheumatoid factor, ANA; **Schirmer's test** (<5 mm in 5 min); **labial gland biopsy** (focal lymphocytic sialadenitis); sialography (punctate sialectasis).
- **Management:** saliva substitutes, sugar-free gum, pilocarpine, artificial tears, fluoride and meticulous dental care; treat associated disease.
- **Complication:** about **15–40 times** increased risk of **B-cell (MALT) lymphoma** — a new or persistent firm parotid swelling needs biopsy.

18.8 Sialosis (Sialadenosis)

Non-inflammatory, non-neoplastic, **bilateral, painless, symmetrical** enlargement of the parotids due to acinar hypertrophy. Causes: **diabetes, alcoholism**, malnutrition, **bulimia**, cirrhosis, drugs. Treat the underlying cause.

18.9 Chapter Revision Table

Table 18.3 Salivary disorders at a glance

Point	Remember
Stensen's duct opens	Opposite upper second molar
Commonest gland for stones	Submandibular (80–90%), mostly radio-opaque
Meal-time pain and swelling	Duct obstruction (stone)
Sialography contraindicated	Acute infection
Acute suppurative parotitis	Dehydrated elderly; Staph aureus; pus from duct
Mumps complication in men	Orchitis
Sjögren's antibodies	Anti-Ro, anti-La
Sjögren's complication	MALT lymphoma
Bilateral painless parotid enlargement	Sialosis (diabetes, alcohol, bulimia)

Chapter MCQs (One Best Answer)

Q1. A 40-year-old man has recurrent painful swelling below the left angle of the mandible when he eats. A hard object is palpable in the anterior floor of the mouth. Which radiograph is most useful?

- A. Chest X-ray
- B. Lateral skull view
- C. Lower true occlusal view
- D. Occipitomental view
- E. Periapical view of the lower incisors

Q2. Why are salivary calculi most common in the submandibular gland?

- A. Its duct is short and straight
- B. Its saliva is acidic and watery
- C. Its saliva is alkaline and mucinous, and the duct runs uphill
- D. It is supplied by the glossopharyngeal nerve
- E. It produces the least saliva

Q3. A dehydrated 80-year-old man, 4 days after abdominal surgery, develops a painful red swelling over the right parotid with fever. Pus is expressed from the parotid duct. What is the most likely organism?

- A. *Candida albicans*
- B. Mumps virus
- C. *Mycobacterium tuberculosis*
- D. *Staphylococcus aureus*
- E. *Streptococcus mutans*

Q4. A 50-year-old woman has dry eyes, a dry mouth with rampant cervical caries and bilateral parotid enlargement. Which investigation is most specific to confirm the diagnosis?

- A. Labial minor salivary gland biopsy
- B. Serum amylase
- C. Sialography only
- D. Thyroid function tests
- E. Ultrasound of the abdomen

Q5. A patient with long-standing Sjögren's syndrome develops a persistent, firm, enlarging swelling in one parotid. What must be excluded?

- A. Acute parotitis
- B. Lymphoma
- C. Mumps
- D. Pleomorphic adenoma
- E. Sialosis

Q6. During excision of the submandibular gland, which nerve is closely related to Wharton's duct and at risk, causing numbness of the tongue?

- A. Chorda tympani alone
- B. Glossopharyngeal nerve
- C. Hypoglossal nerve
- D. Lingual nerve
- E. Mylohyoid nerve

Q7. A 45-year-old man with poorly controlled diabetes and heavy alcohol intake has painless, soft, bilateral symmetrical parotid enlargement for a year. What is the most likely diagnosis?

- A. Bilateral Warthin's tumours
- B. Mumps
- C. Sialosis
- D. Sjögren's syndrome
- E. Tuberculous parotitis

Answer Key & Explanations

1-C 2-C 3-D 4-A 5-B 6-D 7-C

Q1 — C. Meal-time swelling suggests submandibular duct obstruction by a calculus. Most submandibular stones are radio-opaque and are best shown in the anterior duct on a lower true occlusal radiograph; ultrasound shows stones in the gland.

Q2 — C. Submandibular saliva is more alkaline, more viscous and richer in calcium, and the long Wharton's duct drains against gravity. These factors favour stasis and calculus formation.

Q3 — D. Acute suppurative parotitis in a dehydrated postoperative elderly patient is usually caused by *Staphylococcus aureus* ascending the duct. Treatment is rehydration, oral hygiene, antibiotics and drainage of any abscess.

Q4 — A. In suspected Sjögren's syndrome, labial gland biopsy showing focal lymphocytic sialadenitis is a key diagnostic criterion, together with anti-Ro/La antibodies and Schirmer's test.

Q5 — B. Sjögren's syndrome greatly increases the risk of B-cell (MALT) non-Hodgkin lymphoma. A persistent or enlarging firm parotid swelling requires imaging and biopsy.

Q6 — D. The lingual nerve loops beneath Wharton's duct. Injury during gland excision or intraoral stone removal causes ipsilateral tongue numbness and loss of taste in the anterior two-thirds.

Q7 — C. Sialosis is a non-inflammatory, painless, bilateral enlargement associated with diabetes, alcoholism, malnutrition and bulimia. Management is of the underlying cause.

CHAPTER 19

Salivary Gland Tumours

Learning Objectives

- Know the distribution of benign and malignant tumours in the salivary glands.
- Describe pleomorphic adenoma, Warthin's tumour, mucoepidermoid and adenoid cystic carcinoma.
- Investigate a parotid lump and recognise features of malignancy.
- Describe parotidectomy, the identification of the facial nerve, and the complications including Frey's syndrome.

19.1 Distribution and Classification

Table 19.1 Proportion of malignant tumours by gland

Gland	Share of all salivary tumours	Approx. % malignant
Parotid	~80%	~20-25%
Submandibular	~10-15%	~40-50%
Minor salivary glands	~10%	~50-80%
Sublingual	<1%	>80%

★ EXAM PEARLS

- **The smaller the gland, the greater the chance that a tumour is malignant.**
- **"Rule of 80" for the parotid:** ~80% of salivary tumours are parotid; ~80% of parotid tumours are benign; ~80% of these are pleomorphic adenomas; ~80% of pleomorphic adenomas lie in the superficial lobe.

Table 19.2 Common salivary tumours

Benign	Malignant
Pleomorphic adenoma (commonest overall)	Mucoepidermoid carcinoma (commonest malignant overall, commonest in parotid and in children)
Warthin's tumour (adenolymphoma)	Adenoid cystic carcinoma (commonest in submandibular and minor glands)
Basal cell adenoma, oncocytoma, myoepithelioma	Acinic cell carcinoma, carcinoma ex pleomorphic adenoma, salivary duct carcinoma, polymorphous adenocarcinoma
Haemangioma, lymphangioma (children)	Metastatic SCC/melanoma to parotid nodes (from scalp and face skin), lymphoma

19.2 Pleomorphic Adenoma

- **Definition:** a benign mixed tumour containing both epithelial (myoepithelial) and mesenchymal-like (myxoid, chondroid) elements — hence "pleomorphic".
- Commonest salivary tumour; middle-aged, slightly more women; usually in the **superficial lobe** of the parotid, lying over the angle of the mandible.
- **Clinical:** slow-growing (years), painless, firm/rubbery, lobulated, mobile swelling; **facial nerve function normal**. Deep-lobe tumours may present as a parapharyngeal mass pushing the tonsil medially (dumb-bell tumour).
- **Pathology:** an incomplete pseudocapsule with finger-like **pseudopodia**; therefore **enucleation leads to recurrence**, often multinodular.

- **Malignant change** (carcinoma ex pleomorphic adenoma) in long-standing or recurrent tumours — suspect if a long-standing lump suddenly grows, becomes painful or causes facial weakness.
- **Treatment: superficial parotidectomy** (or partial parotidectomy / extracapsular dissection) with a cuff of normal tissue, preserving the facial nerve; avoid tumour spillage. Minor gland (palate) tumours — wide local excision.

19.3 Warthin's Tumour (Adenolymphoma)

- Second commonest benign parotid tumour; almost exclusively in the **parotid**, usually the **lower pole (tail)**.
- Older men (increasingly women), strongly associated with **smoking; bilateral in about 10%**.
- Soft, cystic, fluctuant swelling.
- **Histology:** double layer of oncocytic epithelium lining cysts with a dense lymphoid stroma.
- Takes up **Tc-99m pertechnetate** ("hot" on scan) because of mitochondria-rich oncocytes.
- **Treatment:** superficial parotidectomy / extracapsular dissection, or observation in elderly patients after confident FNAC diagnosis. Malignant change is extremely rare.

19.4 Malignant Tumours

Table 19.3 Important salivary carcinomas

Tumour	Key features
Mucoepidermoid carcinoma	Commonest salivary malignancy; parotid; also commonest in children ; mucous, epidermoid and intermediate cells; low-grade (good prognosis) to high-grade (aggressive)
Adenoid cystic carcinoma	Commonest in submandibular and minor glands (palate); perineural invasion — pain, facial nerve palsy, numbness; "Swiss-cheese" cribriform pattern; skip lesions along nerves; late lung metastases and late recurrence (10–20 years)
Acinic cell carcinoma	Parotid; women; usually low-grade
Carcinoma ex pleomorphic adenoma	Arises in long-standing or recurrent pleomorphic adenoma; aggressive
Metastatic squamous cell carcinoma	From skin cancers of the scalp, ear and face to parotid lymph nodes — common in sun-exposed elderly

Features suggesting malignancy

- **Facial nerve palsy** (the most reliable clinical sign), **pain, rapid growth**, hard consistency, **fixity** to skin or deep tissues, skin ulceration, **cervical lymphadenopathy**, trismus (pterygoid invasion).

19.5 Investigation of a Salivary Lump

- **Ultrasound with FNAC or core biopsy** — first line.
- **MRI** for deep-lobe tumours, malignancy, perineural spread; CT for bone; CT chest / PET-CT for high-grade malignancy.
- **Open incisional biopsy of the parotid is contraindicated** — it risks tumour seeding and facial nerve injury. Minor salivary (palatal) lesions can be biopsied intraorally.
- Examine the facial nerve, oropharynx (deep lobe), skin of scalp and face, and neck nodes.

19.6 Surgical Treatment

Parotidectomy

- **Superficial parotidectomy:** removal of the parotid tissue superficial to the facial nerve — for most benign tumours of the superficial lobe.
- **Total (conservative) parotidectomy:** superficial and deep lobes with nerve preservation — deep-lobe tumours and many malignancies.
- **Radical parotidectomy:** includes sacrifice of the facial nerve, only when the nerve is **directly invaded**; immediate nerve grafting (great auricular or sural nerve) or reanimation.
- **Incision:** modified Blair ("lazy-S") pre-auricular incision curving under the ear lobe into a neck crease; or facelift incision.
- Neck dissection and **postoperative radiotherapy** for high-grade or advanced malignancy, close margins, perineural invasion.

