



La-Net

SUG 401

GENERAL SURGERY I



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Course code: SUG 401

Course title: General Surgery I

Course credit load: 5 Units

Series 1: Foundations of Surgical Practice

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 - Sub Part 1.1.2: The multidisciplinary health care team
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Introduction

Surgery is one of the oldest branches of medicine and one of the most demanding. It requires not only technical skill but also sound clinical judgement, a thorough understanding of human physiology, and the ability to work effectively as part of a team. Before a surgeon can safely operate, they must understand the principles that govern surgical practice: how tissues heal, how infections arise and are controlled, how fluids and electrolytes are managed, and how to keep both the patient and the operating team safe.

This Series lays the foundation for your study of General Surgery I. We shall begin by examining the scope of surgery and the multidisciplinary team. We will then explore the general principles of surgery, wound healing, and haemostasis, followed by surgical infections and antibiotic use. Moving on, we address fluid, electrolyte, and nutritional management. We will then cover safe surgery and universal precautions, and we close with the important issues of HIV/AIDS, COVID-19, and the surgeon.

Series Learning Outcomes

Upon completing this Series, you should be able to:

1. **SLO 1.1:** describe the scope and specialties of surgery and the role of each member of the multidisciplinary surgical team,
2. **SLO 1.2:** describe the principles of surgery, the phases of wound healing, and the methods of surgical haemostasis,
3. **SLO 1.3:** classify surgical infections and describe the principles of antibiotic therapy in surgical practice,
4. **SLO 1.4:** describe the body fluid compartments and outline the assessment and management of fluid, electrolyte, and nutritional disturbances in surgical patients,
5. **SLO 1.5:** describe the WHO Surgical Safety Checklist, universal precautions, and strategies for surgical site infection prevention, and
6. **SLO 1.6:** describe the risks HIV/AIDS and COVID-19 pose to the surgeon and outline the management of needlestick injuries and post-exposure prophylaxis.

1.1 The Surgical Discipline and the Multidisciplinary Team

1.1.1 Scope and specialties of surgery



Surgery is the branch of medicine that uses operative procedures to treat disease, injury, or deformity. Its scope can be understood by considering both the nature of the procedure and the body system involved: diagnostic surgery (biopsy to obtain tissue for analysis), therapeutic surgery (to remove, repair, or reconstruct), palliative surgery (to relieve symptoms when cure is not possible), and reconstructive or cosmetic surgery.

The major surgical specialties include general surgery (abdomen, gastrointestinal tract, breast, endocrine, and herniae), orthopaedic surgery (bones, joints, and musculoskeletal system), neurosurgery (brain and spinal cord), cardiothoracic surgery (heart and lungs), urology (urinary tract and male reproductive system), gynaecological surgery, paediatric surgery, plastic and reconstructive surgery, ophthalmology, and ear, nose, and throat (ENT) surgery. In Nigerian teaching hospitals, each specialty operates as a distinct clinical unit with its own consultants, trainees, and nursing staff.

Fill in the blank: Surgery that aims to relieve symptoms without achieving a cure is called _____ surgery. The specialty covering the abdomen, gastrointestinal tract, breast, and herniae is _____ surgery.

1.1.2 The multidisciplinary health care team

Modern surgical care is delivered by a multidisciplinary health care team (MDT). The core theatre team comprises the operating surgeon, the surgical assistant, the anaesthetist, the scrub nurse (who handles sterile instruments directly within the sterile field), and the circulating nurse (who manages the broader theatre environment). On the ward, the resident doctors, ward nurses, and house officer monitor recovery and manage complications.

Beyond the immediate theatre team, effective care depends on many other professionals. The radiologist interprets imaging that guides diagnosis and intervention. The histopathologist processes surgical specimens and provides the definitive tissue diagnosis. The physiotherapist assists with postoperative rehabilitation and chest physiotherapy. The dietitian manages nutritional support. The pharmacist advises on drug dosing and interactions. The social worker assists with discharge planning. Recognising and respecting these roles is essential for safe surgical practice.

Fill in the blank: The nurse who handles sterile instruments directly during an operation is the _____ nurse. The professional who provides the definitive tissue diagnosis from surgical specimens is the _____.

1.1.3 Surgical ethics, consent, and documentation

Surgical ethics is grounded in four core principles: autonomy (the patient's right to make informed decisions), beneficence (acting in the patient's best interest), non-maleficence (avoiding



harm), and justice (fair distribution of surgical resources). Informed consent is the practical expression of autonomy: the patient must receive sufficient information about the diagnosis, the proposed procedure, its risks and benefits, and the alternatives, in a language they understand, and must agree voluntarily without coercion.

Valid consent requires confirming that the patient has capacity (the ability to understand, retain, weigh, and communicate a decision) and that the consent form is signed and witnessed. Documentation is equally important: the operation note (written immediately after surgery, recording findings, the procedure performed, and any intraoperative complications), the anaesthetic record, and postoperative instructions together form a legal and clinical record that protects both patient and surgeon.

Fill in the blank: The four core ethical principles in surgery are autonomy, beneficence, non-maleficence, and _____. The note recording the procedure performed and intraoperative findings, written immediately after surgery, is the _____ note.

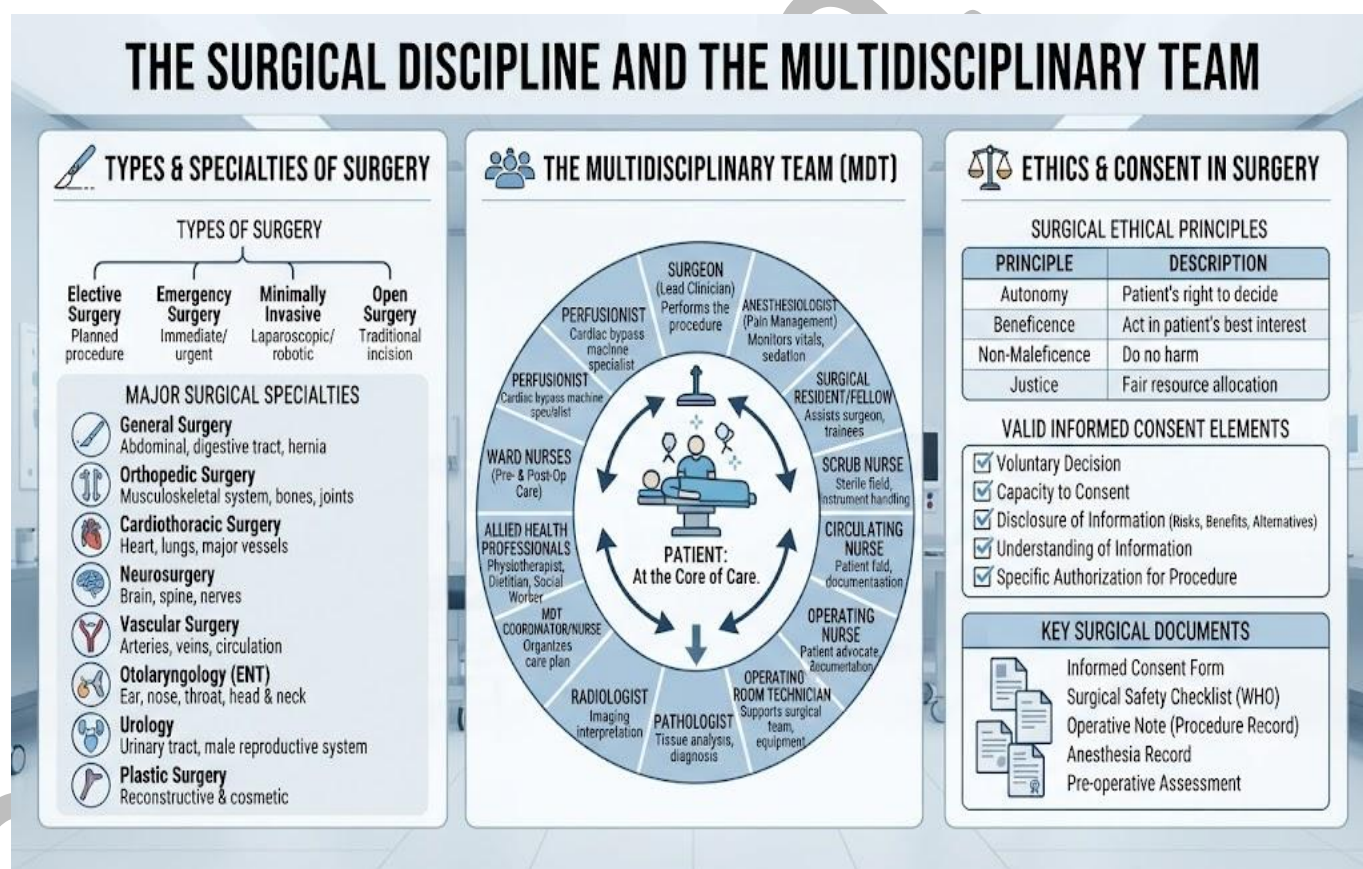


Figure 1.1: Scope of surgery, the multidisciplinary team, and surgical ethics and consent

Pilot questions 1.1

1. Describe the major surgical specialties and state the focus of each. (Linked to SLO 1.1)
2. List the members of the core theatre team and state the role of each. (Linked to SLO 1.1)



3. Describe the roles of the radiologist, histopathologist, and physiotherapist in surgical care. (Linked to SLO 1.1)
4. Describe the four core ethical principles in surgery and explain how each applies in practice. (Linked to SLO 1.1)
5. Describe the elements required for valid informed consent in Nigerian surgical practice. (Linked to SLO 1.1)

1.2 Principles of Surgery

1.2.1 General principles of surgical practice

The general principles guiding surgical decision-making are: establish the correct diagnosis before any intervention; select the operation appropriate for the diagnosis; prepare the patient adequately; perform the procedure with the minimum necessary tissue trauma (the Halstedian principle); and monitor and support the patient carefully during recovery. These principles, whether applied to open or minimally invasive surgery, define the standard of surgical practice.

Operative risk, the probability that the patient will suffer a complication or death as a result of surgery, is assessed using the American Society of Anesthesiologists (ASA) physical status classification: ASA I (healthy patient), ASA II (mild systemic disease not limiting activity), ASA III (severe systemic disease limiting activity), ASA IV (severe systemic disease that is a constant threat to life), and ASA V (moribund patient not expected to survive without the operation). In Nigerian practice, many patients present late with advanced disease and significant comorbidities, making preoperative risk assessment and optimisation particularly important.

Fill in the blank: The principle of performing surgery with the minimum necessary tissue trauma is one of the _____ principles. The ASA class for a patient with a severe systemic disease that is a constant threat to life is class _____.

1.2.2 Wound healing and tissue repair

Wound healing proceeds through four overlapping phases. The haemostatic phase (seconds to minutes) involves platelet aggregation and clot formation. The inflammatory phase (days 1 to 4) sees neutrophils and macrophages remove bacteria and debris; the wound appears red, warm, and swollen. The proliferative phase (days 4 to 21) involves fibroblast migration, collagen deposition, granulation tissue formation, wound contraction by myofibroblasts, and epithelialisation. The remodelling phase (months to years) involves collagen reorganisation and cross-linking; maximum tensile strength reaches approximately 80 percent of the original tissue.

Wounds are classified by bacterial contamination: clean (no infection, no hollow viscus entered), clean-contaminated (controlled entry into a hollow viscus without spillage), contaminated (gross spillage or fresh traumatic wound), and dirty or infected (established infection or faecal peritonitis). Factors impairing healing include local factors (poor blood supply, infection, foreign



body, excessive tension) and systemic factors (malnutrition, diabetes mellitus, anaemia, corticosteroids, immunosuppression, advanced age, and jaundice).

Fill in the blank: The phase of wound healing characterised by fibroblast migration and collagen deposition is the _____ phase. A wound from a cholecystectomy with no bile spillage is classified as _____ contaminated.

1.2.3 Haemostasis in surgery

Haemostasis is the arrest of bleeding and is one of the most fundamental skills in surgery. The physiological response to vessel injury has three stages: primary haemostasis (platelet plug formation), secondary haemostasis (the coagulation cascade, producing a fibrin clot), and fibrinolysis (clot dissolution). Preoperative haemostasis assessment includes a history of easy bruising or prolonged bleeding and laboratory tests (full blood count, prothrombin time, activated partial thromboplastin time, and bleeding time).

Surgical methods of haemostasis include: pressure (direct manual pressure: the first and simplest method), ligation (tying a vessel with a suture), diathermy or electrocautery (electrical current to coagulate vessels: monopolar or bipolar), topical haemostatic agents (oxidised cellulose, fibrin glue, bone wax), and tourniquets (for limb surgery). The decision to transfuse blood is guided by the patient's haemoglobin level, symptoms of anaemia, haemodynamic stability, and expected further blood loss.

Fill in the blank: The coagulation cascade is part of _____ haemostasis, producing a fibrin clot. The use of electrical current to coagulate bleeding vessels during surgery is called _____ or electrocautery.