Table 19.4 Landmarks for identifying the facial nerve trunk

Landmark	Relation to nerve trunk
Tragal pointer (cartilage of external auditory canal)	Nerve lies about 1 cm deep, anterior and inferior to its tip
Posterior belly of digastric	Nerve lies at the same depth, just superior to its attachment to the mastoid
Tympanomastoid suture	Nerve emerges about 6–8 mm deep to the suture (most reliable)
Styloid process	Nerve lies superficial (lateral) to it
Retrograde dissection	Trace a peripheral branch (e.g. marginal mandibular) back to the trunk

Submandibular gland and minor gland tumours

- Submandibular tumours: excision of the gland (benign) or wider excision with level I–III neck dissection (malignant).
- Palatal minor gland tumours: typically at the junction of the hard and soft palate, lateral to the midline; wide local excision including periosteum/bone for malignancy; obturator or flap reconstruction.

19.7 Complications of Parotidectomy

Table 19.5 Complications of parotidectomy

Complication	Details
Facial nerve weakness	Temporary weakness is common (often marginal mandibular branch); permanent palsy is uncommon after benign surgery. Eye care if eye closure is impaired
Frey's syndrome (gustatory sweating)	Sweating and flushing of the cheek skin when eating; cut parasympathetic (auriculotemporal) secretomotor fibres regenerate into sweat glands of the skin flap; diagnosed by Minor's starch-iodine test ; treated with botulinum toxin injections, antiperspirants; prevented by SMAS flap or interposition grafts
Great auricular nerve numbness	Numbness of the ear lobe — almost always some degree
Salivary fistula / sialocele	Collection or leak of saliva; pressure dressing, aspiration, botulinum toxin
Others	Haematoma, infection, skin flap necrosis, hollowing of the face, first-bite syndrome, tumour recurrence

19.8 Chapter Revision Table

Table 19.6 Salivary tumours at a glance

Point	Remember
Commonest salivary tumour	Pleomorphic adenoma
Why enucleation fails	Pseudopodia → recurrence
Older male smoker, lower pole, bilateral 10%	Warthin's tumour (hot on Tc scan)
Commonest salivary malignancy	Mucoepidermoid carcinoma
Perineural spread, late lung metastases	Adenoid cystic carcinoma
Sublingual tumour	Usually malignant
Best clinical sign of malignancy	Facial nerve palsy
Parotid lump investigation	USG + FNAC/core; no open biopsy
Most reliable landmark for facial nerve	Tympanomastoid suture (with tragal pointer)
Gustatory sweating after parotidectomy	Frey's syndrome — botulinum toxin

Chapter MCQs (One Best Answer)

Q1. A 42-year-old woman has a painless, slowly growing, firm, mobile 3 cm swelling in front of the right ear lobe for 4 years. Facial nerve function is normal. What is the most likely diagnosis?

- A. Acinic cell carcinoma
- B. Adenoid cystic carcinoma
- C. Mucoepidermoid carcinoma
- D. Pleomorphic adenoma
- E. Warthin's tumour

Q2. Why is simple enucleation of a pleomorphic adenoma inappropriate?

- A. It always injures the facial nerve
- B. The tumour has pseudopodia extending through an incomplete capsule
- C. The tumour is always malignant
- D. The tumour is radiosensitive
- E. The tumour is very vascular

Q3. A 65-year-old male smoker has a soft, fluctuant swelling at the lower pole of the left parotid; a similar smaller lump is felt on the right. Technetium scan shows increased uptake. What is the diagnosis?

- A. Lymphoma
- B. Mucoepidermoid carcinoma
- C. Pleomorphic adenoma
- D. Sialosis
- E. Warthin's tumour

Q4. A 55-year-old woman has a slow-growing palatal mass with pain and numbness of the upper teeth. Biopsy shows a cribriform ("Swiss-cheese") pattern with perineural invasion. What is the tumour?

- A. Acinic cell carcinoma
- B. Adenoid cystic carcinoma
- C. Ameloblastoma
- D. Pleomorphic adenoma
- E. Squamous cell carcinoma

Q5. A patient with a parotid swelling develops weakness of the ipsilateral face. What does this most strongly suggest?

- A. Bell's palsy unrelated to the lump
- B. Malignant parotid tumour
- C. Pleomorphic adenoma
- D. Sialolithiasis
- E. Warthin's tumour

Q6. Eight months after a superficial parotidectomy, a patient notices sweating and redness of the cheek while eating. What is the mechanism?

- A. Aberrant regeneration of parasympathetic secretomotor fibres into sweat glands
- B. Facial nerve neuroma
- C. Infection of the residual gland
- D. Recurrence of tumour
- E. Salivary fistula

Q7. Which is the best initial investigation of a parotid lump?

- A. Excision biopsy in clinic
- B. Incisional open biopsy
- C. Plain X-ray
- D. Sialography
- E. Ultrasound with fine-needle aspiration or core biopsy

Q8. A tumour in which gland is most likely to be malignant?

- A. Accessory parotid
- B. Parotid
- C. Submandibular
- D. Sublingual
- E. Superficial lobe of parotid

Answer Key & Explanations

1-D 2-B 3-E 4-B 5-B 6-A 7-E 8-D

Q1 — D. A slow-growing, painless, firm, mobile parotid lump with normal facial nerve function in a middle-aged woman is most likely a pleomorphic adenoma, the commonest salivary tumour.

Q2 — B. Pleomorphic adenoma has finger-like pseudopodia protruding through an incomplete pseudocapsule. Enucleation leaves these behind, leading to multinodular recurrence. It is excised with a margin of normal tissue, usually by superficial parotidectomy.

Q3 — E. Warthin's tumour occurs in older smokers, in the parotid tail, may be bilateral (about 10%), is cystic and takes up technetium because of oncocytes.

Q4 — B. Adenoid cystic carcinoma is common in minor salivary glands of the palate and in the submandibular gland. It shows a cribriform pattern, perineural invasion (pain, numbness, nerve palsy) and late lung metastases.

Q5 — B. Benign parotid tumours, even when large, rarely cause facial palsy. Facial nerve weakness associated with a parotid mass strongly suggests malignancy with nerve invasion.

Q6 — A. In Frey's syndrome, divided auriculotemporal parasympathetic fibres to the parotid regenerate into the sweat glands of the overlying skin, so eating triggers gustatory sweating and flushing. Botulinum toxin injection is effective.

Q7 — E. Ultrasound with FNAC or core biopsy is first line. Open incisional biopsy of the parotid risks tumour seeding and facial nerve damage and should be avoided. MRI is added for deep-lobe or malignant lesions.

Q8 — D. The smaller the gland, the higher the proportion of malignant tumours. More than 80% of sublingual gland tumours are malignant, compared with about 20–25% in the parotid.

PART V

The Oesophagus

Dysphagia and Benign Disorders • Carcinoma of the Oesophagus

CHAPTER 20

Dysphagia and Benign Disorders of the Oesophagus

Learning Objectives

- Revise the surgical anatomy of the oesophagus.
- Classify the causes of dysphagia and plan its investigation.
- Describe pharyngeal pouch, achalasia, GORD and Barrett's oesophagus, Plummer-Vinson syndrome and corrosive injury.
- Manage an impacted foreign body such as a denture.

20.1 Surgical Anatomy

- Muscular tube about **25 cm** long, from the **cricopharyngeus at C6** to the gastro-oesophageal junction at **T11**; begins about **15 cm from the upper incisors** and ends about **40 cm** from them.
- Upper third — striated muscle; lower third — smooth muscle; middle — mixed. No serosa (anastomoses leak more easily).
- Upper oesophageal sphincter (cricopharyngeus) and a physiological lower oesophageal sphincter (LOS).

Table 20.1 Normal constrictions (distance from upper incisors)

Site	Distance	Importance
Cricopharyngeus (pharyngo-oesophageal junction)	15 cm	Narrowest point — commonest site of foreign body impaction
Crossing of aortic arch	22.5 cm	Site of foreign body and corrosive injury
Crossing of left main bronchus	27.5 cm	
Diaphragmatic hiatus / LOS	40 cm	Reflux, achalasia

20.2 Dysphagia

Definition: difficulty in swallowing. **Odynophagia** is painful swallowing. **Globus** is a sensation of a lump in the throat without true dysphagia.

Table 20.2 Causes of dysphagia

Group	Examples
Oropharyngeal (difficulty initiating swallow, coughing, nasal regurgitation)	Stroke, motor neurone disease, myasthenia, Parkinson's; oral and pharyngeal cancer, pharyngeal pouch , post-radiotherapy
Oesophageal — in the lumen	Foreign body (food bolus, dentures, coins)
Oesophageal — in the wall	Carcinoma , peptic or corrosive stricture , achalasia , oesophageal web (Plummer-Vinson), eosinophilic oesophagitis, scleroderma, diffuse spasm
Outside the wall	Retrosternal goitre, mediastinal nodes, lung cancer, aortic aneurysm, aberrant right subclavian artery (dysphagia lusoria)

★ EXAM PEARLS

- **Progressive dysphagia, first to solids then to liquids, with weight loss in a patient over 55 is carcinoma until proven otherwise** — urgent endoscopy.
- Dysphagia to **both solids and liquids from the start** suggests a **motility disorder** such as achalasia.

Investigation of dysphagia

Table 20.3 Investigations

Test	Main use
Upper GI endoscopy (OGD) with biopsy	First-line for most oesophageal dysphagia; diagnosis and therapy (dilatation, stent, foreign body removal)
Barium swallow	Pharyngeal pouch (before endoscopy — risk of perforation), achalasia, motility, fistula
High-resolution manometry	Gold standard for achalasia and motility disorders
24-h pH / impedance monitoring	Confirm reflux before antireflux surgery
CT chest/abdomen, EUS, PET-CT	Staging of carcinoma; external compression
FBC, ferritin	Iron deficiency (Plummer-Vinson, bleeding tumour)

20.3 Pharyngeal Pouch (Zenker's Diverticulum)

- **Definition:** a **pulsion diverticulum** of pharyngeal mucosa herniating through **Killian's dehiscence** — a weak area between the **thyropharyngeus** and **cricopharyngeus** parts of the inferior constrictor — due to incoordination/failure of cricopharyngeal relaxation.
- **Patients:** elderly men.
- **Features:** dysphagia, **regurgitation of undigested food** (sometimes hours or days later), **halitosis**, gurgling in the neck, cough and **aspiration pneumonia**, weight loss; swelling on the **left side** of the neck in large pouches.
- **Investigation:** **barium swallow**. Blind endoscopy may perforate the pouch.
- **Treatment:** **endoscopic stapling** (diverticulo-oesophagostomy) or laser; open excision or suspension with **cricopharyngeal myotomy**.
- Rare complication: carcinoma in the pouch.

20.4 Achalasia Cardia

Definition: a primary motility disorder with **failure of relaxation of the LOS** and **absent peristalsis** in the oesophageal body, due to degeneration of ganglion cells in the **myenteric (Auerbach's) plexus**. Chagas' disease (*Trypanosoma cruzi*) produces a similar picture in South America.

- **Features:** young to middle-aged adults; **dysphagia to solids and liquids**, regurgitation (especially at night — aspiration, cough), chest pain, weight loss.
- **Investigations:** **barium swallow** — dilated oesophagus with a smooth tapering "**bird's beak**" at the cardia, absent gastric air bubble, air-fluid level; **manometry** (diagnostic) — incomplete LOS relaxation, aperistalsis; **OGD** to exclude carcinoma at the cardia (**pseudoachalasia**).
- **Treatment:** **laparoscopic Heller's cardiomyotomy** with partial fundoplication; **pneumatic balloon dilatation**; **peroral endoscopic myotomy (POEM)**; botulinum toxin injection for elderly/unfit; calcium-channel blockers or nitrates (limited benefit).
- **Complications:** aspiration pneumonia, malnutrition, and an increased risk of **squamous cell carcinoma**.

20.5 Gastro-oesophageal Reflux Disease and Hiatus Hernia

- **GORD:** reflux of gastric contents causing symptoms or mucosal damage. Due to LOS incompetence, **hiatus hernia** (sliding type commonest), obesity, pregnancy, smoking, alcohol, fatty meals.
- **Features:** **heartburn**, acid regurgitation, waterbrash, odynophagia; chronic cough, hoarseness, asthma.
- **Dental relevance:** **dental erosion**, typically affecting the **palatal surfaces of the upper teeth**, may be the first sign of reflux (also seen in bulimia).
- **Complications:** oesophagitis, **peptic stricture**, ulceration, bleeding, **Barrett's oesophagus**.
- **Investigations:** OGD (oesophagitis, Barrett's, exclude cancer); pH/impedance study and manometry before surgery.
- **Treatment:** lifestyle (weight loss, raise head of bed, avoid late meals, stop smoking); **proton pump inhibitors**; **laparoscopic Nissen fundoplication** for refractory symptoms, large volume reflux or intolerance of medication.

Barrett's oesophagus

Replacement of the normal stratified squamous epithelium of the lower oesophagus by **metaplastic columnar epithelium** (with intestinal metaplasia) due to chronic reflux. It is the main precursor of **oesophageal adenocarcinoma**. Managed by PPIs and **endoscopic surveillance** with biopsies; dysplasia is treated endoscopically (radiofrequency ablation, endoscopic mucosal resection).

20.6 Plummer-Vinson (Paterson-Brown-Kelly) Syndrome

- **Middle-aged women** with **iron-deficiency anaemia** and dysphagia due to a **post-cricoid web**.
- Associated signs: **glossitis**, **angular cheilitis**, koilonychia, pallor — signs a dentist may notice first.
- **Premalignant** — risk of **post-cricoid (hypopharyngeal) carcinoma**.
- **Treatment:** iron replacement; endoscopic dilatation of the web; long-term follow-up.

20.7 Corrosive Injury of the Oesophagus

- Accidental (children) or deliberate ingestion of **alkali** (caustic soda, drain cleaners — deep **liquefactive necrosis**) or **acid** (toilet cleaners — coagulative necrosis, more gastric damage). Common in our setting.
- **Acute features:** burns of lips and mouth, drooling, odynophagia, stridor, chest and abdominal pain; perforation (mediastinitis, peritonitis), shock.
- **Management:** ABC, IV fluids, analgesia, nil by mouth; **do not induce vomiting** or give neutralising agents or nasogastric tube blindly; **early endoscopy (within 24-48 h)** to grade injury; CT for suspected perforation; surgery for perforation/necrosis.
- **Late: stricture** (after 3-8 weeks) — repeated dilatation; oesophageal replacement (colon or gastric conduit) for refractory strictures; long-term risk of **squamous carcinoma**.

20.8 Foreign Bodies and Perforation

- **Foreign bodies:** coins (children), food bolus, fish/chicken bones, button batteries (emergency), and **dentures** in adults — usually impacted at the **cricopharyngeus**.
- **Dental relevance:** partial dentures with metal clasps are dangerous and may be radiolucent if acrylic; advise patients with loose or poorly fitting dentures, and always account for dropped instruments, crowns and extracted teeth during dental procedures (risk of aspiration or ingestion).

- Investigate with soft-tissue lateral neck and chest X-ray (or CT); remove by **flexible or rigid endoscopy**; button batteries require urgent removal.
- **Oesophageal perforation**: commonly **iatrogenic** (endoscopy, dilatation); spontaneous after forceful vomiting (**Boerhaave's syndrome** — **Mackler's triad**: vomiting, chest pain, subcutaneous emphysema). Diagnose with water-soluble contrast swallow or CT; treat with nil by mouth, antibiotics, drainage, stents or surgical repair.

20.9 Chapter Revision Table

Table 20.4 Benign oesophageal disease at a glance

Point	Remember
Narrowest part of oesophagus	Cricopharyngeus, 15 cm from incisors
Pharyngeal pouch site	Killian's dehiscence (thyropharyngeus–cricopharyngeus)
Pouch investigation	Barium swallow (not blind endoscopy)
Bird's beak on barium	Achalasia
Achalasia gold-standard test	Manometry
Achalasia surgery	Laparoscopic Heller's myotomy + fundoplication
Palatal erosion of upper teeth	GORD (or bulimia)
Barrett's oesophagus leads to	Adenocarcinoma
Iron deficiency + web + glossitis	Plummer–Vinson (post-cricoid cancer risk)
Corrosive ingestion	No emetics; endoscopy within 24–48 h

Chapter MCQs (One Best Answer)

- Q1.** A 72-year-old man complains of regurgitating undigested food eaten the previous day, bad breath and gurgling in his neck when he swallows. What is the most appropriate first investigation?
- A. 24-hour pH study
 - B. Barium swallow
 - C. Blind rigid oesophagoscopy
 - D. CT of the chest
 - E. Manometry
- Q2.** A 30-year-old woman has a 2-year history of dysphagia to both solids and liquids, regurgitation at night and weight loss. Barium swallow shows a dilated oesophagus with a smooth "bird's beak" narrowing at the lower end. Which test confirms the diagnosis?
- A. Ambulatory pH monitoring
 - B. CT scan
 - C. High-resolution oesophageal manometry
 - D. Serum ferritin
 - E. Upper GI endoscopy only
- Q3.** A 45-year-old woman has iron-deficiency anaemia, dysphagia for solids, a smooth red tongue and cracks at the corners of her mouth. Endoscopy shows a thin web at the upper oesophagus. Which malignancy is she at increased risk of?
- A. Adenocarcinoma of the lower oesophagus
 - B. Gastric lymphoma
 - C. Parotid carcinoma
 - D. Post-cricoid squamous cell carcinoma
 - E. Thyroid carcinoma
- Q4.** A dentist notices smooth erosion of the palatal surfaces of a 40-year-old man's upper incisors. He reports frequent heartburn. Which condition is most likely responsible?
- A. Achalasia
 - B. Bruxism
 - C. Gastro-oesophageal reflux disease
 - D. Plummer-Vinson syndrome
 - E. Sjögren's syndrome
- Q5.** Barrett's oesophagus predisposes most to which tumour?
- A. Adenocarcinoma of the lower oesophagus
 - B. Gastrointestinal stromal tumour
 - C. Leiomyoma
 - D. Small-cell carcinoma
 - E. Squamous cell carcinoma of the upper oesophagus
- Q6.** A 3-year-old child has swallowed caustic soda (drain cleaner) 2 hours ago. He is drooling and has burns in the mouth. What should NOT be done?
- A. Analgesia
 - B. Endoscopy within 24–48 hours
 - C. Induce vomiting
 - D. Intravenous fluids
 - E. Keep nil by mouth

Q7. An elderly man swallowed his partial upper denture while asleep and now has dysphagia and pain in the neck. At which site is the denture most likely to be impacted?

- A. Cardia of the stomach
- B. Cricopharyngeal sphincter
- C. Crossing of the left main bronchus
- D. Diaphragmatic hiatus
- E. Pylorus

Answer Key & Explanations

1-B 2-C 3-D 4-C 5-A 6-C 7-B

Q1 — B. This is a pharyngeal pouch (Zenker's diverticulum). A barium swallow confirms the diagnosis safely. Endoscopy without knowledge of the pouch risks perforation, because the scope tends to enter the pouch rather than the oesophagus.

Q2 — C. The history and barium appearance suggest achalasia. Manometry confirms it by showing failure of LOS relaxation and absent peristalsis. Endoscopy is also needed to exclude malignancy at the cardia (pseudoachalasia).

Q3 — D. Plummer-Vinson syndrome (iron deficiency, post-cricoid web, glossitis, angular cheilitis) is premalignant and predisposes to post-cricoid (hypopharyngeal) squamous cell carcinoma.

Q4 — C. Intrinsic acid from gastro-oesophageal reflux (or vomiting in bulimia) erodes the palatal surfaces of the upper teeth. Dental erosion may be the first sign; refer for medical assessment and endoscopy.

Q5 — A. Barrett's oesophagus is columnar (intestinal) metaplasia of the lower oesophagus due to chronic reflux and is the main precursor of oesophageal adenocarcinoma. Surveillance endoscopy is recommended.

Q6 — C. Inducing vomiting re-exposes the oesophagus and mouth to the corrosive and risks aspiration and perforation. Management is supportive (airway, fluids, analgesia, nil by mouth) with early endoscopy to grade the injury.

Q7 — B. The cricopharyngeus, about 15 cm from the incisors, is the narrowest part of the oesophagus and the commonest site of foreign body impaction. Dentures with clasps require early endoscopic removal.

CHAPTER 21

Carcinoma of the Oesophagus

Learning Objectives

- Compare squamous cell carcinoma and adenocarcinoma of the oesophagus.
- Recognise the clinical presentation and plan investigation and staging.
- Outline curative and palliative treatment.
- List complications of oesophagectomy.

21.1 Types and Risk Factors

Table 21.1 Squamous cell carcinoma versus adenocarcinoma

Feature	Squamous cell carcinoma	Adenocarcinoma
Frequency	Commonest worldwide and in South Asia	Commonest in Western countries; rising
Site	Upper and middle thirds	Lower third and gastro-oesophageal junction
Risk factors	Smoking, alcohol, very hot drinks, nitrosamines, betel/areca, achalasia, corrosive stricture, Plummer-Vinson , tylosis, previous head and neck SCC	GORD, Barrett's oesophagus , obesity, male sex, smoking
Spread	Local, lymphatic (cervical, mediastinal nodes), blood	Local, lymphatic (coeliac nodes), blood (liver)

21.2 Clinical Features

- **Progressive dysphagia** — first to solids, then soft food, then liquids (symptoms appear late, when much of the lumen is involved).
- **Weight loss** and anorexia; odynophagia; regurgitation and aspiration.
- **Signs of advanced disease:** hoarseness (**left recurrent laryngeal nerve** invasion), cough on swallowing (**tracheo-oesophageal fistula**), haematemesis, supraclavicular nodes (Virchow's node), hepatomegaly, Horner's syndrome, bone pain.
- Iron-deficiency anaemia from chronic blood loss.

21.3 Investigations and Staging

Table 21.2 Investigation of oesophageal cancer

Purpose	Investigation
Diagnosis	Upper GI endoscopy (OGD) with multiple biopsies — first-line
Distant spread (M)	CT chest, abdomen and pelvis; PET-CT for patients considered for curative treatment
Depth of invasion (T) and nodes (N)	Endoscopic ultrasound (EUS) ± FNA of nodes
Airway involvement (upper/middle third)	Bronchoscopy
Peritoneal spread (junctional tumours)	Staging laparoscopy
Fitness for surgery	Lung function, echocardiography, cardiopulmonary exercise testing, nutritional assessment
Barium swallow	Irregular "rat-tail" or "apple-core" stricture with shouldering (useful if endoscopy is not possible)

21.4 Management

Decisions are made by a **multidisciplinary team**. Only about one-third of patients are suitable for curative treatment at presentation.