Principles of Surgery

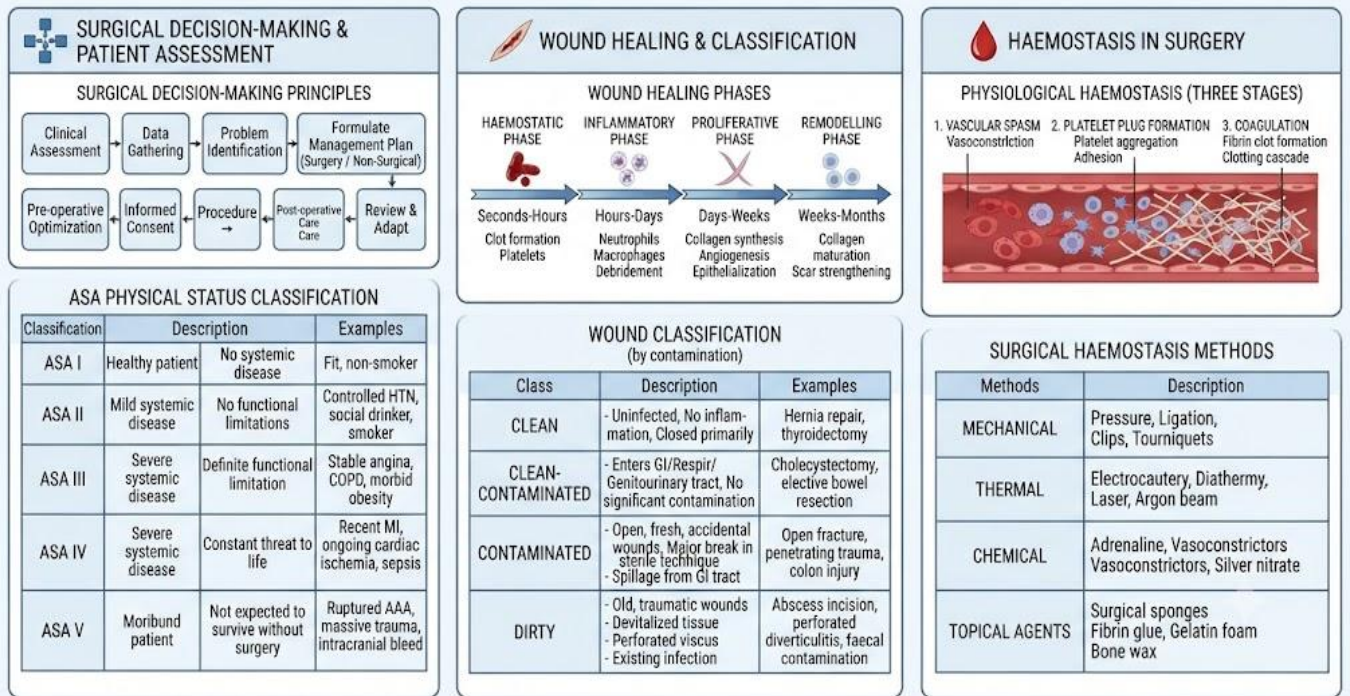


Figure 1.2: Surgical decision-making principles, wound healing phases, wound classification, and haemostasis

Pilot questions 1.2

1. Describe the five general principles of surgical practice. (Linked to SLO 1.2)
2. Describe the ASA physical status classification and give an example for each class. (Linked to SLO 1.2)
3. Describe the four phases of wound healing in sequence. (Linked to SLO 1.2)
4. Classify wounds by bacterial contamination and give an example of each class. (Linked to SLO 1.2)
5. Describe five surgical methods of haemostasis. (Linked to SLO 1.2)

1.3 Surgical Infections and Antibiotic Use

1.3.1 Classification and pathogenesis of surgical infections

Surgical infections are infections arising in the context of surgical disease or requiring surgical management as part of their treatment. Their pathogenesis involves a breach in host defences (skin or mucosal barrier), contamination with microorganisms, and failure of the immune



response to contain the infection. The source of organisms may be endogenous (from the patient's own flora) or exogenous (from the environment or operating team).

Surgical site infections (SSIs) are classified by anatomical depth: superficial incisional (involving only skin and subcutaneous tissue), deep incisional (involving the fascial and muscle layers), or organ or space (involving any space opened or manipulated during surgery, for example an intra-abdominal abscess). An SSI is defined as an infection occurring within 30 days of surgery (or 90 days if an implant is in place). Common causative organisms include *Staphylococcus aureus* (including MRSA), *Escherichia coli*, *Klebsiella* species, *Pseudomonas aeruginosa*, and anaerobes such as *Bacteroides fragilis*.

Fill in the blank: An SSI involving only the skin and subcutaneous tissue is classified as _____ incisional. An SSI is defined as one occurring within _____ days of surgery without an implant.

1.3.2 Principles of antibiotic therapy in surgery

Antibiotics in surgery are used in three contexts. Prophylactic antibiotics prevent infection in a wound that is not yet infected; they are most effective when given within 60 minutes before skin incision and should not be continued beyond 24 hours after surgery. Empirical antibiotics treat an established infection before culture results are available, using broad-spectrum agents; they are de-escalated once the organism is identified. Therapeutic antibiotics target a known organism guided by culture and sensitivity results.

The principles of rational antibiotic use in surgery are: use the narrowest effective spectrum, the correct dose and route, and the shortest effective duration, and de-escalate based on culture results. Antibiotic stewardship is particularly important in Nigerian hospitals, where antimicrobial resistance is a growing threat. Common prophylactic regimens include cefazolin or ampicillin-cloxacillin for clean and clean-contaminated procedures, with metronidazole added for procedures involving the bowel.

Fill in the blank: Prophylactic antibiotics should be given within _____ minutes before skin incision to achieve effective tissue levels. The practice of switching from broad-spectrum to targeted antibiotics on culture results is called _____.

1.3.3 Common surgical infections

Cellulitis is a diffuse spreading infection of the skin and subcutaneous tissue, typically caused by *Streptococcus pyogenes* or *Staphylococcus aureus*, presenting with localised redness, warmth, swelling, and pain. It is treated with systemic antibiotics (flucloxacillin or amoxicillin-clavulanate) without surgical intervention unless abscess formation occurs. An abscess is a localised collection of pus; the principle of management is incision and drainage (I&D), because antibiotics alone cannot penetrate an abscess cavity. The wound is left open and packed to heal by secondary intention.



Necrotising fasciitis is a rapidly progressive, life-threatening infection of the fascia and subcutaneous tissue, associated with severe systemic toxicity out of proportion to the local skin findings. Caused by a mixed flora of aerobes and anaerobes (type I: polymicrobial) or by group A *Streptococcus* alone (type II), its hallmarks are severe pain, skin necrosis, crepitus (gas in tissues), and rapid spread. Treatment requires urgent surgical debridement of all necrotic tissue, broad-spectrum IV antibiotics covering aerobes and anaerobes, and ICU-level supportive care. Any delay in debridement significantly worsens mortality.

Fill in the blank: The definitive treatment of an abscess is incision and _____, because antibiotics alone cannot penetrate the cavity. Necrotising fasciitis is hallmarked by severe pain, skin necrosis, and _____ (gas in tissues).

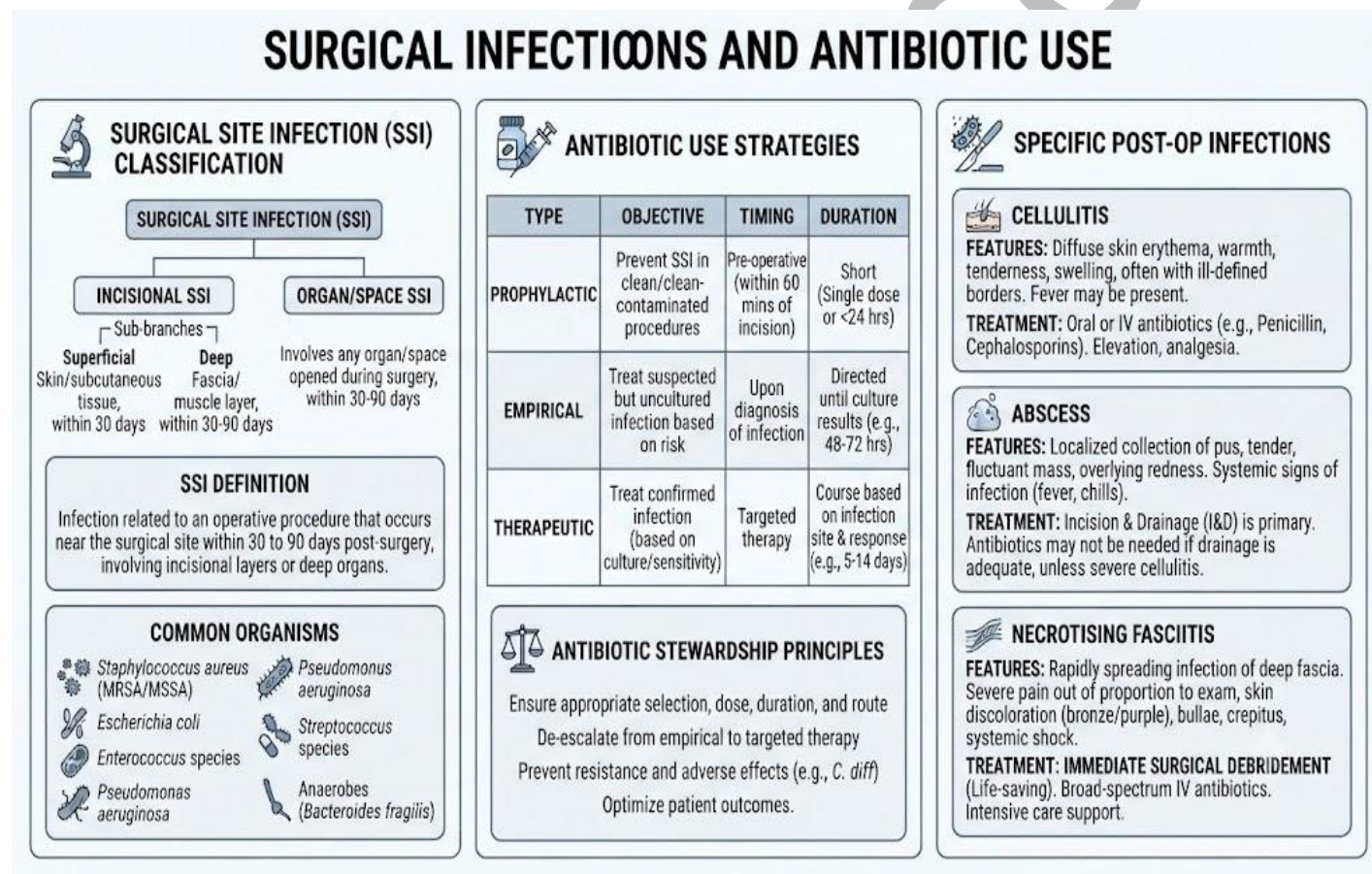


Figure 1.3: Classification of surgical infections, principles of antibiotic use, and common surgical infections

Pilot questions 1.3

1. Classify surgical site infections by anatomical level and give an example of each. (Linked to SLO 1.3)
2. Describe the principles of prophylactic antibiotic use in surgery. (Linked to SLO 1.3)
3. Explain the principle of antibiotic de-escalation and state why it matters. (Linked to SLO 1.3)



4. Describe the clinical features and management of a cutaneous abscess. (Linked to SLO 1.3)
5. Describe the clinical features and management of necrotising fasciitis. (Linked to SLO 1.3)

1.4 Fluid, Electrolyte, and Nutritional Support

1.4.1 Body fluid compartments and balance

Water constitutes approximately 60 percent of total body weight in an adult male. This total body water (TBW) is divided into the intracellular fluid (ICF: two-thirds of TBW, or 40 percent of body weight) and the extracellular fluid (ECF: one-third of TBW, or 20 percent of body weight). The ECF is subdivided into the interstitial fluid (15 percent of body weight) and the intravascular fluid or plasma (5 percent of body weight). The principal extracellular cation is sodium (normal serum level 135 to 145 mmol/L) and the principal intracellular cation is potassium (normal serum level 3.5 to 5.0 mmol/L).

Daily fluid requirements are approximately 30 to 35 mL per kg per day (2000 to 2500 mL for a 70 kg adult). This is balanced by insensible losses (approximately 800 to 1000 mL per day from respiration and sweating), urine output (a minimum of 0.5 mL per kg per hour is required to excrete metabolic waste), and other losses (nasogastric aspirate, surgical drains, stoma output, and diarrhoea). Accurate fluid balance charting in the postoperative surgical patient is essential and often determines outcome.

Fill in the blank: Approximately _____ percent of total body weight in an adult male is water. The principal extracellular cation is _____, with a normal serum level of 135 to 145 mmol/L.

1.4.2 Assessment and correction of fluid and electrolyte disturbances

Fluid deficit is common in surgical patients from reduced oral intake, vomiting, diarrhoea, bowel obstruction, haemorrhage, or third-space losses. Clinical signs: dry mucous membranes, reduced skin turgor, sunken eyes, tachycardia, hypotension, reduced urine output, and elevated urea and creatinine. IV fluid resuscitation uses crystalloids (normal saline 0.9 percent or Hartmann's solution: preferred for most surgical resuscitation as it approximates the composition of extracellular fluid) or colloids (gelatins or albumin: when rapid plasma expansion is needed).

Hyponatraemia (sodium below 135 mmol/L) is the most common electrolyte disturbance, often from excess hypotonic IV fluids or SIADH; corrected by fluid restriction and, in severe symptomatic cases, cautious hypertonic saline. Hypokalaemia (potassium below 3.5 mmol/L) arises from vomiting, nasogastric suction, diarrhoea, and diuretics; causes cardiac arrhythmias and muscle weakness; corrected by oral or IV potassium replacement. IV potassium must never be given as a rapid bolus, as it causes fatal cardiac arrest. Hyperkalaemia (potassium above 5.0 mmol/L) is of particular concern in renal failure.



Fill in the blank: Hartmann's solution is preferred for surgical resuscitation because it approximates the composition of _____ fluid. IV potassium must never be given as a rapid _____ because it can cause fatal cardiac arrest.

1.4.3 Nutritional support in surgical patients

Malnutrition is common in surgical patients and is associated with impaired wound healing, increased infection risk, and higher mortality. Nutritional status is assessed using the Malnutrition Universal Screening Tool (MUST), body mass index (BMI), weight loss history, and serum albumin. The principle guiding nutritional support is: if the gut works, use it. Enteral nutrition (via nasogastric tube, nasojejunal tube, or PEG) maintains gut mucosal integrity, reduces bacterial translocation, and is associated with fewer complications than parenteral nutrition.

Parenteral nutrition (PN), the IV delivery of amino acids, glucose, lipid, electrolytes, vitamins, and trace elements via a central venous catheter, is reserved for patients in whom the gut cannot be used (paralytic ileus, high-output fistula, or severe short bowel syndrome). The daily caloric requirement for a surgical patient is approximately 25 to 30 kcal per kg per day. Enhanced Recovery After Surgery (ERAS) protocols, increasingly adopted in Nigerian tertiary centres, advocate preoperative nutritional optimisation and early postoperative oral feeding.

Fill in the blank: The principle guiding the choice of nutritional route is: if the gut works, _____ it. Parenteral nutrition is delivered via a _____ venous catheter and reserved for patients in whom the gut cannot be used.