Curative treatment

- **Early tumours** (T1a, confined to mucosa): **endoscopic mucosal resection** or submucosal dissection.
- **Locally advanced resectable tumours: neoadjuvant chemoradiotherapy** (e.g. CROSS regimen) or **perioperative chemotherapy** (e.g. FLOT for adenocarcinoma), followed by **oesophagectomy**.
- **Definitive chemoradiotherapy** for SCC of the **upper third / cervical oesophagus** and for patients unfit for surgery; SCC is more radiosensitive than adenocarcinoma.

Table 21.3 Types of oesophagectomy

Operation	Approach	Anastomosis
Ivor Lewis (two-stage)	Laparotomy (or laparoscopy) + right thoracotomy	Intrathoracic
McKeown (three-stage)	Right thoracotomy + laparotomy + neck incision	Cervical
Transhiatal	Laparotomy + neck (no thoracotomy)	Cervical
Minimally invasive	Thoracoscopic and laparoscopic (or robotic)	Either

The stomach is usually used as the replacement conduit (gastric tube); colon or jejunum are alternatives.

Complications of oesophagectomy

- **Anastomotic leak** (more serious when intrathoracic — mediastinitis), conduit necrosis.
- **Pulmonary complications** — pneumonia, ARDS (commonest cause of death).
- **Chylothorax** (thoracic duct injury), **recurrent laryngeal nerve palsy** (cervical anastomosis), atrial fibrillation.
- Late: anastomotic stricture, reflux, dumping, delayed gastric emptying, weight loss.

Palliative treatment

- Aim: relieve **dysphagia**, maintain nutrition and quality of life.
- **Self-expanding metal stent** (also seals a tracheo-oesophageal fistula); external beam radiotherapy or **brachytherapy**; palliative chemotherapy and immunotherapy; endoscopic laser or dilatation.
- Nutritional support (feeding jejunostomy, nasogastric feeding), analgesia, palliative care.

★ EXAM PEARLS

- Overall 5-year survival is poor (about 15–20%) because most patients present late with advanced disease.
- The **left recurrent laryngeal nerve** (hooks around the aortic arch) is the nerve usually involved by middle-third tumours — causing hoarseness, a sign of unresectability in many cases.

21.5 Chapter Revision Table

Table 21.4 Oesophageal cancer at a glance

Point	Remember
Commonest type in South Asia	Squamous cell carcinoma (upper/middle third)
Adenocarcinoma precursor	Barrett's oesophagus
Classic symptom	Progressive dysphagia, solids → liquids, weight loss

Point	Remember
First investigation	OGD with biopsy
T and N staging	Endoscopic ultrasound
Distant metastases	CT ± PET-CT
Barium appearance	Irregular shouldered (apple-core / rat-tail) stricture
Ivor Lewis	Laparotomy + right thoracotomy
Cervical SCC	Definitive chemoradiotherapy
Palliation of dysphagia	Self-expanding metal stent

Chapter MCQs (One Best Answer)

- Q1.** A 62-year-old man who smokes and drinks very hot tea has progressive dysphagia, first to solids and now to liquids, with 9 kg weight loss over 3 months. What is the most appropriate first investigation?
- A. Barium meal and follow-through
 - B. Chest X-ray
 - C. Oesophageal manometry
 - D. PET-CT scan
 - E. Upper GI endoscopy with biopsy
- Q2.** A 58-year-old man with long-standing heartburn and obesity is found to have a tumour at the gastro-oesophageal junction. What is the most likely histological type?
- A. Adenocarcinoma
 - B. Gastrointestinal stromal tumour
 - C. Leiomyosarcoma
 - D. Lymphoma
 - E. Squamous cell carcinoma
- Q3.** A patient with carcinoma of the middle third of the oesophagus develops hoarseness. Which nerve is most likely involved?
- A. External branch of superior laryngeal nerve
 - B. Left recurrent laryngeal nerve
 - C. Phrenic nerve
 - D. Right recurrent laryngeal nerve
 - E. Vagus nerve below the hilum
- Q4.** Which investigation is most accurate for assessing the depth of tumour invasion (T stage) and regional nodes in oesophageal cancer?
- A. Barium swallow
 - B. Bronchoscopy
 - C. Chest X-ray
 - D. Endoscopic ultrasound
 - E. Staging laparoscopy
- Q5.** A patient with inoperable oesophageal carcinoma coughs whenever he drinks water. A tracheo-oesophageal fistula is confirmed. What is the best palliative treatment?
- A. Feeding gastrostomy alone
 - B. Laser therapy
 - C. Oesophagectomy
 - D. Repeated dilatation
 - E. Self-expanding covered metal stent
- Q6.** Which of the following is NOT a recognised risk factor for squamous cell carcinoma of the oesophagus?
- A. Achalasia
 - B. Barrett's oesophagus
 - C. Corrosive stricture
 - D. Plummer-Vinson syndrome
 - E. Smoking

Q7. An Ivor Lewis oesophagectomy is performed through which approach?

- A. Left thoracoabdominal incision only
- B. Laparotomy and neck incision only
- C. Laparotomy and right thoracotomy
- D. Neck incision only
- E. Right thoracotomy, laparotomy and neck incision

Answer Key & Explanations

1-E 2-A 3-B 4-D 5-E 6-B 7-C

Q1 — E. Progressive dysphagia with weight loss in an older patient suggests oesophageal carcinoma. Upper GI endoscopy with biopsy is the first-line investigation for diagnosis; staging follows.

Q2 — A. Chronic reflux, Barrett's oesophagus and obesity predispose to adenocarcinoma of the lower oesophagus and gastro-oesophageal junction. Squamous cell carcinoma usually affects the upper and middle thirds.

Q3 — B. The left recurrent laryngeal nerve loops under the aortic arch in the mediastinum, close to the middle third of the oesophagus. Its invasion causes hoarseness and usually indicates locally advanced disease.

Q4 — D. Endoscopic ultrasound shows the layers of the oesophageal wall and nearby lymph nodes, allowing accurate T and N staging, and permits FNA of suspicious nodes. CT and PET-CT are used for distant metastases.

Q5 — E. A covered self-expanding metal stent relieves dysphagia and seals the tracheo-oesophageal fistula, preventing aspiration. Dilatation would worsen the fistula.

Q6 — B. Barrett's oesophagus predisposes to adenocarcinoma, not squamous cell carcinoma. Smoking, alcohol, achalasia, corrosive strictures, Plummer-Vinson syndrome and hot drinks are risk factors for SCC.

Q7 — C. The Ivor Lewis operation is a two-stage oesophagectomy through an abdominal approach (to mobilise the stomach) and a right thoracotomy, with an intrathoracic anastomosis. The McKeown operation adds a neck incision.

MOCK EXAMINATIONS

Two complete practice papers in the UHS/professional examination style,
with answer keys and model SEQ answers

Mock Paper 1

Instructions

- **Section A:** 30 One-Best-Answer MCQs — 30 marks — 45 minutes.
- **Section B:** 6 Short Essay Questions (SEQs) — 5 marks each, 30 marks — 1 hour 30 minutes.
- Attempt all questions. Write SEQ answers in a logical order: definition, features, investigations, management, complications.
- Answer keys and model SEQ answers are given at the end of both papers — attempt the paper first under exam conditions.

Section A — MCQs (One Best Answer)

1. A clean laceration of the cheek presents 3 hours after injury. What is the usual upper limit of the "golden period" within which primary closure is considered safe?
 - A. 1 hour
 - B. 6 hours
 - C. 24 hours
 - D. 48 hours
 - E. 7 days
2. A diabetic man has rapidly spreading necrosis of the scrotal and perineal skin with crepitus and toxaemia. What is this condition called?
 - A. Carbuncle
 - B. Erysipelas
 - C. Fournier's gangrene
 - D. Gas gangrene of muscle
 - E. Pyoderma gangrenosum
3. In an emergency when the blood group is unknown, which red cells may be transfused to a woman of child-bearing age?
 - A. A negative
 - B. AB positive
 - C. B positive
 - D. O negative
 - E. O positive
4. A patient with septic shock remains hypotensive (MAP 55 mmHg) after 30 mL/kg of crystalloid. Which drug is the first-line vasopressor?
 - A. Adrenaline
 - B. Dobutamine
 - C. Dopamine
 - D. Noradrenaline
 - E. Vasopressin
5. A 70 kg man has lost about 1 litre of blood after a fall. Which finding is most expected?
 - A. Anuria
 - B. Confusion and lethargy
 - C. Pulse 110/min with narrowed pulse pressure and normal systolic BP
 - D. Pulse 150/min with systolic BP 60 mmHg
 - E. Respiratory rate >35/min

- 6.** Hartmann's solution contains an anion that is converted by the liver into bicarbonate. Which is it?
- A. Acetate
 - B. Chloride
 - C. Citrate
 - D. Gluconate
 - E. Lactate
- 7.** A patient with prolonged nasogastric aspiration has muscle weakness and abdominal distension. Which ECG change is typical of his likely electrolyte disturbance?
- A. Delta waves
 - B. J waves
 - C. Peaked T waves
 - D. Short QT interval
 - E. U waves
- 8.** A patient on warfarin with INR 6.5 has life-threatening bleeding. What is the best immediate reversal?
- A. Fresh frozen plasma alone
 - B. Oral vitamin K only
 - C. Platelet transfusion
 - D. Protamine sulphate
 - E. Prothrombin complex concentrate with IV vitamin K
- 9.** What is the minimum fasting period for breast milk before elective general anaesthesia in an infant?
- A. 1 hour
 - B. 2 hours
 - C. 4 hours
 - D. 6 hours
 - E. 8 hours
- 10.** Eight days after hip surgery, a patient has a swollen, tender calf. What is the investigation of choice?
- A. CT pulmonary angiography
 - B. D-dimer alone
 - C. Duplex ultrasound of the leg veins
 - D. Plain X-ray of the leg
 - E. Venography in all cases
- 11.** Which technique is most widely used for repair of a unilateral cleft lip?
- A. Abbe flap
 - B. Furlow double-opposing Z-plasty
 - C. Millard rotation-advancement
 - D. Veau-Wardill-Kilner pushback
 - E. Von Langenbeck repair
- 12.** A child with a cleft lip and palate has bilateral pits on the lower lip; her father has similar pits. Which syndrome is this?
- A. DiGeorge
 - B. Down
 - C. Pierre Robin
 - D. Treacher Collins
 - E. Van der Woude

- 13.** Which space is NOT part of the classical description of Ludwig's angina?
- A. Left submandibular
 - B. Parotid
 - C. Right submandibular
 - D. Sublingual
 - E. Submental
- 14.** Leukoplakia is best described as:
- A. A clinical term for a white patch not attributable to any other definable lesion
 - B. A histological diagnosis of dysplasia
 - C. A red velvety patch
 - D. A white patch caused by candida that wipes off
 - E. Always malignant
- 15.** Which constituent of areca nut is chiefly responsible for fibroblast stimulation in oral submucous fibrosis?
- A. Arecoline
 - B. Capsaicin
 - C. Nicotine
 - D. Nitrosamine from tobacco only
 - E. Tannic acid alone
- 16.** In Pakistan, which site within the oral cavity is most commonly affected by squamous cell carcinoma?
- A. Buccal mucosa and gingivobuccal sulcus
 - B. Floor of mouth
 - C. Hard palate
 - D. Tip of tongue
 - E. Upper lip
- 17.** After segmental mandibulectomy for oral cancer, which is the most commonly used free flap to reconstruct the mandible?
- A. Anterolateral thigh
 - B. Fibula
 - C. Latissimus dorsi
 - D. Pectoralis major
 - E. Radial forearm
- 18.** After enucleation of an odontogenic keratocyst, which adjunct is used to reduce recurrence?
- A. Antibiotic packing only
 - B. Carnoy's solution / peripheral ostectomy
 - C. Hydrogen peroxide rinse
 - D. Radiotherapy
 - E. Steroid injection
- 19.** In which region is ameloblastoma most commonly found?
- A. Anterior maxilla
 - B. Condyle
 - C. Mandibular symphysis
 - D. Maxillary sinus
 - E. Posterior body and ramus of mandible

- 20.** Which statement about a thyroglossal fistula is correct?
- A. It is always congenital
 - B. It is always acquired, after infection or incomplete removal of a cyst
 - C. It opens into the tonsillar fossa
 - D. It lies at the anterior border of the SCM
 - E. It never recurs
- 21.** Nodes between the cricoid cartilage and the clavicle along the internal jugular vein belong to which level?
- A. Level Ib
 - B. Level II
 - C. Level III
 - D. Level IV
 - E. Level VI
- 22.** In tuberculous lymphadenitis, a "collar-stud abscess" refers to:
- A. A calcified node
 - B. An abscess in the retropharyngeal space
 - C. Matted nodes without pus
 - D. Pus that has burst through the deep fascia, forming two communicating cavities
 - E. A sinus with undermined edges
- 23.** A "type III" modified radical (functional) neck dissection preserves which structures?
- A. IJV only
 - B. SAN only
 - C. SAN and IJV only
 - D. SAN, IJV and SCM
 - E. SCM only
- 24.** Which treatment for Graves' disease is absolutely contraindicated in pregnancy?
- A. Beta-blockers short term
 - B. Propylthiouracil
 - C. Radioactive iodine
 - D. Total thyroidectomy in the second trimester
 - E. Carbimazole after the first trimester
- 25.** Papillary thyroid carcinoma spreads mainly by which route?
- A. Blood to bone
 - B. Blood to lung
 - C. Direct invasion only
 - D. Lymphatics
 - E. Transcoelomic
- 26.** After total thyroidectomy, inflating a BP cuff above systolic pressure for 3 minutes causes flexion of the wrist and fingers. What is this sign?
- A. Battle's sign
 - B. Chvostek's sign
 - C. Kernig's sign
 - D. Tinel's sign
 - E. Trousseau's sign

27. The superior parathyroid glands develop from which pharyngeal pouch?

- A. First
- B. Second
- C. Third
- D. Fourth
- E. Fifth

28. The parotid (Stensen's) duct opens into the mouth opposite which tooth?

- A. Lower first molar
- B. Lower second premolar
- C. Upper canine
- D. Upper second molar
- E. Upper third molar

29. Which parotid tumour characteristically shows increased uptake on a technetium-99m pertechnetate scan?

- A. Acinic cell carcinoma
- B. Adenoid cystic carcinoma
- C. Mucoepidermoid carcinoma
- D. Pleomorphic adenoma
- E. Warthin's tumour

30. Achalasia results from degeneration of ganglion cells in which structure?

- A. Auerbach's (myenteric) plexus
- B. Coeliac ganglion
- C. Meissner's (submucosal) plexus
- D. Phrenic nerve
- E. Stellate ganglion

Section B — Short Essay Questions

Q1. A 35-year-old man presents with bilateral submandibular swelling, raised floor of mouth and difficulty breathing one week after toothache in a lower molar.

- a) What is the most likely diagnosis? Define it. (1)
- b) List the clinical features. (2)
- c) Outline the management. (2)

Q2. A 25-year-old motorcyclist is brought to the emergency department after a road traffic accident with a pulse of 130/min and BP 85/60 mmHg.

- a) Classify haemorrhagic shock (ATLS classes). (2)
- b) Outline the initial management of this patient. (3)

Q3. A 30-year-old man who chews gutka complains of burning in the mouth and progressive difficulty in opening his mouth.

- a) What is the likely diagnosis and its aetiology? (1)
- b) Describe the clinical features. (2)
- c) Outline the management. (2)

Q4. A 10-year-old girl has a midline neck swelling that moves upward on protrusion of the tongue.

- a) What is the diagnosis? Describe its embryological basis. (2)
- b) Which investigation is essential before surgery and why? (1)
- c) Name and describe the operation of choice. (2)

Q5. A 40-year-old woman has undergone total thyroidectomy for multinodular goitre.

- a) List the complications of thyroidectomy. (3)
- b) How will you diagnose and manage postoperative hypocalcaemia? (2)

Q6. A 45-year-old woman has a slowly growing painless swelling in front of the ear for five years.

- a) What is the most likely diagnosis? (1)
- b) How will you investigate her? (1)
- c) Outline the treatment and why enucleation is avoided. (2)
- d) What is Frey's syndrome? (1)

Mock Paper 2

Instructions

- **Section A:** 30 One-Best-Answer MCQs — 30 marks — 45 minutes.
- **Section B:** 6 Short Essay Questions (SEQs) — 5 marks each, 30 marks — 1 hour 30 minutes.
- Attempt all questions. Write SEQ answers in a logical order: definition, features, investigations, management, complications.
- Answer keys and model SEQ answers are given at the end of both papers — attempt the paper first under exam conditions.

Section A — MCQs (One Best Answer)

1. Which white cell count fulfils a criterion for SIRS?
 - A. 6 000/mm³
 - B. 8 000/mm³
 - C. 10 000/mm³
 - D. 11 000/mm³
 - E. 13 000/mm³
2. A farmer with a deep, soil-contaminated wound does not know his tetanus immunisation history. What is the correct prophylaxis?
 - A. Antibiotics only
 - B. Nothing if the wound is cleaned
 - C. Tetanus immunoglobulin only
 - D. Tetanus toxoid only
 - E. Tetanus toxoid plus human tetanus immunoglobulin
3. A stab wound to the chest causes hypotension, distended neck veins and muffled heart sounds. What is the diagnosis?
 - A. Cardiac tamponade
 - B. Haemothorax
 - C. Neurogenic shock
 - D. Septic shock
 - E. Tension pneumothorax
4. A patient in DIC is bleeding with prolonged PT and APTT. Which product replaces most coagulation factors?
 - A. Albumin
 - B. Cryoprecipitate alone
 - C. Fresh frozen plasma
 - D. Packed red cells
 - E. Vitamin K
5. Transfusion-related acute lung injury (TRALI) characteristically develops within how long of transfusion?
 - A. 6 hours
 - B. 3 days
 - C. 1 week
 - D. 2 weeks
 - E. 1 month

- 6.** A shocked patient has pH 7.21, PaCO_2 3.8 kPa, HCO_3^- 13 mmol/L and lactate 6 mmol/L. What is the disorder?
- A. Metabolic acidosis with respiratory compensation
 - B. Metabolic alkalosis
 - C. Normal ABG
 - D. Respiratory acidosis
 - E. Respiratory alkalosis
- 7.** Which patient is ASA III?
- A. Brain-dead organ donor
 - B. Fit 25-year-old
 - C. Moribund patient with ruptured aneurysm
 - D. Patient with well-controlled hypertension
 - E. Patient with poorly controlled diabetes and stable angina
- 8.** Before a major elective operation with high bleeding risk, how long beforehand should clopidogrel normally be stopped (where safe)?
- A. 12 hours
 - B. 24 hours
 - C. 3 days
 - D. 7 days
 - E. 1 month
- 9.** A scar remains confined to the original incision, is raised and red, and gradually improves over a year. What is it?
- A. Contracture
 - B. Hypertrophic scar
 - C. Keloid
 - D. Marjolin's ulcer
 - E. Stitch abscess
- 10.** What is the commonest respiratory complication after abdominal surgery?
- A. ARDS
 - B. Atelectasis
 - C. Lung abscess
 - D. Pleural effusion
 - E. Pulmonary embolism
- 11.** In alveolar bone grafting for cleft alveolus, bone is most commonly harvested from:
- A. Calvarium
 - B. Fibula
 - C. Iliac crest
 - D. Mandibular symphysis only
 - E. Rib
- 12.** A child with a repaired cleft palate has persistent hypernasal speech due to velopharyngeal insufficiency despite speech therapy. Which operation may be indicated?
- A. Alveolar bone graft
 - B. Le Fort I osteotomy
 - C. Millard repair
 - D. Pharyngoplasty
 - E. Tonsillectomy

- 13.** In chronic osteomyelitis of the mandible, a radiodense fragment of dead bone surrounded by a radiolucent zone is called:
- A. Cloaca
 - B. Involucrum
 - C. Osteophyte
 - D. Sequestrum
 - E. Torus
- 14.** Which oral white lesion can be wiped off, leaving a red base?
- A. Frictional keratosis
 - B. Hairy leukoplakia
 - C. Homogeneous leukoplakia
 - D. Lichen planus
 - E. Pseudomembranous candidiasis
- 15.** A carcinoma of the lower alveolus that invades through the cortical bone of the mandible is staged as:
- A. T1
 - B. T2
 - C. T3
 - D. T4a
 - E. T4b
- 16.** Squamous cell carcinoma of the lip most commonly affects:
- A. Commissure only
 - B. Lower lip
 - C. Philtrum
 - D. Upper lip
 - E. Equally upper and lower lips
- 17.** A 15-year-old has a radiolucent lesion in the mandible that scallops between the roots of vital teeth. At surgery the cavity is empty. What is it?
- A. Ameloblastoma
 - B. Dentigerous cyst
 - C. Odontogenic keratocyst
 - D. Radicular cyst
 - E. Simple (solitary) bone cyst
- 18.** A ranula that extends into the neck to present as a submandibular swelling has passed through or around which muscle?
- A. Buccinator
 - B. Digastric (posterior belly)
 - C. Genioglossus
 - D. Mylohyoid
 - E. Platysma
- 19.** What is the preferred first-line treatment for a large macrocystic lymphatic malformation (cystic hygroma) of the neck in an infant without airway compromise?
- A. Incision and drainage
 - B. Observation only
 - C. Radiotherapy
 - D. Radical neck dissection
 - E. Sclerotherapy (e.g. OK-432, bleomycin)