FLUID ELECTROLYTE AND NUTRITIONAL SUPPORT IN SURGERY

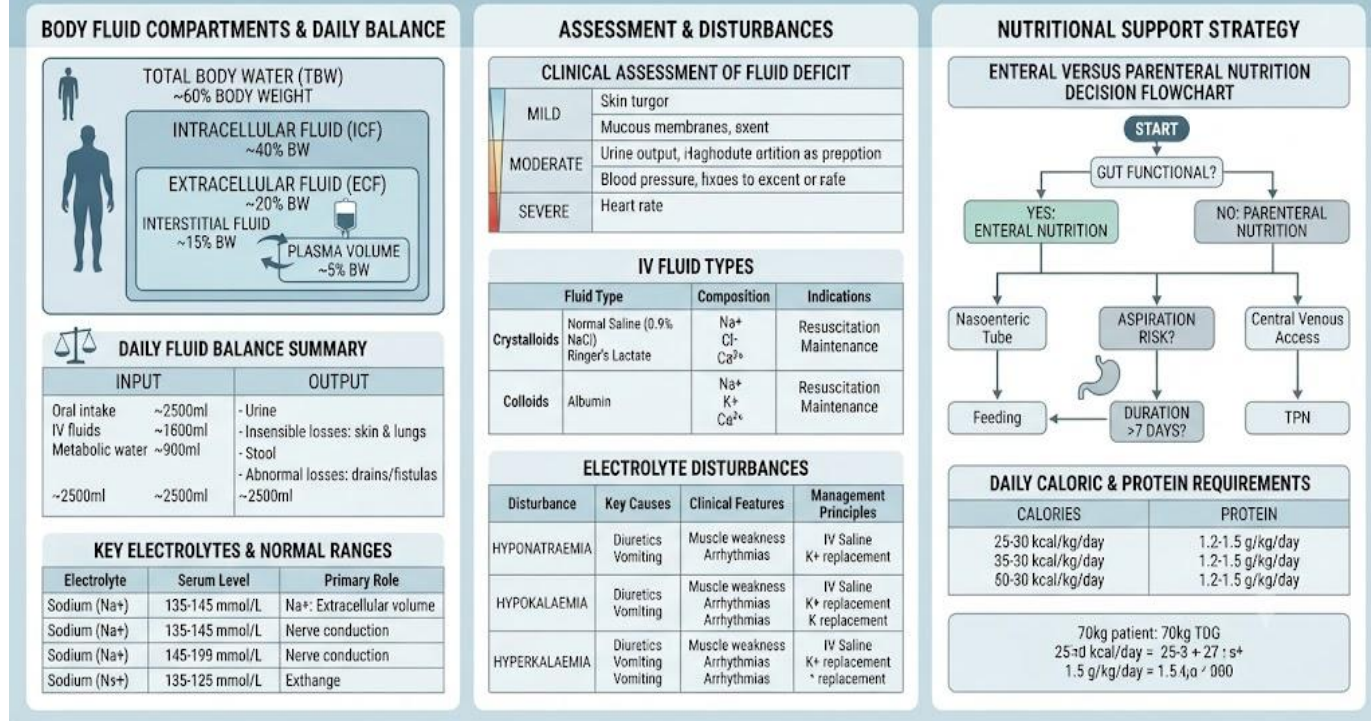


Figure 1.4: Body fluid compartments, fluid and electrolyte disturbances, and nutritional support in surgical patients

Pilot questions 1.4

- Describe the body fluid compartments and state the percentage of body weight each represents. (Linked to SLO 1.4)
- Describe the clinical signs of fluid deficit in a surgical patient. (Linked to SLO 1.4)
- Distinguish crystalloid from colloid IV fluids and state when each is used. (Linked to SLO 1.4)
- Describe the causes and management of hypokalaemia in a postoperative patient. (Linked to SLO 1.4)
- Describe the principle of enteral versus parenteral nutrition and state the indication for each. (Linked to SLO 1.4)

1.5 Safe Surgery and Universal Precautions



1.5.1 The WHO Surgical Safety Checklist

The WHO Surgical Safety Checklist was introduced in 2008 as part of the Safe Surgery Saves Lives campaign, after evidence that a significant proportion of surgical complications and deaths were preventable. It divides the perioperative period into three phases. The Sign In phase (before anaesthesia) confirms patient identity, the surgical site marking, the anaesthetic machine check, known allergies, and pulse oximeter function. The Time Out phase (before skin incision, with all team members present and paused) confirms the patient and procedure, reviews anticipated critical events, and confirms antibiotic prophylaxis.

The Sign Out phase (before the patient leaves the theatre) confirms the name of the procedure performed, that swab and instrument counts are correct, that specimens are labelled, and that any equipment problems have been noted. Implementation of the WHO checklist in Nigerian hospitals has been associated with reductions in postoperative complications, unplanned returns to theatre, and mortality. The checklist promotes a culture of safety, open communication, and shared team responsibility.

Fill in the blank: The WHO Surgical Safety Checklist has three phases: Sign In, _____, and Sign Out. The Time Out phase is performed _____ skin incision, with all theatre team members present.

1.5.2 Universal precautions in the operating theatre

Universal precautions are infection control measures applied to all patients regardless of known or suspected infectious status, based on the principle that blood and body fluids may contain transmissible agents. In the operating theatre they include: wearing gloves (double-gloving for high-risk cases), impermeable surgical gowns, masks, and eye protection; safe sharps handling (dispose immediately into a puncture-resistant sharps container; never recap needles by hand); and using the neutral zone (passing sharps between team members via a kidney dish or magnetic mat rather than hand-to-hand).

Hand hygiene (washing with soap and water or alcohol-based hand rub) is the single most important measure for preventing healthcare-associated infections. It must be performed at the WHO Five Moments: before patient contact, before an aseptic procedure, after body fluid exposure, after patient contact, and after contact with the patient's environment. In the surgical setting, compliance with hand hygiene before scrubbing, after doffing gloves, and after each patient contact is mandatory.

Fill in the blank: Universal precautions are applied to _____ patients regardless of their infectious status. The _____ zone involves placing sharps in a kidney dish for transfer between team members, eliminating hand-to-hand passing.

1.5.3 Surgical site infection prevention

SSI prevention strategies are classified as preoperative, intraoperative, and postoperative. Preoperative measures: antiseptic shower the night before surgery; hair removal by clipping not



shaving (shaving creates micro-abrasions that increase SSI risk); glycaemic control in diabetic patients (target blood glucose below 10 mmol/L perioperatively); smoking cessation (ideally 4 to 8 weeks before surgery); and antibiotic prophylaxis within 60 minutes before skin incision.

Intraoperative measures include: maintaining normothermia (patient warming with forced-air blankets and warmed IV fluids, as hypothermia impairs neutrophil function), maintaining tissue oxygenation (80 percent FiO₂ during and 2 hours after surgery), gentle tissue handling (minimising devitalisation and haematoma), and chlorhexidine-alcohol skin preparation (superior to povidone-iodine in most studies). Postoperative: keep the wound covered with a sterile dressing for 48 hours; leave uncovered if healing satisfactorily thereafter; identify and act upon signs of SSI (redness, swelling, purulent discharge, fever) early.

Fill in the blank: Hair removal before surgery should be done by _____, not shaving. Maintaining _____ (normal body temperature) during surgery reduces SSI risk by preserving neutrophil function.

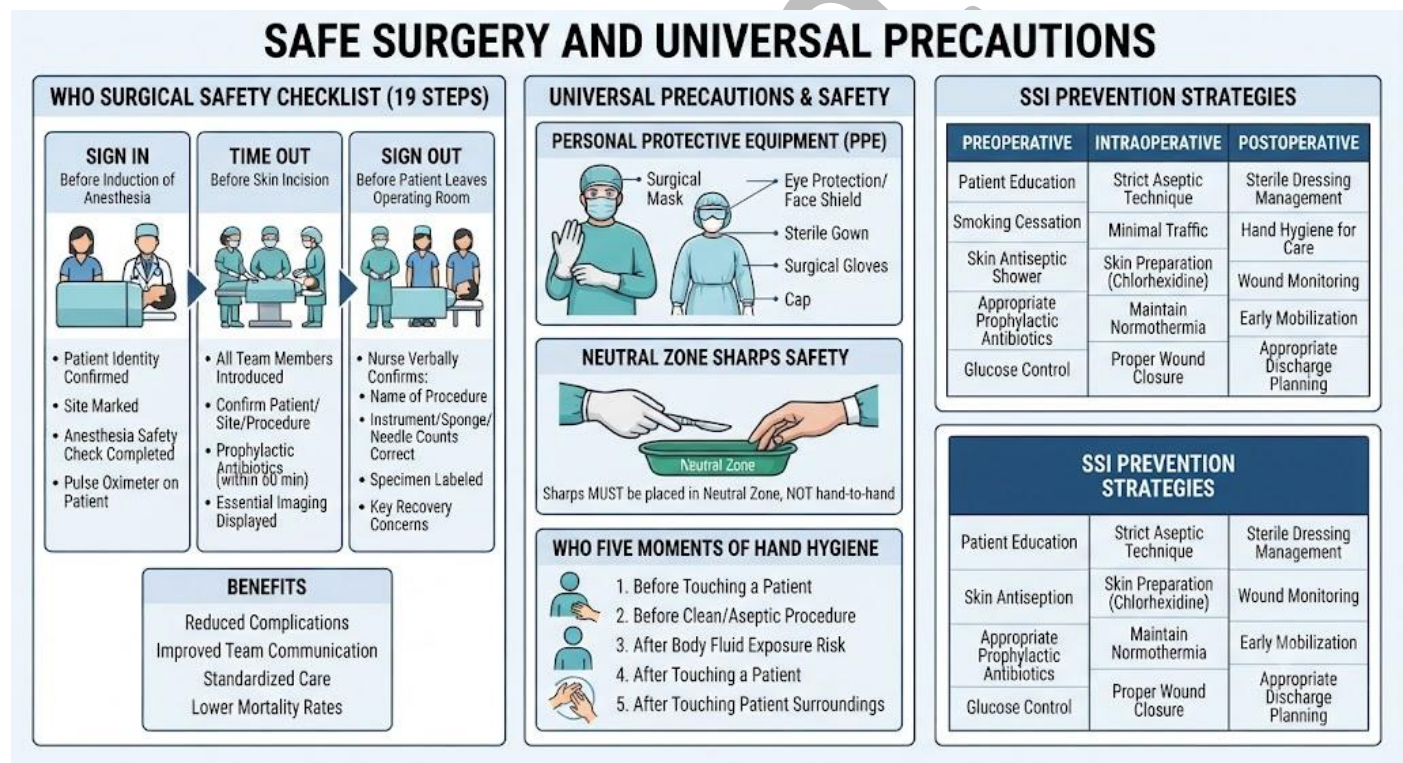


Figure 1.5: The WHO Surgical Safety Checklist, universal precautions, and surgical site infection prevention

Pilot questions 1.5

- Describe the three phases of the WHO Surgical Safety Checklist and state what is confirmed in each. (Linked to SLO 1.5)
- Describe the personal protective equipment required in the operating theatre as part of universal precautions. (Linked to SLO 1.5)



- Describe the neutral zone technique and explain why it reduces sharps injuries. (Linked to SLO 1.5)
- Describe three preoperative and two intraoperative SSI prevention measures. (Linked to SLO 1.5)
- Explain why hair removal by shaving increases SSI risk and state the preferred alternative. (Linked to SLO 1.5)

1.6 HIV/AIDS, COVID-19, and the Surgeon

1.6.1 HIV/AIDS: transmission risk and precautions for the surgeon

HIV is transmitted through contact with infected blood and body fluids, making surgery a high-risk professional activity. The risk of HIV transmission from a single needlestick injury with HIV-infected blood is approximately 0.3 percent. Factors that increase this risk include a hollow-bore needle (which carries a lumen of blood that is injected into the wound), a deep injury, visible blood on the device, and a high viral load in the source patient. Surgeons performing procedures with prolonged hand-in-cavity exposure (open abdominal or cardiothoracic surgery) are at highest risk.

Precautions in the operating theatre include: consistent application of universal precautions (double-gloving, eye protection, impermeable gowns), use of the neutral zone for sharps transfer, blunt needles for suturing where feasible, and techniques that minimise hand-in-cavity work (using instruments rather than fingers to retract). A surgeon who is HIV-positive may continue to operate provided viral load is undetectable on antiretroviral therapy and additional precautions are observed. All surgeons should know their own HIV status through voluntary confidential testing.

Fill in the blank: The risk of HIV transmission from a single needlestick injury with infected blood is approximately _____ percent. _____ needles reduce sharps injury risk during suturing and should be used where technically feasible.

1.6.2 Needlestick injuries and post-exposure prophylaxis

In the event of a needlestick or sharps injury, immediate first aid is essential: wash the wound thoroughly with soap and running water for at least 2 minutes, allow the wound to bleed freely under running water (do not squeeze or suck the wound), and irrigate mucosal splashes copiously with water or normal saline. The injury must then be reported immediately to the occupational health or infection control officer, and the source patient's HIV, hepatitis B, and hepatitis C status must be determined (with consent).

Post-exposure prophylaxis (PEP) for HIV consists of TLD (tenofovir plus lamivudine plus dolutegravir) taken once daily for 28 days, started as soon as possible after exposure (ideally within 2 hours and no later than 72 hours; PEP is ineffective after 72 hours). For hepatitis B, an unvaccinated worker should receive hepatitis B immunoglobulin (HBIG) within 24 hours and



commence the hepatitis B vaccination series. Follow-up HIV and hepatitis B testing is performed at 6 weeks, 12 weeks, and 6 months after exposure.

Fill in the blank: HIV PEP must be started within _____ hours of exposure and continued for _____ days. For hepatitis B, an unvaccinated exposed worker should receive _____ immunoglobulin within 24 hours.

1.6.3 COVID-19 and surgical practice

SARS-CoV-2 is transmitted primarily by respiratory droplets and aerosols, making the operating theatre, where intubation and airway manipulation generate aerosols, a high-risk environment. Patients with active COVID-19 have significantly higher rates of postoperative pulmonary complications, thromboembolic events, and mortality than non-infected patients. Elective surgery should therefore be deferred until at least 7 weeks after COVID-19 infection to minimise perioperative risk.

Enhanced IPC measures for COVID-19 in the operating theatre include: preoperative SARS-CoV-2 testing for all elective patients; FFP2 or FFP3 respirators (N95 equivalent) for all aerosol-generating procedures; full PPE (gown, gloves, eye protection, and respirator) for the theatre team; a dedicated COVID-19 theatre with negative-pressure ventilation where possible; and strict donning and doffing protocols. Emergency surgery in a COVID-19-positive patient cannot be deferred and requires full PPE and heightened vigilance for postoperative complications.

Fill in the blank: Elective surgery should be deferred for at least _____ weeks after COVID-19 infection. _____ or FFP3 respirators must be used during aerosol-generating procedures in COVID-19-positive patients.



HIV, AIDS, COVID-19 AND THE SURGEON

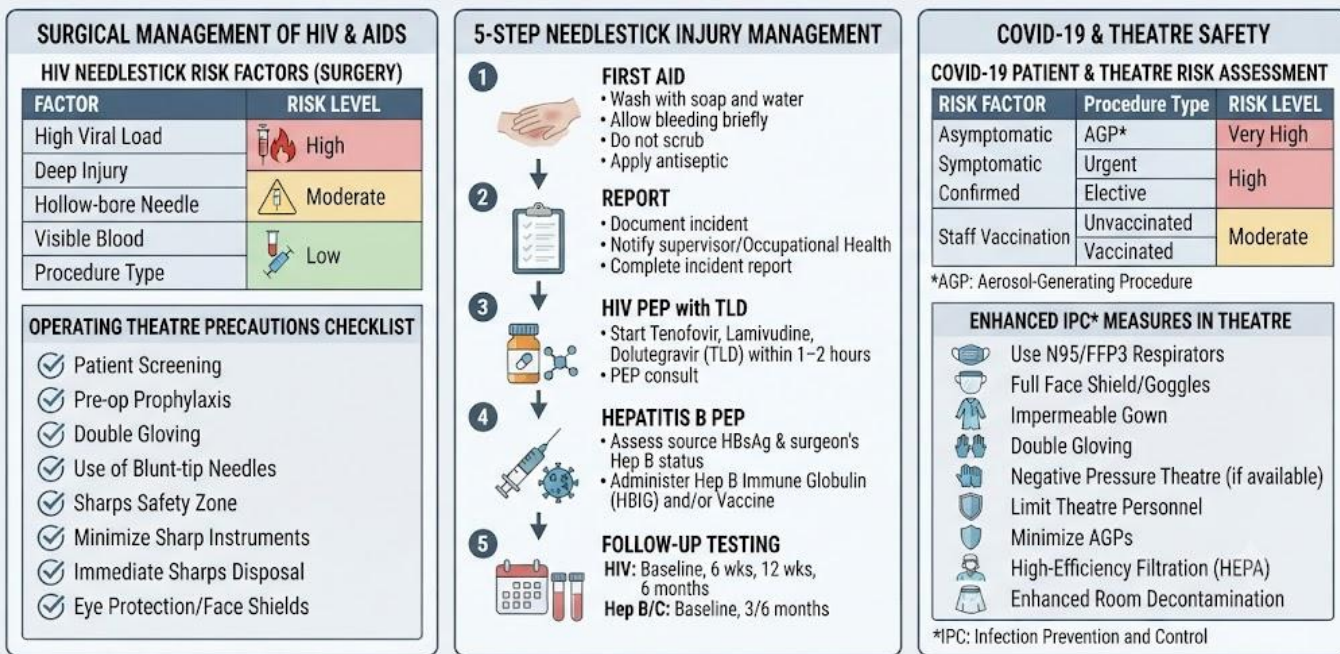


Figure 1.6: HIV/AIDS transmission risk, needlestick injury management, and COVID-19 in surgical practice

Pilot questions 1.6

- State the risk of HIV transmission per needlestick injury and describe three factors that increase this risk. (Linked to SLO 1.6)
- Describe the immediate first aid steps following a needlestick injury in the operating theatre. (Linked to SLO 1.6)
- Describe the HIV post-exposure prophylaxis regimen: drugs, timing, and duration. (Linked to SLO 1.6)
- Describe the enhanced IPC measures required when operating on a COVID-19-positive patient. (Linked to SLO 1.6)
- Explain why elective surgery should be deferred after COVID-19 infection and state the recommended interval. (Linked to SLO 1.6)

Series Summary



This Series established the foundations of surgical practice. We covered the scope and specialties of surgery, the multidisciplinary team, and surgical ethics and consent, then examined the general principles of surgery, wound healing phases and classification, and haemostasis. Moving on, we described the classification and management of surgical infections (cellulitis, abscess, and necrotising fasciitis) and the principles of antibiotic prophylaxis, empirical therapy, and de-escalation. We addressed fluid compartments, electrolyte disturbances, and the enteral versus parenteral nutrition decision, and we examined safe surgery through the WHO Surgical Safety Checklist, universal precautions, and SSI prevention.

Having completed this Series, you should now be able to describe the surgical team and the scope of surgery (SLO 1.1), apply the principles of surgery and wound healing (SLO 1.2), classify surgical infections and apply rational antibiotic principles (SLO 1.3), assess and manage fluid, electrolyte, and nutritional disturbances (SLO 1.4), apply the WHO Surgical Safety Checklist and universal precautions (SLO 1.5), and manage HIV and COVID-19 risks in the operating theatre (SLO 1.6). These foundations underpin every subsequent Series in General Surgery I.

Glossary of Terms

- **Antibiotic stewardship:** a coordinated set of strategies to improve antibiotic prescribing, reduce unnecessary use, and slow the development of antimicrobial resistance in healthcare settings.
- **ASA classification:** the American Society of Anesthesiologists physical status grading from ASA I (healthy) to ASA V (moribund), used to estimate perioperative risk.
- **Cellulitis:** a diffuse spreading infection of the skin and subcutaneous tissue, typically caused by *Streptococcus pyogenes* or *Staphylococcus aureus*; treated with systemic antibiotics without surgical intervention unless abscess forms.
- **De-escalation:** switching from broad-spectrum empirical antibiotics to a narrow-spectrum agent targeted at the identified organism once culture and sensitivity results are available.
- **Enteral nutrition:** delivery of nutritional support into the gastrointestinal tract via a nasogastric tube, nasojejunal tube, or PEG; preferred over parenteral nutrition when the gut is functioning.
- **Granulation tissue:** new tissue formed during the proliferative phase of wound healing, consisting of new capillaries, fibroblasts, and collagen; the basis of healing by secondary intention.
- **Informed consent:** the process by which a patient with capacity, after receiving full information, voluntarily agrees to a proposed surgical procedure; a legal and ethical requirement before any surgery.
- **Necrotising fasciitis:** a rapidly progressive life-threatening infection of the fascia and subcutaneous tissue requiring urgent surgical debridement and broad-spectrum IV antibiotics; hallmarked by severe pain, skin necrosis, and crepitus.



- **Neutral zone:** a designated area (kidney dish or magnetic mat) where sharps are placed for transfer between scrub team members, eliminating direct hand-to-hand passing of sharp instruments.
- **Post-exposure prophylaxis (PEP):** antiretroviral therapy (TLD: tenofovir, lamivudine, dolutegravir) started within 72 hours of potential HIV exposure and continued for 28 days to prevent seroconversion.
- **Surgical site infection (SSI):** an infection occurring within 30 days of surgery (90 days if a prosthetic implant is in place), classified as superficial incisional, deep incisional, or organ or space.
- **WHO Surgical Safety Checklist:** a three-phase perioperative safety tool (Sign In, Time Out, Sign Out) proven to reduce surgical complications and mortality by ensuring critical safety steps are performed and communicated.



Concept Check Questions [Series 1]

Objective questions

- Surgery that aims to relieve symptoms without achieving a cure is called _____ surgery. (Linked to SLO 1.1)
- The phase of wound healing characterised by fibroblast migration and collagen deposition is the _____ phase. (Linked to SLO 1.2)
- A surgical site infection is defined as one occurring within _____ days of surgery without an implant. (Linked to SLO 1.3)
- The preferred IV fluid for most surgical resuscitation is _____ solution, as it approximates the composition of extracellular fluid. (Linked to SLO 1.4)
- HIV post-exposure prophylaxis must be started within _____ hours of exposure to be effective. (Linked to SLO 1.6)

Short-answer questions

11. Describe the roles of the scrub nurse, circulating nurse, and anaesthetist in the theatre team. (Linked to SLO 1.1)
12. Classify wounds by degree of bacterial contamination and give an example of each class. (Linked to SLO 1.2)
13. Describe the principles of prophylactic antibiotic use in surgery. (Linked to SLO 1.3)
14. Describe the clinical signs of fluid deficit in a surgical patient and outline the initial resuscitation. (Linked to SLO 1.4)
15. Describe the three phases of the WHO Surgical Safety Checklist and what is confirmed in each. (Linked to SLO 1.5)

Long-answer questions

16. Describe the four phases of wound healing and the factors that impair wound healing. (Linked to SLO 1.2)
17. Describe the clinical features and management of necrotising fasciitis. (Linked to SLO 1.3)
18. Describe the body fluid compartments and outline the management of hypokalaemia in a postoperative patient. (Linked to SLO 1.4)
19. Describe the universal precautions and SSI prevention strategies relevant to the operating theatre. (Linked to SLO 1.5)



20. Describe the management of a needlestick injury in the operating theatre, including HIV and hepatitis B PEP. (Linked to SLO 1.6)

Answers to Concept Check Questions [Series 1]

Objective questions

- Palliative.
- Proliferative.
- 30.
- Hartmann's.
- 72.

Short-answer questions

- Scrub nurse: works within the sterile field; handles sterile instruments directly; performs swab and instrument counts before and after the operation. Circulating nurse: works outside the sterile field; retrieves supplies; manages the broader theatre environment; communicates with the wider hospital team. Anaesthetist: assesses the patient preoperatively; induces and maintains anaesthesia; monitors vital signs and the airway intraoperatively; provides postoperative analgesia.
- Clean: no infection and no hollow viscus entered; for example, an inguinal hernia repair. Clean-contaminated: controlled entry into a hollow viscus without spillage; for example, an elective cholecystectomy. Contaminated: gross spillage or fresh traumatic wound; for example, a laparotomy for perforated appendix before peritonitis. Dirty or infected: established infection or faecal peritonitis; for example, a laparotomy for sigmoid perforation with faecal contamination.
- Prophylactic antibiotics must be given within 60 minutes before skin incision to achieve peak tissue levels at the time of contamination. The choice should cover the expected organisms for the procedure (cefazolin for clean and clean-contaminated; add metronidazole for bowel procedures). They should not be continued beyond 24 hours after surgery. A repeat intraoperative dose is given if the procedure exceeds twice the antibiotic half-life or blood loss exceeds 1500 mL.
- Clinical signs of fluid deficit: dry mucous membranes, reduced skin turgor, sunken eyes, tachycardia, hypotension (late sign), reduced urine output below 0.5 mL per kg per hour, and elevated urea and creatinine. Initial resuscitation: administer a crystalloid bolus (250 to 500 mL Hartmann's solution over 15 to 30 minutes) and reassess heart rate, blood pressure, urine output,



and capillary refill; repeat as needed; if haemorrhage is the cause, consider early blood transfusion.

- **Sign In** (before anaesthesia): confirm patient identity, consent, surgical site marking, anaesthetic machine check, known allergies, and pulse oximeter function. **Time Out** (before skin incision: all team present and paused): confirm patient and procedure, review critical events from each team member, confirm antibiotic prophylaxis and display essential imaging. **Sign Out** (before patient leaves theatre): record procedure name, confirm swab and instrument counts, confirm specimen labelling, note equipment problems and recovery concerns.

Long-answer questions

- **Basic response:** Four phases of wound healing: Haemostatic (seconds to minutes: platelet aggregation and vasoconstriction and fibrin clot formation arrest bleeding). Inflammatory (days 1 to 4: neutrophils then macrophages phagocytose bacteria and debris; wound is red, warm, swollen, and tender). Proliferative (days 4 to 21: fibroblasts migrate and deposit collagen; granulation tissue forms; myofibroblasts contract the wound; epithelialisation covers the surface). Remodelling (months to years: collagen fibres reorganise and cross-link; tensile strength increases to a maximum of approximately 80 percent of original). Factors impairing healing: local (poor blood supply, infection, foreign body, haematoma, excessive wound tension) and systemic (malnutrition, diabetes mellitus, anaemia, corticosteroid use, immunosuppression, advanced age, jaundice, uraemia).

Value-added response: Vitamin C is a critical cofactor for collagen synthesis (hydroxylation of proline and lysine residues in procollagen); deficiency (scurvy) impairs the proliferative phase and can cause previously healed wounds to break down. Preoperative nutritional assessment and correction of vitamin deficiencies, particularly vitamin C and zinc, directly improves wound healing outcomes in malnourished surgical patients.

- **Basic response:** Necrotising fasciitis is a rapidly progressive, life-threatening infection of the fascia and subcutaneous tissue. Clinical features: severe pain (often disproportionate to deceptively mild early skin appearances), overlying skin progressing from erythema to dusky discolouration to frank necrosis, crepitus (crackling on palpation from gas-producing organisms), fluid-filled bullae, and rapid systemic deterioration (high fever, tachycardia, hypotension, and confusion). Type I is polymicrobial (mixed aerobes and anaerobes); type II is caused by group A *Streptococcus*. Management: urgent surgical debridement of all necrotic tissue without delay (do not wait for imaging if the diagnosis is clinically clear); broad-spectrum IV antibiotics covering aerobes and anaerobes (for example meropenem plus clindamycin); ICU-level haemodynamic support; nutritional support; and ultimately wound closure or skin grafting once the wound is clean.

Value-added response: Delay in debridement is the most important determinant of mortality in necrotising fasciitis: debridement more than 24 hours after diagnosis carries mortality above 70



percent, compared with below 20 percent when performed within 12 hours. In Nigerian practice, the clinical diagnosis alone is sufficient to proceed directly to the operating theatre without waiting for CT confirmation.

- **Basic response:** Body fluid compartments: total body water (TBW) approximately 60 percent of body weight; ICF two-thirds of TBW (40 percent body weight); ECF one-third of TBW (20 percent body weight), divided into interstitial fluid (15 percent body weight) and plasma (5 percent body weight). Management of hypokalaemia: identify and correct the cause (vomiting, NG suction, diarrhoea, diuretics). Mild to moderate hypokalaemia (potassium 3.0 to 3.5 mmol/L): oral potassium chloride (KCl) if the patient can take it. Severe or symptomatic hypokalaemia (potassium below 3.0 mmol/L or cardiac arrhythmias present): IV KCl (20 to 40 mmol in 100 to 250 mL normal saline over 1 to 2 hours via a peripheral vein; maximum 10 mmol per hour peripherally or 20 mmol per hour via a central line). Monitor ECG and recheck serum potassium after each replacement. Never administer IV potassium as a rapid bolus: it causes fatal ventricular fibrillation.