- 20.** In an adult over 40 years, a non-thyroid neck lump is malignant in roughly what proportion of cases?
- A. 5%
 - B. 20%
 - C. 50%
 - D. 80%
 - E. 100%
- 21.** Which of the following is a "B symptom" of lymphoma?
- A. Alcohol-induced pain
 - B. Drenching night sweats
 - C. Generalised itching
 - D. Hoarseness
 - E. Splenomegaly
- 22.** After neck dissection a patient has ptosis, a small pupil and loss of sweating on the same side of the face. Which structure was injured?
- A. Cervical sympathetic chain
 - B. Facial nerve
 - C. Hypoglossal nerve
 - D. Oculomotor nerve
 - E. Phrenic nerve
- 23.** Which is NOT an accepted indication for surgery in a multinodular goitre?
- A. Compression of the trachea
 - B. Cosmetic concern
 - C. Retrosternal extension
 - D. Suspicion of malignancy on FNAC
 - E. Small asymptomatic euthyroid goitre with benign cytology
- 24.** A middle-aged woman has a stony-hard goitre fixed to surrounding neck structures; biopsy shows dense fibrosis with IgG4-positive plasma cells. What is the diagnosis?
- A. Anaplastic carcinoma
 - B. de Quervain's thyroiditis
 - C. Graves' disease
 - D. Hashimoto's thyroiditis
 - E. Riedel's thyroiditis
- 25.** Which combination makes up MEN 2A?
- A. Medullary thyroid cancer, pheochromocytoma, parathyroid hyperplasia
 - B. Medullary thyroid cancer, mucosal neuromas, marfanoid habitus
 - C. Papillary thyroid cancer, adrenal adenoma, insulinoma
 - D. Parathyroid, pancreas, pituitary
 - E. Pituitary adenoma, pheochromocytoma, gastrinoma
- 26.** A multilocular radiolucent giant cell lesion of the mandible in a patient with renal stones and raised calcium is most likely:
- A. Ameloblastoma
 - B. Brown tumour of hyperparathyroidism
 - C. Cherubism
 - D. Odontogenic myxoma
 - E. Paget's disease

27. During parotidectomy the facial nerve trunk is found approximately 1 cm deep, anterior and inferior to the tip of which landmark?

- A. Coronoid process
- B. Mastoid tip
- C. Styloid process
- D. Tragal pointer
- E. Zygomatic arch

28. After an episode of forceful vomiting following heavy drinking, a man develops severe chest pain and subcutaneous emphysema in the neck. What is the diagnosis?

- A. Achalasia
- B. Boerhaave's syndrome
- C. Mallory-Weiss tear
- D. Myocardial infarction
- E. Pharyngeal pouch

29. Barrett's oesophagus is defined histologically as:

- A. Columnar metaplasia replacing squamous epithelium in the lower oesophagus
- B. Fibrosis of the submucosa
- C. Loss of ganglion cells
- D. Squamous metaplasia of the stomach
- E. Web formation in the post-cricoid region

30. A barium swallow shows an irregular stricture with shouldered margins in the mid-oesophagus of a 65-year-old with weight loss. What is the most likely diagnosis?

- A. Achalasia
- B. Carcinoma
- C. Corrosive stricture
- D. Peptic stricture
- E. Pharyngeal pouch

Section B — Short Essay Questions

Q1. A 30-year-old labourer presents to a dental clinic with inability to open his mouth. He had a puncture wound of the foot two weeks ago.

- a) What is the diagnosis and its pathogenesis? (1)
- b) List the clinical features. (1.5)
- c) Outline the management. (1.5)
- d) How can it be prevented after injury? (1)

Q2. A 62-year-old man on warfarin for atrial fibrillation needs extraction of two mandibular molars.

- a) How will you assess him before extraction? (2)
- b) Describe the local haemostatic measures you will use. (2)
- c) Which analgesics should be avoided and why? (1)

Q3. A 55-year-old naswar user has a non-healing ulcer of the left buccal mucosa for two months.

- a) List the risk factors for oral cancer. (1)
- b) How will you investigate and stage him? (2)
- c) Outline the principles of management. (2)

Q4. Radiographs show a well-defined radiolucency in the posterior mandible of a 20-year-old.

- a) Compare a dentigerous cyst with an odontogenic keratocyst. (3)
- b) Compare enucleation and marsupialisation. (2)

Q5. A 20-year-old woman has matted lymph nodes in the right side of the neck with evening fever and weight loss.

- a) What is the most likely diagnosis? Describe its stages. (2)
- b) How will you confirm the diagnosis? (1)
- c) Outline the treatment. (2)

Q6. A 40-year-old woman complains of dysphagia to both solids and liquids for two years with regurgitation at night.

- a) What is the likely diagnosis? (1)
- b) How does her presentation differ from that of oesophageal carcinoma? (1)
- c) Name the investigations and their findings. (1.5)
- d) Outline the treatment options. (1.5)

Mock Paper 1 — Answer Key and Model Answers

Section A — MCQ Key and Explanations

MCQ answers: 1-B 2-C 3-D 4-D 5-C 6-E 7-E 8-E 9-C 10-C 11-C 12-E 13-B 14-A 15-A 16-A 17-B 18-B 19-E 20-B 21-D 22-D 23-D 24-C 25-D 26-E 27-D 28-D 29-E 30-A

1 — B. Contaminated soft-tissue wounds can generally be closed primarily within about 6 hours; facial wounds, with their rich blood supply, are often closed later after thorough cleaning and debridement.

2 — C. Fournier's gangrene is a polymicrobial (type 1) necrotising fasciitis of the perineum and genitalia, commonest in diabetics. Treatment is resuscitation, broad-spectrum antibiotics and urgent radical debridement.

3 — D. Group O RhD-negative red cells lack A, B and D antigens and are the universal red-cell donor. RhD-negative cells are essential in women of child-bearing age to avoid sensitisation.

4 — D. Noradrenaline is the first-line vasopressor in septic shock, targeting MAP of at least 65 mmHg. Dobutamine is an inotrope used for low cardiac output.

5 — C. A 1-litre loss (about 15–30%) is Class II haemorrhage: tachycardia (100–120) with narrowed pulse pressure but normal systolic pressure. Hypotension appears in Class III.

6 — E. Hartmann's (Ringer's lactate) contains 29 mmol/L lactate, which the liver metabolises to bicarbonate, making it a "balanced" crystalloid.

7 — E. Nasogastric losses cause hypokalaemia, which produces flattened T waves, U waves and ST depression, together with ileus and weakness.

8 — E. Prothrombin complex concentrate replaces factors II, VII, IX and X rapidly; IV vitamin K maintains the reversal. FFP is slower and less effective; protamine reverses heparin.

9 — C. Usual fasting times are 2 hours for clear fluids, 4 hours for breast milk and 6 hours for formula, milk and solid food.

10 — C. Duplex (compression) ultrasound is the investigation of choice for suspected DVT. D-dimer is raised after surgery and is only useful to exclude DVT in low-probability patients.

11 — C. The Millard rotation-advancement repair is the standard technique for unilateral cleft lip. Furlow, Veau-Wardill-Kilner and von Langenbeck are palatal repairs.

12 — E. Van der Woude syndrome is an autosomal dominant condition of lower lip pits with cleft lip and/or palate (IRF6 gene). It is the commonest syndromic cause of clefting.

13 — B. Ludwig's angina is a bilateral cellulitis of the submandibular, sublingual and submental spaces. The parotid space is not involved.

14 — A. Leukoplakia is a clinical term for a predominantly white plaque of questionable risk after other known causes are excluded. Biopsy determines the presence and grade of dysplasia.

15 — A. The alkaloid arecoline stimulates fibroblast proliferation and collagen synthesis, while flavonoids and tannins reduce collagen breakdown, leading to juxta-epithelial fibrosis.

16 — A. Where smokeless tobacco and areca nut quids are held in the buccal vestibule, the buccal mucosa and gingivobuccal sulcus are the commonest sites, unlike the West where the lateral tongue predominates.

17 — B. The fibula free flap provides up to 25 cm of straight bone that can be osteotomised and accepts dental implants, with a skin paddle for intraoral lining.

- 18 — B.** OKCs recur because of their thin, friable lining and daughter cysts. Chemical cauterisation with Carnoy's solution or peripheral ostectomy of the cavity reduces recurrence.
- 19 — E.** About 80% of ameloblastomas arise in the mandible, mostly in the molar-ramus region.
- 20 — B.** A thyroglossal fistula is never congenital; it follows rupture or incision of an infected cyst or incomplete excision. A branchial fistula, by contrast, is congenital.
- 21 — D.** Level IV (lower jugular) nodes extend from the cricoid to the clavicle and drain the hypopharynx, thyroid, cervical oesophagus and larynx.
- 22 — D.** When a cold abscess breaks through the deep cervical fascia, pus collects in the subcutaneous space, connected by a narrow track to the deep abscess — a collar-stud abscess.
- 23 — D.** Type III MRND removes levels I–V but preserves all three non-lymphatic structures: the spinal accessory nerve, internal jugular vein and sternocleidomastoid.
- 24 — C.** Radioactive iodine crosses the placenta and destroys the fetal thyroid; it is contraindicated in pregnancy and breastfeeding. Surgery, if needed, is safest in the second trimester.
- 25 — D.** Papillary carcinoma spreads predominantly through lymphatics to central (level VI) and lateral neck nodes. Follicular carcinoma spreads via the blood to bone and lungs.
- 26 — E.** Carpal spasm induced by a BP cuff is Trousseau's sign of hypocalcaemia. Chvostek's sign is facial twitching on tapping the facial nerve.
- 27 — D.** The superior parathyroids arise from the fourth pouch; the inferior parathyroids and thymus from the third pouch.
- 28 — D.** Stensen's duct pierces the buccinator and opens on a papilla in the buccal mucosa opposite the upper second molar crown.
- 29 — E.** Warthin's tumour contains mitochondria-rich oncocytes that concentrate pertechnetate, appearing as a "hot" nodule.
- 30 — A.** Loss of inhibitory neurons in the myenteric (Auerbach's) plexus causes failure of LOS relaxation and aperistalsis.

Section B — SEQ Model Answers (Key Points)

Q1. Ludwig's angina

- **Definition:** rapidly spreading bilateral cellulitis of the submandibular, sublingual and submental spaces, usually from lower second/third molars.
- **Features:** brawny board-like induration, elevated protruding tongue, drooling, dysphagia, trismus, muffled voice, fever, toxæmia; stridor and dyspnoea are late danger signs.
- **Management:** secure airway (awake fiberoptic intubation or tracheostomy under LA); IV co-amoxiclav/penicillin + metronidazole; surgical decompression of spaces with drains; extraction of the causative tooth; fluids, analgesia, glucose control; ± dexamethasone.

Q2. Haemorrhagic shock

- **Class I** <15% (<750 mL), pulse <100, BP normal; **Class II** 15–30%, pulse 100–120, pulse pressure narrowed; **Class III** 30–40%, pulse 120–140, BP falls, confused, urine 5–15 mL/h; **Class IV** >40%, pulse >140, lethargic, negligible urine.
- This patient: Class III.
- **Management:** ABCDE; high-flow O₂; two large-bore cannulae; bloods incl. cross-match; control external bleeding; tranexamic acid within 3 h; early blood products (1:1:1), limited crystalloid; permissive hypotension (not with head injury); catheter, monitoring; identify source (FAST, CT) and arrange surgical/radiological control; prevent hypothermia.