Value-added response: Hypokalaemia markedly potentiates digoxin toxicity, even at therapeutic digoxin levels; a postoperative patient on digoxin who develops hypokalaemia from vomiting or NG suction is at high risk of life-threatening arrhythmias. Routine electrolyte monitoring every 24 to 48 hours in postoperative patients receiving IV fluid therapy is therefore essential in Nigerian surgical wards.

- **Basic response:** Universal precautions: wear gloves (double-gloving for high-risk cases), impermeable gown, mask, and eye protection for all procedures involving blood or body fluids; use the neutral zone (kidney dish or magnetic mat) for sharps transfer: never hand-to-hand; dispose of sharps immediately into a puncture-resistant sharps container; never recap needles; use blunt suture needles where feasible; perform hand hygiene at the WHO Five Moments. SSI prevention: preoperative (antiseptic shower the night before; clip hair rather than shave; glycaemic control below 10 mmol/L in diabetic patients; smoking cessation 4 to 8 weeks before surgery; antibiotic prophylaxis within 60 minutes before incision); intraoperative (normothermia with forced-air warming and warmed IV fluids; FiO₂ 80 percent; gentle tissue handling; chlorhexidine-alcohol skin preparation); postoperative (sterile dressing for 48 hours; leave uncovered if healing; early detection and management of SSI signs).

Value-added response: Chlorhexidine-alcohol skin preparation is now recommended over povidone-iodine for most surgical sites, based on randomised trial evidence of superior SSI reduction. However, it must not be applied to mucous membranes or near the eyes and ears, and it must be allowed to dry completely before diathermy is applied to avoid the risk of alcohol-vapour ignition in the operating theatre.

- **Basic response:** Immediate first aid: wash the wound with soap and running water for at least 2 minutes; allow the wound to bleed freely under running water; irrigate mucosal splashes copiously with water or saline; do not squeeze or suck the wound. Report immediately to the occupational health or infection control officer; determine the source patient's HIV, hepatitis B, and hepatitis C status with consent. HIV PEP: start TLD (tenofovir 300 mg plus lamivudine 300



mg plus dolutegravir 50 mg as a single daily tablet) within 2 hours of exposure (maximum 72 hours); continue for 28 days; PEP is ineffective after 72 hours. Hepatitis B PEP for an unvaccinated worker: administer hepatitis B immunoglobulin (HBIG) within 24 hours and commence the hepatitis B vaccination series (three doses at 0, 1, and 6 months). Document the incident, PEP given, and source patient status. Follow-up HIV testing at 6 weeks, 12 weeks, and 6 months.

Value-added response: Hepatitis C virus carries a transmission risk of approximately 1.8 percent per needlestick injury from a hepatitis C-positive source, which is higher than HIV (0.3 percent). There is no post-exposure prophylaxis for hepatitis C; however, early detection of seroconversion on follow-up testing allows prompt treatment with direct-acting antivirals (DAAs), which achieve above 95 percent cure rates. This makes timely follow-up testing after a needlestick injury from any source critically important for all surgical healthcare workers.

Answers to Pilot Questions [Series 1]

Part 1.1

1. General surgery (GI tract, abdomen, breast, endocrine, herniae), orthopaedic (bones, joints, musculoskeletal), neurosurgery (brain and spinal cord), cardiothoracic (heart and lungs), urology (urinary tract and male reproductive system), gynaecological (female reproductive system), paediatric (surgical conditions of childhood), plastic and reconstructive (soft tissue repair and reconstruction), ophthalmology (eye surgery), and ENT (ear, nose, and throat).
2. Operating surgeon: leads and performs the surgical procedure. Surgical assistant: retracts and assists; may be a resident or another surgeon. Anaesthetist: induces and maintains anaesthesia; monitors vital signs; manages the airway; provides postoperative analgesia. Scrub nurse: handles sterile instruments directly within the sterile field; performs swab and instrument counts. Circulating nurse: works outside the sterile field; retrieves supplies; manages the theatre environment; communicates with the wider team.
3. Radiologist: interprets imaging (X-ray, ultrasound, CT, MRI) to guide diagnosis, staging, and surgical planning; performs image-guided interventions (drainage, biopsy). Histopathologist: processes and analyses surgical specimens to provide the definitive tissue diagnosis (confirms malignancy, identifies organisms); provides intraoperative frozen section reports. Physiotherapist: delivers preoperative chest physiotherapy in high-risk patients; provides postoperative respiratory exercises and chest physiotherapy to prevent atelectasis; assists with early mobilisation and rehabilitation after major surgery.
4. Autonomy: the patient has the right to make their own informed decisions and to accept or refuse treatment; the surgeon must provide full information without coercion. Beneficence: the surgeon must act in the patient's best medical interest, offering interventions likely to benefit them. Non-maleficence: the surgeon must avoid causing unnecessary harm; choose the procedure with the most favourable risk-to-benefit ratio; do not operate when surgery is not in the patient's interest.



Justice: surgical resources must be allocated fairly and equitably, without discrimination based on ability to pay, social status, or personal bias.

5. Valid informed consent requires: confirmed patient capacity (ability to understand, retain, weigh, and communicate a decision); disclosure of the diagnosis, the proposed procedure and its intended benefit, the significant and common risks, and the available alternatives including non-surgical management; absence of coercion (the patient decides freely); and proper documentation (consent form signed by the patient or their legal guardian if the patient lacks capacity, and witnessed by a third party; information given in a language and format the patient understands).

Part 1.2

1. Establish the correct diagnosis before operating; select the operation appropriate for the confirmed diagnosis; prepare the patient adequately (optimise comorbidities, correct fluid and electrolyte imbalances, obtain valid consent); perform the operation with minimum tissue trauma (Halstedian principle: precise dissection, gentle tissue handling, meticulous haemostasis, minimal devitalisation); monitor and support the patient carefully during recovery (postoperative care: fluid balance, analgesia, wound care, early mobilisation).
2. ASA I: healthy patient; no systemic disease; normal functional capacity; example: elective inguinal hernia repair in a 25-year-old. ASA II: mild systemic disease not limiting activity; example: well-controlled hypertension or type 2 diabetes; elective cholecystectomy. ASA III: severe systemic disease limiting activity but not immediately life-threatening; example: poorly controlled diabetes, moderate COPD, morbid obesity; appendicectomy. ASA IV: severe systemic disease that is a constant threat to life; example: recent MI or severe cardiac failure; emergency laparotomy. ASA V: moribund patient not expected to survive 24 hours with or without surgery; example: ruptured aortic aneurysm with haemorrhagic shock.
3. Haemostatic phase (seconds to minutes): platelet aggregation, vasoconstriction, and fibrin clot formation arrest bleeding. Inflammatory phase (days 1 to 4): neutrophils then macrophages phagocytose bacteria and cellular debris; wound is red, warm, swollen, and tender. Proliferative phase (days 4 to 21): fibroblasts migrate and synthesise collagen; granulation tissue forms (new capillaries and connective tissue); wound contracts (myofibroblasts); epithelialisation closes the surface. Remodelling phase (months to years): collagen fibres reorganise and cross-link; tensile strength increases to a maximum of approximately 80 percent of original; mature scar forms.
4. Clean: no infection and no hollow viscus entered; example: thyroidectomy or mastectomy. Clean-contaminated: controlled entry into a hollow viscus without spillage; example: elective right hemicolectomy. Contaminated: gross spillage of bowel content or fresh traumatic wound; example: laparotomy for perforated appendix before peritonitis is established. Dirty or infected: established infection or perforated viscus with faecal contamination; example: laparotomy for faecal peritonitis from sigmoid perforation.



5. Pressure (direct manual pressure: always the first step; apply for 5 to 10 minutes to a bleeding vessel or wound surface). Ligation (tie the bleeding vessel with an absorbable or non-absorbable suture or metal clip). Diathermy or electrocautery (monopolar: electrical current via a single active electrode causes tissue coagulation; bipolar: current flows only between two forceps tips: safer near nerves and bowel). Topical haemostatic agents (oxidised cellulose: Surgicel; fibrin glue: biological clot; bone wax: controls bleeding from cut bone surfaces). Tourniquet (pneumatic tourniquet on a limb for a bloodless surgical field: maximum 90 minutes for the lower limb).

Part 1.3

1. Superficial incisional SSI: infection of only the skin and subcutaneous tissue of the incision; example: wound redness and purulent discharge after appendicectomy, managed with wound opening and dressing. Deep incisional SSI: infection involving the fascial and muscle layers; example: fascial dehiscence with purulent discharge after laparotomy, requiring operative re-exploration. Organ or space SSI: infection of any anatomical space opened or manipulated during surgery; example: intra-abdominal abscess after bowel resection, managed by CT-guided drainage or re-laparotomy.
2. Prophylactic antibiotics are given to prevent infection in a wound that is not yet infected. Key principles: give within 60 minutes before skin incision (to achieve peak tissue levels at the time of contamination); choose agents covering the expected organisms for the procedure (cefazolin or ampicillin-cloxacillin for clean and clean-contaminated; add metronidazole for bowel and gynaecological procedures); do not continue beyond 24 hours after surgery (prolonged use promotes resistance without reducing SSI risk); repeat the dose intraoperatively if the operation exceeds twice the antibiotic half-life or blood loss exceeds 1500 mL.
3. De-escalation is the practice of switching from the initial broad-spectrum empirical antibiotic regimen to a narrow-spectrum agent targeted at the specific organism identified on culture and sensitivity results. It is important for three reasons: it reduces the selective pressure that drives the emergence of antimicrobial resistance (by minimising unnecessary exposure to broad-spectrum agents), it reduces the risk of side effects and *Clostridioides difficile* infection associated with prolonged broad-spectrum antibiotic use, and it is more cost-effective. In Nigerian hospitals, where antimicrobial resistance patterns are evolving rapidly, routine de-escalation is an essential component of antibiotic stewardship programmes.
4. An abscess is a localised collection of pus within a tissue or confined space. Clinical features: a swelling that is tender, warm, erythematous, and fluctuant (fluctuance on palpation indicates pus under pressure and is the key clinical sign of an abscess ready for drainage). Management: incision and drainage (I&D) under local or general anaesthesia; make an adequate incision to allow free drainage; break down any loculations with a finger; irrigate the cavity with saline; pack the wound loosely with ribbon gauze or a wick; leave the wound open to heal by secondary intention with regular dressing changes. Antibiotics are added only if there is surrounding



cellulitis, systemic features (fever, tachycardia), or the patient is immunocompromised or has valvular heart disease.

5. Necrotising fasciitis presents with severe pain (typically out of proportion to the early skin appearance, which may look deceptively mild), overlying skin progressing from erythema to dusky discolouration to frank necrosis, crepitus (a crackling sensation on palpation or gas visible on plain X-ray or CT from gas-producing organisms), fluid-filled bullae, and rapid systemic deterioration (high fever, tachycardia, hypotension, confusion). Management: do not delay for imaging if the diagnosis is clinically clear; take the patient immediately to the operating theatre for urgent and aggressive surgical debridement of all visibly necrotic tissue (leave the wound open; repeat debridements are typically required at 24 to 48 hour intervals in the first few days); broad-spectrum IV antibiotics covering aerobes and anaerobes (meropenem plus clindamycin or piperacillin-tazobactam plus clindamycin); ICU-level haemodynamic and respiratory support; nutritional support; and definitive wound closure or skin grafting once the wound is clean and healthy.

Part 1.4

1. Total body water (TBW): approximately 60 percent of body weight in an adult male (lower in females approximately 55 percent and in obese individuals approximately 50 percent, as adipose tissue has low water content). Intracellular fluid (ICF): two-thirds of TBW, approximately 40 percent of body weight; principal cation is potassium (3.5 to 5.0 mmol/L). Extracellular fluid (ECF): one-third of TBW, approximately 20 percent of body weight; principal cation is sodium (135 to 145 mmol/L); subdivided into interstitial fluid (approximately 15 percent of body weight, surrounding cells in tissues) and intravascular fluid or plasma (approximately 5 percent of body weight, within blood vessels).
2. Mild fluid deficit: dry mouth and mucous membranes, increased thirst, reduced skin turgor (the skin returns to its normal position slowly after being pinched), dark concentrated urine. Moderate deficit: sunken eyes, tachycardia (the earliest haemodynamic sign of fluid deficit), orthostatic hypotension (drop in systolic BP of above 20 mmHg on standing from lying), urine output below 0.5 mL per kg per hour, elevated urea and creatinine (prerenal azotaemia). Severe deficit or hypovolaemic shock: marked tachycardia above 120 beats per minute, hypotension (systolic BP below 90 mmHg: a late sign indicating loss of more than 30 percent of circulating blood volume), cold peripheries with prolonged capillary refill above 2 seconds, altered consciousness, and anuria.
3. Crystalloids are aqueous solutions of electrolytes that distribute across all fluid compartments. Examples: normal saline (0.9 percent NaCl: isotonic; may cause hyperchloraemic acidosis if given in large volumes) and Hartmann's solution (lactated Ringer's: the preferred surgical crystalloid as it most closely resembles ECF composition; contains sodium, chloride, potassium, calcium, and lactate; less likely to cause acidosis). Indications: routine maintenance fluids, resuscitation of most fluid deficits. Colloids are solutions containing large molecules (gelatins



such as Gelofusine, or human albumin) that remain predominantly within the intravascular compartment, producing more sustained plasma volume expansion. Indications: when rapid and sustained intravascular volume expansion is needed (haemorrhagic shock before blood products are available, hypoalbuminaemia). Crystalloids are generally preferred as first-line for most surgical resuscitation.

4. Causes: vomiting and nasogastric suction (loss of hydrochloric acid and potassium from the stomach), prolonged diarrhoea (potassium lost in stool), prolonged IV fluid therapy without adequate potassium supplementation, loop or thiazide diuretic use, metabolic alkalosis (potassium shifts intracellularly in exchange for hydrogen ions). Clinical features: muscle weakness (can progress to paralysis), cardiac arrhythmias (flat or inverted T-waves, prominent U-waves on ECG; risk of ventricular fibrillation especially with digoxin). Management: identify and correct the underlying cause; mild to moderate (potassium 3.0 to 3.5 mmol/L): oral KCl supplementation if the patient can take oral medication; severe (potassium below 3.0 mmol/L or symptomatic with arrhythmias): IV KCl 20 to 40 mmol in 100 to 250 mL normal saline over 1 to 2 hours via a peripheral vein (maximum rate 10 mmol per hour peripheral, 20 mmol per hour central venous line). Never give IV potassium as a rapid bolus: fatal ventricular fibrillation.
5. Principle: if the gut works, use it. Enteral nutrition (EN): delivery of nutrients into the GI tract via nasogastric tube, nasojejunal tube, or PEG. Advantages: maintains gut mucosal integrity (prevents villous atrophy and reduces bacterial translocation across the bowel wall), stimulates intestinal motility, preserves gut-associated immune function, lower cost, and fewer serious complications. Indicated for any patient who cannot take adequate oral nutrition but has a functioning GI tract. Parenteral nutrition (PN): IV delivery of amino acids, glucose, lipid emulsion, electrolytes, vitamins, and trace elements via a central venous catheter. Indicated when the GI tract cannot be used: paralytic ileus (inability to tolerate enteral feeds), mechanical bowel obstruction, high-output small bowel fistula (above 500 mL per day), and severe short bowel syndrome (less than 100 cm of remaining small bowel). Daily caloric requirement: approximately 25 to 30 kcal per kg per day for most surgical patients (higher in sepsis or major burns).

Part 1.5

- Sign In (performed by the anaesthetist before anaesthesia is induced, with the circulating nurse and surgeon present): confirm patient identity using two identifiers (full name and hospital number or date of birth); confirm written consent is present and the procedure matches; confirm the surgical site is marked; confirm the anaesthetic machine and medication check is complete; confirm the pulse oximeter is attached and functioning; confirm known allergies; assess the risk of difficult airway or aspiration. Time Out (performed by a designated team member with all theatre staff paused and present, before skin incision): all team members confirm the patient's name and the planned procedure; the surgeon states the critical steps, expected blood loss, and any patient-specific concerns; the anaesthetist states any anaesthetic concerns; the scrub nurse confirms instrument sterilisation and any equipment issues; antibiotic prophylaxis is confirmed as given within 60 minutes; essential imaging is displayed and confirmed correct. Sign Out



(performed by the scrub nurse before the patient leaves the operating room): the name of the procedure performed is recorded; swab, needle, and instrument counts are confirmed as correct; surgical specimens are confirmed as correctly labelled with the patient's details; any equipment problems are reported for attention; key recovery concerns (post-op analgesia, observations, IV access) are communicated to the anaesthetic team.

- Minimum PPE for all procedures: surgical gloves (single glove as minimum; double-glove for high-risk cases: known or suspected HIV, hepatitis B or C positive, or high splash risk procedures); impermeable fluid-resistant surgical gown (prevents blood and body fluid soaking through to skin and clothing); surgical face mask (fluid-resistant mask preferred: protects the patient from the team's respiratory secretions and protects the team from splashes to the mouth and nose); eye protection (clear goggles or full face visor: essential protection against blood and fluid splashes to the eyes and conjunctiva; particularly important in laparotomy, vascular surgery, and orthopaedic surgery with power tools). All PPE must be donned before entering the sterile field and doffed safely in the correct sequence (gloves last off, avoiding self-contamination) after leaving.
- The neutral zone technique designates a specific area on the instrument trolley or a separate kidney dish or magnetic mat where sharp instruments (loaded needle holders, scalpel handles, scissors) are placed by the user and retrieved by the recipient without simultaneous hand contact between the two team members. The user places the sharp into the neutral zone and verbalises this; the recipient retrieves it only after the user's hand has moved away; after use, the sharp is returned to the neutral zone. It reduces sharps injuries because the majority of needlestick injuries in the operating theatre occur during direct instrument-to-instrument hand transfers, when both the passer and the receiver have simultaneous contact with the sharp; the neutral zone eliminates this moment of simultaneous contact and is particularly effective in combination with a verbal announcement.
- Three preoperative measures: (1) antibiotic prophylaxis within 60 minutes before skin incision: the most evidence-based single SSI prevention measure, reducing SSI rates by approximately 50 percent for clean-contaminated procedures; (2) hair removal by clipping rather than shaving: razor shaving creates micro-abrasions that become colonised by bacteria within hours; clipping immediately before surgery in the operating department is associated with the lowest SSI rates; (3) glycaemic control below 10 mmol/L perioperatively in diabetic patients: hyperglycaemia impairs neutrophil chemotaxis, phagocytosis, and oxidative burst killing of bacteria, significantly increasing SSI risk. Two intraoperative measures: (1) maintaining normothermia with forced-air warming blankets and warmed IV fluids: hypothermia (core temperature below 36 degrees C) reduces tissue oxygen tension and impairs neutrophil oxidative killing of bacteria, increasing SSI risk; (2) gentle tissue handling: minimising tissue devitalisation, haematoma formation, and dead space, as devitalised tissue and haematoma provide ideal culture media for bacteria.
- Shaving with a razor blade creates microscopic cuts and abrasions in the skin surface, disrupting the normal skin barrier and creating entry points for bacteria. Within 2 hours of shaving, these micro-abrasions become colonised with skin bacteria (primarily *Staphylococcus* species); by the time surgery is performed (if hair was shaved the night before), the bacterial load at the proposed incision site is significantly higher than in unshaved or clipped skin, directly increasing the risk of



SSI. Clipping with a single-use electric clipper head removes the hair above the skin surface without creating abrasions; when performed in the operating department immediately before the patient enters the operating theatre, it minimises the interval for bacterial colonisation. If no hair removal is actually necessary for the procedure (that is, hair does not interfere with the operation or wound closure), it should not be performed at all.

Part 1.6

1. The risk of HIV transmission from a single needlestick injury from an HIV-positive source is approximately 0.3 percent (3 per 1000 exposures). Three factors increasing this risk: (1) a hollow-bore needle (for example a phlebotomy needle or IV cannula: its lumen carries a column of infected blood that is injected into the wound on penetration, delivering a much larger viral inoculum than a solid suture needle); (2) a deep injury (greater depth of penetration delivers more infected material into the wound and closer to blood vessels, increasing the effective inoculum); (3) a high viral load in the source patient (a patient with untreated or late-stage HIV has very high circulating HIV RNA levels; the concentration of virus per mL of blood is dramatically higher, so the same volume of blood delivers a much larger inoculum per exposure).
2. Immediate steps for a needlestick injury: (1) stop the current surgical task immediately if it is safe to do so and inform the scrub team; (2) remove gloves and wash the wound vigorously with soap and running water for at least 2 minutes (soap disrupts viral lipid envelopes and mechanical washing removes the inoculum from the wound surface and tracks); (3) allow the wound to bleed freely under running water to flush out the inoculum (do not squeeze or massage the wound as this may drive the inoculum deeper into the tissues; do not suck the wound as the oral mucosa provides a potential entry route); (4) for mucosal splashes to the eyes, irrigate immediately and copiously with clean water or physiological saline for at least 5 minutes; for oral mucosa, rinse with large amounts of water; (5) cover the wound with a waterproof dressing and proceed to report.
3. HIV PEP regimen in Nigerian practice: preferred first-line regimen is TLD (tenofovir disoproxil fumarate 300 mg plus lamivudine 300 mg plus dolutegravir 50 mg) as a single fixed-dose combination tablet taken once daily. Timing: the regimen must be started as soon as possible after exposure, ideally within 2 hours; the maximum window for PEP efficacy is 72 hours after exposure (animal and epidemiological studies show no efficacy when started after this window). Duration: 28 days of continuous daily treatment without interruption; interruptions reduce efficacy. Side effects are generally mild (nausea, headache, fatigue) and tend to resolve within the first 1 to 2 weeks. Follow-up: HIV testing at 6 weeks, 12 weeks, and 6 months to confirm non-seroconversion; the exposed healthcare worker should also be assessed for mental health impact of the injury.
4. Enhanced IPC measures when operating on a COVID-19-positive patient: (1) all members of the theatre team must wear an FFP2 or FFP3 respirator (N95 equivalent or higher): standard surgical masks are insufficient to filter the submicron aerosols generated by intubation, extubation, and



laparoscopic gas insufflation; (2) the anaesthetic team managing the airway must wear full PPE: FFP3 respirator, impermeable gown, double gloves, and full face shield or powered air-purifying respirator (PAPR); (3) perform the operation in a designated COVID-19-positive theatre with negative-pressure ventilation (air flows inward from the corridor, preventing spread of contaminated air) where available; (4) minimise the number of theatre personnel to essential staff only; (5) use rapid sequence induction (RSI) with video laryngoscopy for intubation to minimise aerosolisation time and the number of airway manipulation attempts; (6) have a low threshold for postoperative ICU admission given the significantly higher risk of pulmonary complications and thromboembolic events.

5. Data from the COVIDSurg international collaborative study showed that 30-day postoperative mortality in patients with perioperative COVID-19 was approximately 24 percent, compared with approximately 2 percent in COVID-negative patients undergoing similar procedures. The main perioperative complications are: postoperative pulmonary complications (pneumonia, ARDS, prolonged ventilator dependency: from COVID-19 pneumonitis exacerbated by general anaesthesia and surgical stress), thromboembolic events (deep vein thrombosis and pulmonary embolism: from COVID-19-induced hypercoagulable state persisting for weeks after the acute infection), and prolonged ICU stay. These risks remain elevated for at least 7 weeks after the acute infection (reflecting persistent systemic inflammation and coagulopathy that takes time to resolve), after which they return to near-baseline levels. Deferring elective surgery for at least 7 weeks after COVID-19 infection (and until the patient is fully recovered and asymptomatic) is therefore the evidence-based recommendation.

References and Attributions [Series 1]

Textual References

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- Federal Ministry of Health Nigeria. (2021). National Guidelines for HIV Prevention, Treatment and Care. Abuja: FMOH.

Figures, Plates, Tables, and Boxes



- Figure 1.1: The surgical discipline and the multidisciplinary team. AI-generated using the prompt: "Three-panel diagram: surgical specialties branching diagram and types of surgery; circular MDT diagram with patient at centre; two-column ethical principles and informed consent table with key documents box." Suggested OER search string: "surgical specialties multidisciplinary team surgical ethics informed consent diagram OER."
- Figure 1.2: Principles of surgery, wound healing, and haemostasis. AI-generated using the prompt: "Three-panel diagram: surgical decision-making principles flow and ASA classification table; wound healing phases timeline and wound classification table; physiological haemostasis stages and surgical haemostasis methods table." Suggested OER search string: "wound healing phases classification surgical haemostasis ASA classification diagram OER."
- Figure 1.3: Surgical infections and antibiotic use. AI-generated using the prompt: "Three-panel diagram: hierarchical SSI classification by level and source with definition and common organisms; three-row antibiotic use table (prophylactic, empirical, therapeutic) with stewardship box; cellulitis, abscess, and necrotising fasciitis condition boxes." Suggested OER search string: "surgical infections classification SSI antibiotic prophylaxis cellulitis abscess necrotising fasciitis OER."
- Figure 1.4: Fluid, electrolyte, and nutritional support. AI-generated using the prompt: "Three-panel diagram: nested body fluid compartment diagram with daily balance summary; fluid deficit assessment and IV fluid types and electrolyte disturbances table; enteral versus parenteral nutrition decision flowchart." Suggested OER search string: "body fluid compartments electrolyte disturbances enteral parenteral nutrition surgery diagram OER."
- Figure 1.5: Safe surgery and universal precautions. AI-generated using the prompt: "Three-panel diagram: WHO Surgical Safety Checklist three-column diagram (Sign In, Time Out, Sign Out); PPE illustration and neutral zone sharps safety diagram and WHO Five Moments box; SSI prevention three-column table." Suggested OER search string: "WHO surgical safety checklist universal precautions SSI prevention operating theatre OER."
- Figure 1.6: HIV/AIDS, needlestick injury management, and COVID-19. AI-generated using the prompt: "Three-panel diagram: HIV transmission risk table and theatre precautions checklist; five-step needlestick injury management flowchart; COVID-19 surgical risks table and enhanced IPC measures list." Suggested OER search string: "HIV surgical risk needlestick injury post-exposure prophylaxis COVID-19 surgical practice OER."



Series 2: Clinical Evaluation in Surgery

- **Part 2.1: History Taking in Surgery**
 - Sub Part 2.1.1: The surgical history
 - Sub Part 2.1.2: Common surgical presenting complaints
 - Sub Part 2.1.3: Past medical, family, and social history in surgery
- **Part 2.2: Physical Examination of the Surgical Patient**
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- **Part 2.3: Physical Signs in Clinical Surgery**
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 - Sub Part 2.5.2: From symptoms and signs to diagnosis
 - Sub Part 2.5.3: Communicating the diagnosis to the patient
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 - Sub Part 2.6.1: Acute abdomen
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 - Sub Part 2.6.3: Herniae and lumps: clinical presentation



Introduction

The ability to take a thorough surgical history and to perform a systematic physical examination are the most fundamental clinical skills in surgery. Together, they enable the clinician to generate a differential diagnosis, select appropriate investigations, and establish the working diagnosis on which management decisions are based. In many Nigerian hospitals, a well-conducted clinical evaluation remains the most reliable tool available, particularly in settings where advanced investigations are limited.

This Series focuses on the clinical evaluation of the surgical patient. We shall begin with the structured surgical history and the assessment of common surgical complaints. We will then examine the physical examination of the surgical patient, including the abdomen and lumps, and explore the important physical signs in clinical surgery. Moving on, we survey surgical investigations and the process of arriving at a diagnosis. We close with the clinical presentation of the most common surgical conditions encountered in Nigerian practice.

Series Learning Outcomes

Upon completing this Series, you should be able to:

1. **SLO 2.1:** take a structured surgical history and identify the key features of common surgical presenting complaints,
2. **SLO 2.2:** perform a systematic physical examination of the surgical patient, including the abdomen and a lump,
3. **SLO 2.3:** identify and interpret the important physical signs in clinical surgery,
4. **SLO 2.4:** select and interpret appropriate investigations for a surgical patient,
5. **SLO 2.5:** formulate a differential diagnosis from surgical symptoms and signs and communicate the diagnosis to the patient, and
6. **SLO 2.6:** describe the typical clinical presentation of the acute abdomen, intestinal obstruction, herniae, and lumps.