Q3. Oral submucous fibrosis

- **Diagnosis:** OSMF — chronic progressive juxta-epithelial fibrosis; cause: areca nut (arecoline), chilli, nutritional deficiency.
- **Features:** burning with spicy food, vesicles, blanching (marble-like), palpable vertical fibrous bands, shrunken uvula, depapillated tongue, progressive trismus, dysphagia, hearing loss; potentially malignant.
- **Management:** stop habit; nutritional supplements; intralesional steroid $\pm$ hyaluronidase; pentoxifylline; mouth-opening exercises; surgical release with flap reconstruction for severe trismus; biopsy suspicious areas; lifelong follow-up.

Q4. Thyroglossal cyst

- **Diagnosis:** thyroglossal cyst — remnant of the thyroglossal duct along the descent of the thyroid from the foramen caecum to the neck.
- **Essential investigation:** ultrasound ($\pm$ isotope scan) to confirm a normal thyroid gland, so that ectopic thyroid is not removed.
- **Sistrunk's operation:** excision of the cyst with the whole tract and the central part of the body of the hyoid bone up to the foramen caecum — reduces recurrence.

Q5. Complications of thyroidectomy

- **Early:** reactionary haemorrhage and neck haematoma (airway compromise), laryngeal oedema, RLN palsy (unilateral — hoarseness; bilateral — stridor), EBSLN injury (loss of high pitch), hypocalcaemia, thyroid storm, tracheomalacia, infection.
- **Late:** hypothyroidism, permanent hypoparathyroidism, recurrence, keloid/hypertrophic scar.
- **Hypocalcaemia:** perioral/digital tingling, cramps, Chvostek and Trousseau signs, prolonged QT; check serum Ca/PTH on day 1; treat symptomatic patients with 10 mL 10% calcium gluconate IV slowly, then oral calcium and alfacalcidol.

Q6. Pleomorphic adenoma of parotid

- **Diagnosis:** pleomorphic adenoma of the parotid.
- **Investigations:** ultrasound with FNAC/core biopsy; MRI for deep-lobe extension; avoid open biopsy.
- **Treatment:** superficial parotidectomy (or partial parotidectomy/extracapsular dissection) preserving the facial nerve. Enucleation is avoided because pseudopodia through the incomplete capsule cause recurrence.
- **Frey's syndrome:** gustatory sweating and flushing of the cheek after parotidectomy, due to aberrant regeneration of parasympathetic (auriculotemporal) fibres into sweat glands; treated with botulinum toxin.

Mock Paper 2 — Answer Key and Model Answers

Section A — MCQ Key and Explanations

MCQ answers: 1-E 2-E 3-A 4-C 5-A 6-A 7-E 8-D 9-B 10-B 11-C 12-D 13-D 14-E 15-D 16-B 17-E 18-D 19-E 20-D 21-B 22-A 23-E 24-E 25-A 26-B 27-D 28-B 29-A 30-B

1 — E. SIRS criteria include WBC above 12 000 or below 4 000/mm³, with temperature, heart rate and respiratory rate abnormalities.

2 — E. A tetanus-prone wound in a patient with unknown or incomplete immunisation needs both active (toxoid) and passive (human tetanus immunoglobulin) immunisation, plus wound debridement.

3 — A. Beck's triad — hypotension, raised JVP and muffled heart sounds — indicates cardiac tamponade, a cause of obstructive shock treated by pericardiocentesis or thoracotomy.

4 — C. FFP contains all coagulation factors and is used for multiple factor deficiencies, together with platelets and cryoprecipitate (fibrinogen) as needed, while treating the cause.

5 — A. TRALI is a non-cardiogenic pulmonary oedema occurring within 6 hours of transfusion, caused by donor antibodies against recipient leucocytes.

6 — A. Low pH and low bicarbonate indicate metabolic acidosis (lactic acidosis from hypoperfusion); the low PaCO₂ reflects compensatory hyperventilation.

7 — E. ASA III is severe systemic disease with functional limitation, e.g. poorly controlled diabetes or stable angina. Controlled hypertension is ASA II.

8 — D. Clopidogrel irreversibly inhibits platelets; it is stopped about 7 days before high-bleeding-risk surgery unless the patient has a recent coronary stent, where cardiology advice is needed.

9 — B. A hypertrophic scar stays within the wound margins and often regresses; a keloid extends beyond the wound and rarely regresses.

10 — B. Atelectasis due to retained secretions and shallow breathing is the commonest postoperative chest complication, usually within 48 hours.

11 — C. Cancellous bone from the iliac crest is the standard graft for the cleft alveolus, placed at 8–11 years before the permanent canine erupts.

12 — D. Pharyngoplasty (e.g. sphincter pharyngoplasty or pharyngeal flap) improves velopharyngeal closure in persistent velopharyngeal insufficiency.

13 — D. A sequestrum is a piece of necrotic bone separated from living bone. The involucrum is new subperiosteal bone; a cloaca is an opening in the involucrum through which pus drains.

14 — E. Pseudomembranous candidiasis (thrush) forms creamy plaques that wipe off to leave an erythematous surface. Leukoplakia, lichen planus and hairy leukoplakia cannot be wiped off.

15 — D. Invasion through cortical bone of the mandible or maxilla, into the maxillary sinus or facial skin, is T4a (moderately advanced). Superficial erosion of a tooth socket alone does not qualify.

16 — B. Lip SCC affects the lower lip in the vast majority of cases because of greater sun exposure; basal cell carcinoma is relatively more common on the upper lip skin.

17 — E. A simple bone cyst is a pseudocyst of young people with no epithelial lining, scalloping between roots; surgical exploration usually leads to healing.

18 — D. A plunging ranula extends through a dehiscence in, or around the free posterior border of, the mylohyoid. Treatment is excision of the sublingual gland.

- 19 — E.** Macrocystic lymphatic malformations respond well to sclerotherapy; surgery is used for localised or residual lesions. Incision causes infection and recurrence.
- 20 — D.** According to the "rule of 80", about 80% of non-thyroid neck lumps in adults over 40 are neoplastic, most of them malignant metastases from head and neck primaries.
- 21 — B.** B symptoms are fever above 38°C, drenching night sweats and weight loss over 10% in 6 months. They indicate more advanced disease and affect staging.
- 22 — A.** Injury to the cervical sympathetic chain causes Horner's syndrome: ptosis, miosis, anhidrosis and apparent enophthalmos.
- 23 — E.** A small, asymptomatic, euthyroid goitre with benign cytology is managed by observation. Surgery is indicated for pressure symptoms, retrosternal extension, suspected malignancy, toxicity and cosmesis.
- 24 — E.** Riedel's thyroiditis is an IgG4-related fibrosing disease producing a woody hard gland that mimics carcinoma. Steroids are used; isthmusectomy relieves tracheal compression.
- 25 — A.** MEN 2A consists of medullary thyroid carcinoma, pheochromocytoma and parathyroid hyperplasia (RET mutation). MEN 2B adds mucosal neuromas and marfanoid habitus without hyperparathyroidism; MEN 1 is the "3 Ps".
- 26 — B.** Hypercalcaemia with stones and a jaw giant-cell lesion indicates a brown tumour of hyperparathyroidism, which regresses after parathyroidectomy.
- 27 — D.** The tragal pointer (cartilage of the external auditory canal) points to the facial nerve trunk, which lies about 1 cm deep, anterior and inferior to its tip. The tympanomastoid suture and posterior belly of digastric are other landmarks.
- 28 — B.** Mackler's triad of vomiting, chest pain and subcutaneous emphysema indicates spontaneous full-thickness oesophageal rupture (Boerhaave's syndrome). A Mallory-Weiss tear is mucosal only and causes haematemesis.
- 29 — A.** Barrett's oesophagus is replacement of the normal stratified squamous epithelium of the distal oesophagus by metaplastic columnar epithelium (with intestinal metaplasia), predisposing to adenocarcinoma.
- 30 — B.** An irregular, shouldered ("apple-core" or "rat-tail") stricture with weight loss in an older patient suggests carcinoma. Achalasia shows a smooth bird's-beak tapering.

Section B — SEQ Model Answers (Key Points)

Q1. Tetanus

- **Diagnosis:** tetanus — *Clostridium tetani* spores enter a wound; tetanospasmin travels along nerves and blocks release of GABA and glycine → unopposed muscle contraction.
- **Features:** trismus (first sign), risus sardonicus, neck stiffness, dysphagia, opisthotonus, board-like abdomen, reflex spasms with preserved consciousness, autonomic instability.
- **Management:** ICU, quiet room; wound debridement; human tetanus immunoglobulin; metronidazole; diazepam and magnesium for spasms; ventilation/tracheostomy; nutrition; active immunisation after recovery.
- **Prevention:** wound toilet; toxoid booster and/or HTIG according to immunisation status and wound type.

Q2. Anticoagulated patient needing extraction

- **Assessment:** indication for warfarin, other drugs, bleeding history, liver disease; INR within 24 h (72 h if stable); proceed in primary care if INR <4; do not stop warfarin; plan treatment early in the day and week; liaise with physician if INR high.
- **Local measures:** atraumatic extraction; LA with vasoconstrictor; pack socket with oxidised cellulose or gelatin sponge; suture; bite on gauze 20–30 min; tranexamic acid 5% mouthwash

four times daily for 2–5 days; post-operative instructions and contact number.

- **Analgesia:** avoid NSAIDs and aspirin (antiplatelet effect, increased bleeding, interaction with warfarin); use paracetamol. Avoid metronidazole, erythromycin and azole antifungals or check INR (potentiate warfarin).

Q3. Oral squamous cell carcinoma

- **Risk factors:** smokeless tobacco (naswar, gutka), smoking, areca nut, alcohol, HPV (oropharynx), OPMDs, chronic trauma, poor oral hygiene, immunosuppression.
- **Investigation:** incisional biopsy; USG ± FNAC of nodes; CT/MRI (depth of invasion, bone); OPG; CT chest or PET-CT; panendoscopy; fitness and dental assessment; TNM staging (AJCC 8th — size, depth of invasion, bone invasion, nodes, ENE).
- **Principles:** MDT; wide local excision with ~1 cm margin; marginal or segmental mandibulectomy; neck dissection (therapeutic for N+, elective selective for DOI >3–4 mm); reconstruction (local, radial forearm, fibula, pectoralis major); adjuvant RT, or CRT for positive margins/ENE; dental care, rehabilitation and follow-up.

Q4. Dentigerous cyst vs OKC; enucleation vs marsupialisation

- **Dentigerous:** reduced enamel epithelium around crown of unerupted tooth (lower 8, upper 3); unilocular, attached at CEJ; expands buccally; low recurrence; enucleation with tooth or marsupialisation in children.
- **OKC:** dental lamina remnants; posterior mandible; parakeratinised lining, keratin contents; grows along medulla with little expansion; uni- or multilocular; high recurrence; Gorlin–Goltz; enucleation + Carnoy's/peripheral ostectomy.
- **Enucleation:** whole lining removed, full histology, single operation — risk to nerve/teeth/fracture in large cysts.
- **Marsupialisation:** window into cyst, preserves structures, allows eruption — incomplete histology, long follow-up, often second operation.