2.1 History Taking in Surgery

2.1.1 The surgical history

A surgical history follows the same structure as any medical history but requires greater precision in characterising the presenting complaint, as the nature and quality of symptoms often



directly indicate the underlying surgical pathology. The history begins with the presenting complaint stated in the patient's own words, followed by a detailed history of the presenting complaint: onset (sudden or gradual), site, character (colicky, constant, sharp, dull), severity, radiation, duration, progression, and any associated symptoms. The timing and mode of onset are particularly important: sudden severe pain suggests a catastrophic event such as viscus perforation or vascular rupture.

Always ask about the effect of the complaint on the patient's daily activities and function: a surgeon must understand how much the problem is affecting the patient's life, as this influences the threshold for operative intervention. Complete the history by enquiring about appetite and weight (significant unintentional weight loss raises concern for malignancy), bowel habit (changes in frequency, consistency, or the presence of blood), urinary symptoms, and menstrual history in women of childbearing age. Review of systems must cover cardiovascular, respiratory, and neurological symptoms, as comorbidities in these systems affect surgical fitness.

Fill in the blank: The timing and mode of onset of a surgical symptom are important: sudden severe abdominal pain suggests _____ perforation or vascular _____. Significant unintentional weight loss in a surgical patient raises concern for _____.

2.1.2 Common surgical presenting complaints

Pain is the most common surgical complaint and must be characterised using the SOCRATES mnemonic: Site, Onset, Character, Radiation, Associated symptoms, Timing, Exacerbating and relieving factors, and Severity. Colicky pain (intermittent, coming in waves with complete or near-complete relief between episodes) suggests obstruction of a hollow viscus (bowel colic, ureteric colic, biliary colic). Constant severe pain suggests inflammation or ischaemia. The radiation of pain follows predictable anatomical patterns: epigastric pain radiating to the back suggests acute pancreatitis or a posterior peptic ulcer; right iliac fossa pain suggests appendicitis; right hypochondrial pain radiating to the right shoulder suggests gallbladder disease (referred pain via the right phrenic nerve to the right shoulder tip).

A lump or swelling is another common surgical presentation. The clinician must determine when it was first noticed, how it has changed in size over time, whether it is painful, and whether there are any associated systemic symptoms (fever, weight loss, night sweats: the B symptoms of lymphoma). Rectal bleeding (haematochezia: bright red blood per rectum) may indicate haemorrhoids (most common), colorectal carcinoma, diverticular disease, or anal fissure. Dysphagia (difficulty swallowing) is a red-flag symptom that must be investigated urgently, as it suggests oesophageal pathology including carcinoma.

Fill in the blank: Pain that comes in waves with complete relief between episodes is called _____ pain and suggests obstruction of a hollow viscus. Epigastric pain radiating to the _____ suggests acute pancreatitis or a posterior peptic ulcer.

2.1.3 Past medical, family, and social history in surgery



The past medical history in a surgical patient must specifically cover previous surgical operations (ask about the indication, the procedure, and any complications: adhesions from previous abdominal surgery are the most common cause of small bowel obstruction in Nigeria), previous anaesthetic problems (difficult intubation, malignant hyperthermia, or prolonged apnoea from suxamethonium may be familial), previous episodes of the same complaint (recurrent biliary colic suggests cholelithiasis), and known medical comorbidities (hypertension, diabetes mellitus, ischaemic heart disease, asthma, sickle cell disease, and HIV, all of which affect operative risk and perioperative management).

The drug history covers all current medications, with particular attention to: anticoagulants (warfarin, direct oral anticoagulants: must be stopped and reversed before elective surgery), antiplatelet drugs (aspirin, clopidogrel: discuss with the surgeon whether to continue perioperatively), steroids (long-term steroid use causes adrenal suppression: stress-dose steroids are needed perioperatively), and oral contraceptive pill (increases thromboembolic risk: consider stopping 4 weeks before major elective surgery). The social history documents the patient's occupation, smoking status (increases respiratory complications and impairs wound healing), alcohol consumption (hepatic impairment and withdrawal risk), and the patient's home circumstances and support network for postoperative recovery.

Fill in the blank: Adhesions from previous abdominal _____ are the most common cause of small bowel obstruction in Nigeria. _____ (warfarin, DOACs) must be stopped and reversed before elective surgery.

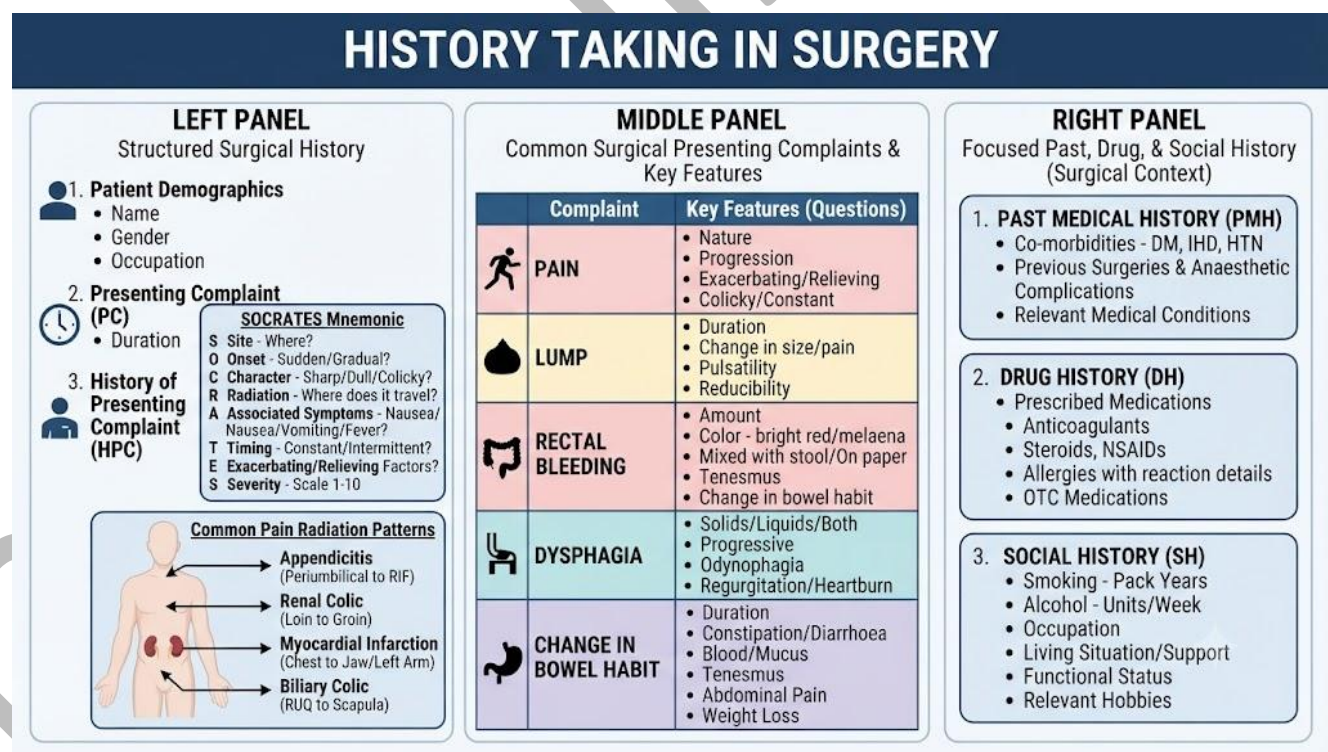


Figure 2.1: Surgical history framework, SOCRATES, common surgical complaints, and past medical and social history



Pilot questions 2.1

1. Describe the SOCRATES mnemonic and explain how it applies to abdominal pain. (Linked to SLO 2.1)
2. Distinguish colicky from constant abdominal pain and state the surgical significance of each. (Linked to SLO 2.1)
3. Describe the radiation patterns of abdominal pain and state the likely diagnosis for each. (Linked to SLO 2.1)
4. State four drug classes that are particularly important to document in the surgical drug history and explain why. (Linked to SLO 2.1)
5. Explain why a history of previous abdominal surgery is important in a patient with acute small bowel obstruction. (Linked to SLO 2.1)

2.2 Physical Examination of the Surgical Patient

2.2.1 General examination and vital signs

The surgical physical examination begins with a general inspection before the patient is examined in detail: assess the patient's general state of health (well or unwell), nutritional status, colour (pallor, jaundice, central cyanosis), hydration status, level of consciousness, and the presence of any obvious abnormality. Vital signs are measured and recorded: temperature (fever above 38 degrees C or hypothermia below 36 degrees C: hypothermia in sepsis is a sinister sign), heart rate (tachycardia: infection, pain, haemorrhage, dehydration, or pulmonary embolism), blood pressure (hypotension: shock; hypertension: may indicate pain or pre-existing disease), respiratory rate (the most sensitive early indicator of deterioration in a surgical patient), and oxygen saturation.

The hands and peripheries provide important clinical information: finger clubbing (chronic suppurative lung disease, bronchogenic carcinoma, inflammatory bowel disease, cirrhosis), koilonychia (iron deficiency from chronic GI blood loss), leukonychia (hypoalbuminaemia from malnutrition or chronic liver disease), palmar erythema and spider naevi (chronic liver disease), Dupuytren's contracture (palmar fibromatosis: associated with alcoholic liver disease), and peripheral oedema (hypoproteinaemia, cardiac failure, venous insufficiency, or lymphoedema). A systematic head-to-toe approach ensures no finding is missed.

Fill in the blank: A respiratory rate that is elevated is the most sensitive early indicator of _____ in a surgical patient. Finger clubbing in a surgical patient may indicate chronic suppurative lung disease, bronchogenic carcinoma, inflammatory bowel disease, or _____.

2.2.2 Examination of the abdomen



Abdominal examination follows the sequence: inspection, palpation, percussion, and auscultation (IPPA). Inspection: look for scars (document location, type, and approximate date), distension (generalised: gas, fluid, fat, faeces, or fetus; localised: hernia, mass, or organomegaly), visible peristalsis (suggests intestinal obstruction: a late and serious sign), skin changes (caput medusae: dilated periumbilical veins indicating portal hypertension; Grey Turner's sign: bruising in the flanks indicating retroperitoneal haemorrhage; Cullen's sign: periumbilical bruising indicating intraperitoneal haemorrhage: both classically associated with severe acute pancreatitis).

Palpation is performed with warm hands, starting away from the area of pain and moving systematically through all nine regions. Assess for tenderness (localised or generalised), rigidity (board-like rigidity: indicates generalised peritonitis from free intraperitoneal gas or pus), guarding (voluntary or involuntary), and organomegaly (liver, spleen, and kidneys). Percussion elicits tympanism (gas-filled bowel or free gas under the diaphragm: loss of liver dullness) and shifting dullness (free peritoneal fluid: ascites). Auscultation assesses bowel sounds: absent (paralytic ileus or peritonitis), high-pitched tinkling (mechanical obstruction), or normal.

Fill in the blank: Abdominal examination follows the sequence of inspection, palpation, _____, and auscultation. Loss of liver _____ on percussion indicates free gas under the diaphragm.

2.2.3 Examination of a lump

A structured approach to examining a lump or swelling uses a systematic sequence of physical characteristics. Site and size (measure in two dimensions). Shape (regular or irregular). Surface (smooth, nodular, bosselated). Edge (well-defined or ill-defined). Consistency (soft, firm, hard, stony-hard: stony hardness suggests malignancy or calcification). Fluctuance (fluid within: tested by the cross-fluctuation technique using two fingers). Transillumination (a bright light placed behind the lump: positive transillumination indicates a fluid-filled cystic lesion such as a hydrocoele or sebaceous cyst without hair or keratin).

Further characteristics: pulsatility (expansile pulsation suggests an arterial aneurysm; transmitted pulsation is not diagnostic), reducibility (a hernia or varicocoele reduces on lying down or on gentle pressure), compressibility (a venous lesion or haemangioma empties on compression and refills on release), tenderness, temperature (increased warmth over a lump suggests inflammation or vascular tumour), fixity to skin or deep structures, regional lymph nodes (enlarged draining nodes suggest malignancy or infection), and auscultation over the lump (bruit over an arteriovenous malformation or vascular tumour).

Fill in the blank: Stony hardness of a lump suggests _____ or calcification. Positive _____ indicates that a lump is fluid-filled and cystic (for example a hydrocoele).



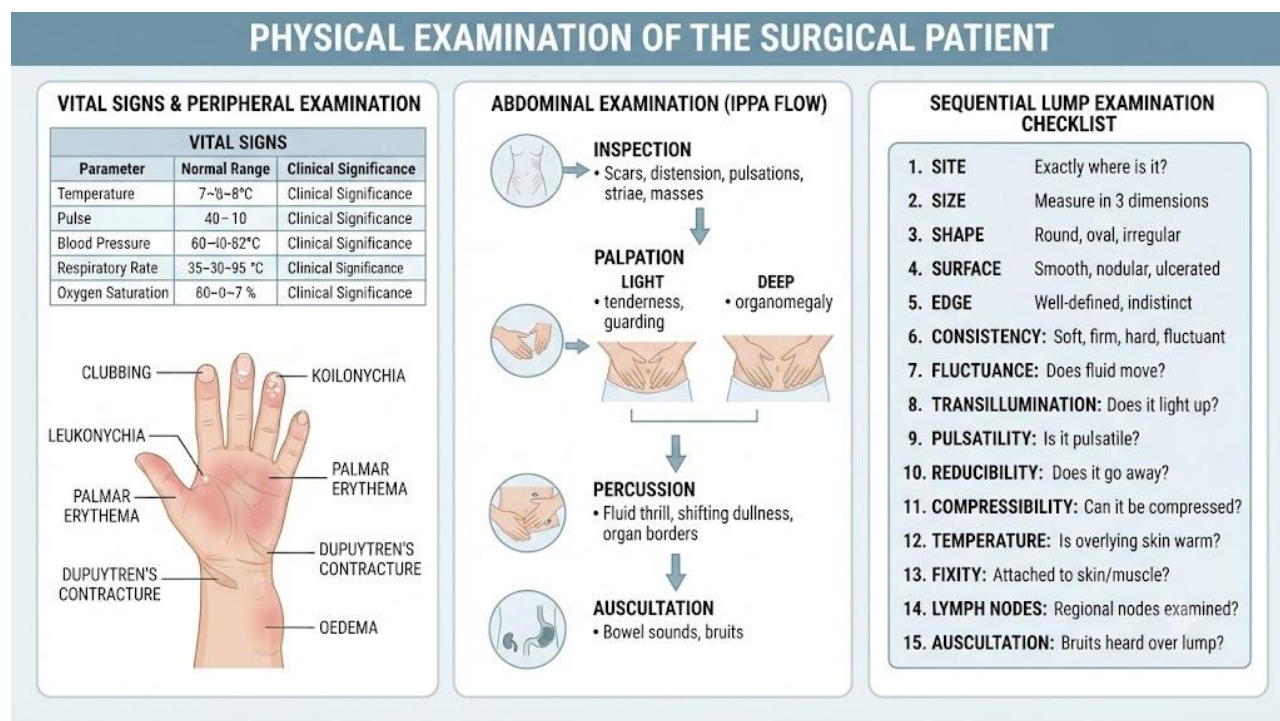


Figure 2.2: General examination and vital signs, abdominal examination (IPPA), and examination of a lump