Q5. Tuberculous cervical lymphadenitis

- **Stages:** lymphadenitis → periadenitis (matting) → cold abscess → collar-stud abscess → sinus.
- **Confirmation:** FNAC (caseating granulomas, ZN stain, GeneXpert, culture); USG; CXR; ESR; Mantoux/IGRA; HIV; excision biopsy if inconclusive.
- **Treatment:** 2HRZE + 4HR (6 months) with pyridoxine; aspirate cold abscess through a non-dependent site; excise persistent nodes/sinus; nutrition; explain possible paradoxical enlargement.

Q6. Achalasia

- **Diagnosis:** achalasia cardia.
- **Difference:** achalasia — younger, long history, dysphagia to solids and liquids from the start, regurgitation; carcinoma — older, short progressive history, solids then liquids, marked weight loss.
- **Investigations:** barium swallow — dilated oesophagus, bird's beak, absent gastric bubble; manometry — incomplete LOS relaxation, aperistalsis (diagnostic); OGD — exclude pseudoachalasia (carcinoma of cardia).
- **Treatment:** laparoscopic Heller's myotomy with partial fundoplication; pneumatic dilatation; POEM; botulinum toxin for unfit/elderly; nitrates or calcium-channel blockers have limited role.

High-Yield One-Liners for Last-Minute Revision

Read this section on the night before the examination. Each line is a fact frequently tested in MCQs, short questions and viva.

Part I — Principles of Surgery

- Sepsis = life-threatening organ dysfunction due to dysregulated host response to infection.
- Most surgical infections are endogenous; oral infections are mixed aerobic-anaerobic.
- Thyroidectomy is a clean wound (SSI 1-2%); oral surgery is clean-contaminated.
- Prophylactic antibiotic: single IV dose at induction.
- Cellulitis — *Streptococcus pyogenes*; abscess — *Staphylococcus aureus*; drain pus.
- Necrotising fasciitis: pain out of proportion — urgent radical debridement.
- Gas gangrene: *C. perfringens*, alpha toxin (lecithinase), crepitus.
- Tetanus: tetanospasmin blocks GABA and glycine; trismus is the first sign.
- Actinomycosis: sulphur granules, woody induration, multiple sinuses — long-term penicillin.
- Needlestick risk: HBV 30%, HCV 3%, HIV 0.3%; HIV PEP within 72 h (ideally 1 h).
- Shock = inadequate tissue perfusion; hypotension appears only in Class III haemorrhage (>30%).
- Neurogenic shock: hypotension with bradycardia and warm peripheries.
- Anaphylaxis: adrenaline 0.5 mg IM (0.5 mL of 1:1000), repeat after 5 min.
- Best bedside guide to resuscitation: urine output >0.5 mL/kg/h.
- Tranexamic acid in trauma within 3 hours.
- Reactionary haemorrhage within 24 h; secondary haemorrhage at 7-14 days (infection).
- Haemophilia A — factor VIII, X-linked, prolonged APTT.
- Warfarin and dental extraction: continue warfarin, check INR, proceed if INR <4.
- Platelets are stored at 20-24°C — highest risk of bacterial contamination.
- Massive transfusion: hypothermia, hypocalcaemia (citrate), hyperkalaemia, coagulopathy.
- Total body water 60% of body weight; daily Na and K 1 mmol/kg each.
- Hyperkalaemia with ECG changes: calcium gluconate first.
- Correct hyponatraemia no faster than 10 mmol/L per 24 h.
- Post-thyroidectomy tingling + Chvostek sign = hypocalcaemia → IV calcium gluconate.
- Pyloric stenosis: hypochloreaemic hypokalaemic metabolic alkalosis.
- Fasting: food 6 h, clear fluids 2 h.
- ASA II = mild systemic disease; ASA IV = constant threat to life.
- Long-term steroids → perioperative hydrocortisone cover.
- Postoperative fever day 1-2 atelectasis; day 5-7 wound infection/leak; day 7-10 DVT.
- Burst abdomen: salmon-pink discharge on day 7-10.
- Keloid extends beyond the wound; treat with intralesional triamcinolone.

Part II — Oral Cavity and Jaws

- Cleft lip: failure of medial nasal and maxillary process fusion; cleft palate: palatal shelves.
- Lip repair ~3 months (rule of 10s); palate 6-12 months; alveolar bone graft 8-11 years.
- Cleft palate → glue ear (tensor veli palatini).
- Ludwig's angina: bilateral submandibular, sublingual and submental spaces — airway first.
- Second and third molar roots lie below the mylohyoid → submandibular space infection.
- Danger area of face → cavernous sinus thrombosis (proptosis, ophthalmoplegia).

- Vincent's sign: lower lip numbness in mandibular osteomyelitis or malignancy.
- Osteoradionecrosis prevention: dental extractions 10–14 days before radiotherapy.
- MRONJ: bisphosphonates and denosumab.
- Erythroplakia carries the highest malignant risk of all oral potentially malignant disorders.
- OSMF: areca nut, blanching, fibrous bands, progressive trismus.
- Any oral ulcer not healing in 3 weeks must be biopsied.
- Oral SCC in South Asia: buccal mucosa commonest; in the West: lateral tongue.
- Depth of invasion >3–4 mm → elective neck dissection.
- Positive margin or extranodal extension → postoperative chemoradiotherapy.
- Most important prognostic factor in oral cancer: nodal metastasis.
- Commonest jaw cyst: radicular; around crown of unerupted tooth: dentigerous.
- OKC: posterior mandible, keratin, high recurrence; multiple OKCs → Gorlin-Goltz.
- Ameloblastoma: soap-bubble radiolucency, root resorption — resection with 1–1.5 cm margin.
- Ranula arises from the sublingual gland — excise the gland.

Part III — The Neck

- Thyroglossal cyst moves with swallowing and tongue protrusion — Sistrunk's operation.
- Branchial cyst: anterior border of SCM, upper third; cholesterol crystals.
- Branchial fistula opens internally in the tonsillar fossa.
- Cystic hygroma: posterior triangle, infancy, brilliantly transilluminant.
- Carotid body tumour: moves side to side, not vertically — never biopsy.
- Neck lump in an adult >40: malignant until proven otherwise — USG + FNAC, no open biopsy.
- TB lymphadenitis: matted nodes, cold abscess, collar-stud abscess; ATT 6 months.
- Cold abscess: aspirate through a non-dependent site; never incise.
- Hodgkin lymphoma: Reed-Sternberg cells; diagnosis by excision biopsy.
- Virchow's node (left supraclavicular) → gastric cancer (Troisier's sign).
- Radical neck dissection removes levels I–V + SAN + IJV + SCM.
- Supraomohyoid dissection = levels I–III (oral cancer, N0 neck).
- Accessory nerve injury → shoulder drop and weak abduction above 90°.
- Chyle leak: left neck, milky fluid — MCT diet.
- First thyroid test: TSH; Graves' antibody: TRAb.
- Bethesda IV (follicular neoplasm) → diagnostic lobectomy.
- Lugol's iodine 10 days before surgery for Graves'.
- Carbimazole → agranulocytosis (sore throat); PTU in first trimester.
- Papillary cancer: commonest, lymphatic spread, psammoma bodies, Orphan Annie nuclei.
- Follicular cancer: blood spread to bone and lung; FNAC cannot diagnose.
- Medullary cancer: C cells, calcitonin, RET, exclude pheochromocytoma first.
- MEN 2B: mucosal neuromas of lips and tongue, marfanoid habitus.
- Neck haematoma after thyroidectomy: open wound at the bedside (SCOOP).
- Bilateral RLN palsy: stridor with relatively good voice.
- EBSLN injury: loss of high-pitched voice.
- Primary hyperparathyroidism: single adenoma in 80–85%; ↑Ca, ↑PTH, ↓phosphate.
- Brown tumour and loss of lamina dura in the jaw → hyperparathyroidism.
- Hungry bone syndrome: severe hypocalcaemia after parathyroidectomy.

Parts IV and V — Salivary Glands and Oesophagus

- Stensen's duct opens opposite the upper second molar; Wharton's at the sublingual papilla.
- Stones: 80–90% submandibular, mostly radio-opaque; parotid stones mostly radiolucent.
- Meal-time pain and swelling = salivary duct obstruction.
- Acute suppurative parotitis: dehydrated elderly, *S. aureus*.
- Sjögren's: anti-Ro/La, labial gland biopsy; risk of MALT lymphoma.
- Smaller gland → higher chance of malignancy (sublingual >80% malignant).
- Pleomorphic adenoma: commonest; pseudopodia — do not enucleate.
- Warthin's: older male smokers, parotid tail, bilateral in 10%, hot on technetium scan.
- Mucoepidermoid: commonest salivary malignancy; adenoid cystic: perineural spread.
- Facial palsy with a parotid lump = malignancy.
- Frey's syndrome: gustatory sweating — botulinum toxin.
- Narrowest part of oesophagus: cricopharyngeus, 15 cm from incisors.
- Pharyngeal pouch through Killian's dehiscence — barium swallow first.
- Achalasia: bird's beak; manometry; Heller's myotomy.
- Palatal erosion of upper teeth: GORD or bulimia.
- Barrett's oesophagus → adenocarcinoma.
- Plummer-Vinson: iron deficiency, web, glossitis → post-cricoid carcinoma.
- Corrosive ingestion: no emetics; endoscopy within 24–48 h; late stricture.
- Oesophageal SCC: upper/middle third; adenocarcinoma: lower third.
- Ivor Lewis oesophagectomy: laparotomy + right thoracotomy.

References and Further Reading

- Williams NS, O'Connell PR, McCaskie AW, editors. *Bailey & Love's Short Practice of Surgery*. 28th ed. Boca Raton: CRC Press; 2023. (Principal reference for all chapters.)
- American College of Surgeons. *Advanced Trauma Life Support (ATLS) Student Course Manual*. 10th ed. Chicago: ACS. (Classes of haemorrhage, Chapter 2.)
- Amin MB, et al., editors. *AJCC Cancer Staging Manual*. 8th ed. New York: Springer. (TNM staging, Chapter 10.)
- Ali SZ, VanderLaan PA, editors. *The Bethesda System for Reporting Thyroid Cytopathology*. (Chapter 15.)
- Singer M, et al. The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3). *JAMA* 2016. (Chapter 1.)
- World Health Organization. *Classification of Head and Neck Tumours*. 5th ed. Lyon: IARC. (Chapters 9, 11, 19.)

Students are strongly encouraged to read the corresponding chapters of *Bailey & Love's Short Practice of Surgery* for a fuller understanding of each topic. Drug doses and guidelines change; always consult current national and local guidance.

A Final Word to the Student

Surgery is learnt at the bedside and in the operating theatre, but it is examined on paper. I hope this book has made the paper part easier. Remember that behind every MCQ is a patient — the child with a cleft lip, the farmer with tetanus, the young man with an oral cancer from naswar. Learn these facts well, and one day they will help you to recognise disease early and treat it safely.

I pray that Allah grants you success in your examinations and in your careers.

Prof. Dr. Zahid Mahmood

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