Pilot questions 2.2

- Describe the vital signs assessment in a surgical patient and state the significance of each. (Linked to SLO 2.2)
- Describe the peripheral signs in the hands that are clinically relevant in a surgical patient. (Linked to SLO 2.2)
- Describe the IPPA sequence for abdominal examination, stating the key findings at each step. (Linked to SLO 2.2)
- Describe the structured approach to examining a lump, naming all the characteristics assessed. (Linked to SLO 2.2)
- Distinguish an expansile pulsation from a transmitted pulsation in a lump and state the significance of each. (Linked to SLO 2.2)

2.3 Physical Signs in Clinical Surgery

2.3.1 Signs of peritoneal irritation



Peritoneal irritation (peritonism) occurs when the parietal peritoneum is inflamed, typically from infection (peritonitis: bacterial contamination from viscus perforation), chemical injury (bile, gastric acid, urine, or blood in the peritoneal cavity), or ischaemia. The cardinal signs are: tenderness on palpation (localised to the affected area or generalised in diffuse peritonitis), guarding (involuntary contraction of the abdominal wall muscles in response to palpation: a reflex protective mechanism), rigidity (board-like sustained contraction of the abdominal wall: indicates advanced peritonitis with diffuse inflammation of the parietal peritoneum), and rebound tenderness (pain that is worse when the examining hand is suddenly released after deep palpation: indicates inflammation of the parietal peritoneum adjacent to the organ).

Rovsing's sign is positive when pressure applied to the left iliac fossa causes pain in the right iliac fossa, suggesting appendiceal inflammation. The psoas sign (pain on extension of the right hip, stretching the psoas muscle) and obturator sign (pain on internal rotation of the flexed right hip, stretching the obturator internus) are additional tests for retrocaecal or pelvic appendicitis respectively. Loss of liver dullness on percussion (replaced by tympanism) indicates free gas under the right hemidiaphragm from a perforated hollow viscus and is a classical sign of visceral perforation.

Fill in the blank: Involuntary contraction of the abdominal wall muscles on palpation is called _____. Loss of liver _____ on percussion, replaced by tympanism, indicates free intraperitoneal gas from a perforated viscus.

2.3.2 Signs in gastrointestinal obstruction

Intestinal obstruction produces characteristic clinical signs that vary with the level of obstruction. High small bowel obstruction (jejunal) causes early and profuse vomiting (initially gastric then bilious then faeculent), minimal abdominal distension, and early bowel sounds. Low small bowel obstruction (ileal) causes later and less profuse vomiting, central abdominal distension, and classic high-pitched tinkling or rushes on auscultation. Large bowel obstruction causes marked abdominal distension (typically peripheral, involving all four quadrants), late or absent vomiting, absolute constipation (no passage of flatus or faeces: the most reliable symptom of complete obstruction), and tympanism on percussion.

Abdominal distension in obstruction follows the law of Laplace: the caecum (widest portion of the large bowel) is at greatest risk of perforation in colonic obstruction, as wall tension is highest where the diameter is greatest. A caecal diameter above 12 cm on plain X-ray or CT indicates imminent perforation and requires urgent decompression. Visible peristalsis (wavelike movements across the abdomen corresponding to peristaltic contractions of distended bowel loops) is a late and serious sign of advanced mechanical obstruction and indicates a significant degree of obstruction with dilated bowel.

Fill in the blank: Absolute constipation (no passage of flatus or faeces) is the most reliable symptom of complete _____ obstruction. The _____ is at greatest risk of perforation in large bowel obstruction because it has the largest diameter.



2.3.3 Important eponymous surgical signs

Several clinical signs in surgery bear the names of the surgeons who first described them and remain in everyday use. Murphy's sign: the examiner places their hand in the right hypochondrium and asks the patient to take a deep breath; the descending inflamed gallbladder contacts the examiner's hand, causing the patient to catch their breath and stop inhaling (positive Murphy's sign); it indicates acute cholecystitis and distinguishes it from hepatomegaly (which does not cause a positive Murphy's sign). Cullen's sign (periumbilical bruising) and Grey Turner's sign (flank bruising) indicate retroperitoneal haemorrhage, classically from severe acute pancreatitis (both are late signs appearing 24 to 48 hours after the onset of the haemorrhage).

Courvoisier's law states that in obstructive jaundice, a palpable, non-tender gallbladder is unlikely to be due to gallstones; this is because chronic cholelithiasis causes fibrosis and a shrunken gallbladder incapable of distending, whereas obstruction from pancreatic head carcinoma or a bile duct tumour causes progressive distension of a previously normal gallbladder. The sign of Dance (an empty right iliac fossa on palpation) suggests intussusception (telescoping of one segment of bowel into another), as the intussusception draws the bowel away from the right iliac fossa. Trousseau's sign of malignancy (migratory superficial thrombophlebitis) suggests an underlying occult visceral malignancy (particularly pancreatic carcinoma).

Fill in the blank: Murphy's sign is positive in acute _____ and is elicited by asking the patient to _____ deeply while pressure is applied in the right hypochondrium. Courvoisier's law states that a palpable non-tender gallbladder in obstructive jaundice is unlikely to be due to _____.



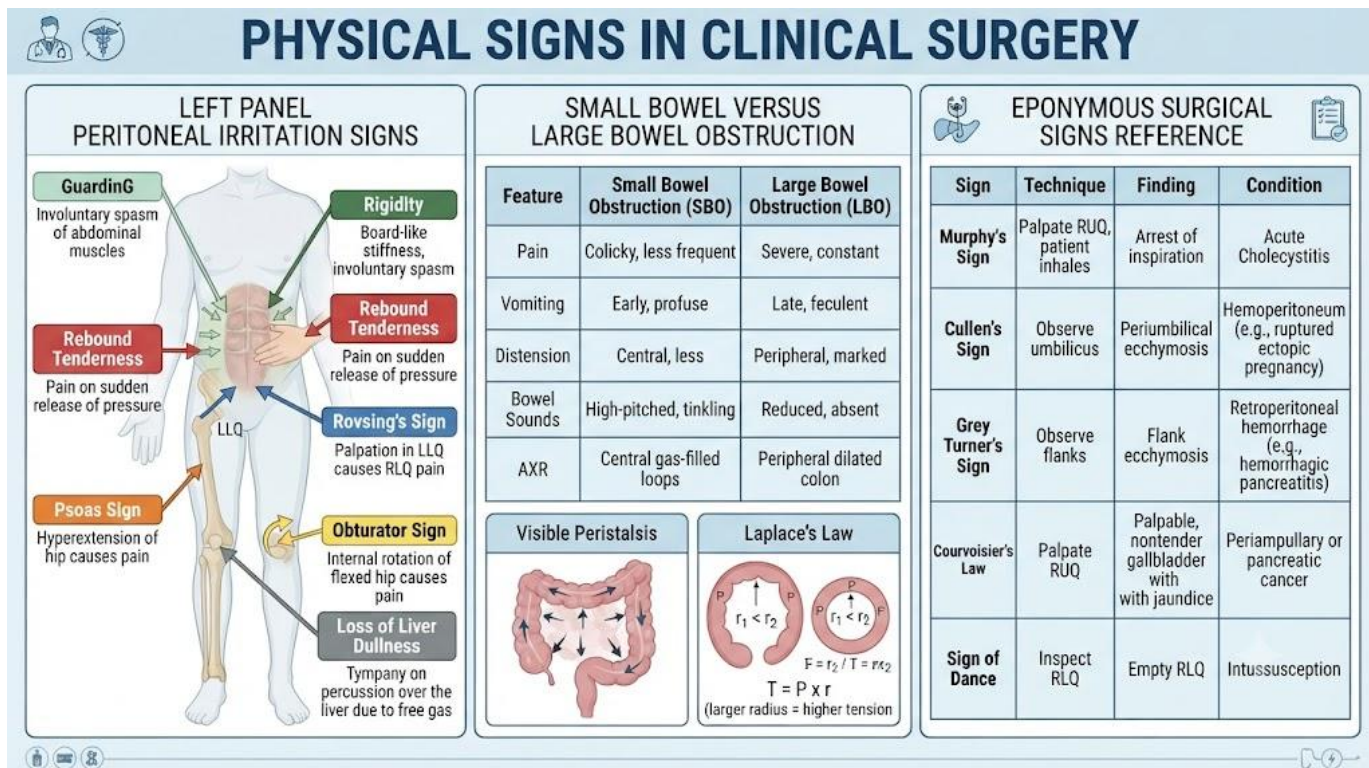


Figure 2.3: Signs of peritoneal irritation, gastrointestinal obstruction signs, and eponymous surgical signs

Pilot questions 2.3

1. Describe the signs of peritoneal irritation and distinguish guarding from rigidity. (Linked to SLO 2.3)
2. Describe Rovsing's sign, the psoas sign, and the obturator sign and state the diagnosis each suggests. (Linked to SLO 2.3)
3. Compare the clinical signs of small bowel and large bowel obstruction. (Linked to SLO 2.3)
4. Describe Murphy's sign, state how it is elicited, and state the diagnosis it suggests. (Linked to SLO 2.3)
5. State Courvoisier's law and explain the pathophysiological basis for it. (Linked to SLO 2.3)



2.4 Investigation of the Surgical Patient

2.4.1 Haematological and biochemical investigations

Routine preoperative investigations serve two purposes: to establish the patient's baseline physiological status and to detect abnormalities that may affect operative risk or require correction before surgery. Full blood count (FBC): haemoglobin (anaemia increases operative risk and impairs wound healing: correct preoperatively if time allows), white cell count (leucocytosis suggests infection or inflammation; leucopenia may indicate bone marrow suppression from chemotherapy), and platelet count (thrombocytopaenia increases bleeding risk). Urea and electrolytes (U&E): renal function must be assessed before any major operation (acute kidney injury is a common postoperative complication; pre-existing chronic kidney disease alters drug dosing); sodium and potassium must be within normal limits before elective surgery.

Liver function tests (LFTs) are indicated in jaundiced patients, those with known liver disease, or those with significant alcohol use, as hepatic dysfunction affects drug metabolism, coagulation factor production, and wound healing. Serum amylase (or lipase) is the most important single test in suspected acute pancreatitis: a level above three times the upper limit of normal is diagnostic in the appropriate clinical context. Coagulation studies (prothrombin time and APTT) are required before any operation in patients on anticoagulants, with liver disease, or with a history of abnormal bleeding. Group and save (blood group and antibody screen) is performed for all operations in which blood transfusion may be required; cross-match is requested when transfusion is expected.

Fill in the blank: A serum amylase above _____ times the upper limit of normal is diagnostic of acute pancreatitis in the appropriate clinical context. A _____ and save is performed before all operations in which blood transfusion may be needed.

2.4.2 Imaging in surgical practice

Plain X-rays remain widely used in Nigerian surgical practice. Erect chest X-ray (CXR): detects free air under the diaphragm (pneumoperitoneum from visceral perforation: classically a crescent of air under the right hemidiaphragm), pleural effusion (sympathetic or empyema), and mediastinal widening. Plain abdominal X-ray (supine and erect): dilated bowel loops with air-fluid levels (intestinal obstruction: valvulae conniventes in small bowel; haustral markings in large bowel), absence of rectal gas (complete obstruction), and radio-opaque calculi (renal, ureteric, or gallstones: though only 10 percent of gallstones are radio-opaque).

Ultrasound is the first-line imaging for most abdominal surgical conditions in Nigerian practice: it is safe (no radiation), widely available, inexpensive, and real-time. It is the investigation of choice for gallstones, acute cholecystitis, liver masses, appendicitis, renal and ureteric calculi, and abdominal aortic aneurysm. CT scanning, where available, provides superior anatomical detail and is the gold standard for staging malignancy, evaluating the source and extent of intra-abdominal sepsis, characterising complex solid organ injuries, and planning complex surgical



procedures. MRI is used for soft tissue characterisation, hepatobiliary and pancreatic pathology (MRCP: magnetic resonance cholangiopancreatography), and rectal cancer staging.

Fill in the blank: Free air under the diaphragm on an erect CXR indicates _____ from a perforated viscus. Ultrasound is the investigation of choice for _____ and acute cholecystitis in Nigerian surgical practice.

2.4.3 Histopathological and microbiological investigations

Histopathological investigation provides the definitive tissue diagnosis. Biopsy types used in surgery: fine needle aspiration cytology (FNAC: uses a fine needle to aspirate cells from a solid lesion: provides cytological but not architectural information: used for thyroid nodules, breast lumps, and lymph nodes), core needle biopsy (Tru-Cut: uses a larger cutting needle to obtain a tissue core: provides histological architecture for definitive diagnosis), incisional biopsy (surgical removal of a portion of a lesion for histology), and excisional biopsy (removal of the entire lesion: diagnostic and potentially therapeutic). Intraoperative frozen section allows rapid histological assessment of a specimen while the patient is still on the operating table (result in 20 to 30 minutes), guiding the extent of resection.

Microbiological investigations guide the treatment of surgical infections. Wound swabs and pus cultures (taken at the time of incision and drainage or debridement: identify the causative organism and guide antibiotic de-escalation), blood cultures (taken before antibiotics in any patient with fever and suspected bacteraemia or sepsis: two sets from different sites), urine cultures (for urinary tract infections before urological procedures), and peritoneal fluid cultures (from laparotomy washings or drain fluid in intra-abdominal sepsis) are all relevant. Sensitivity testing is essential to guide targeted antibiotic therapy and de-escalation.

Fill in the blank: FNAC uses a fine needle to aspirate _____ from a solid lesion, providing cytological information. Blood cultures should be taken _____ antibiotics are administered in a febrile surgical patient.



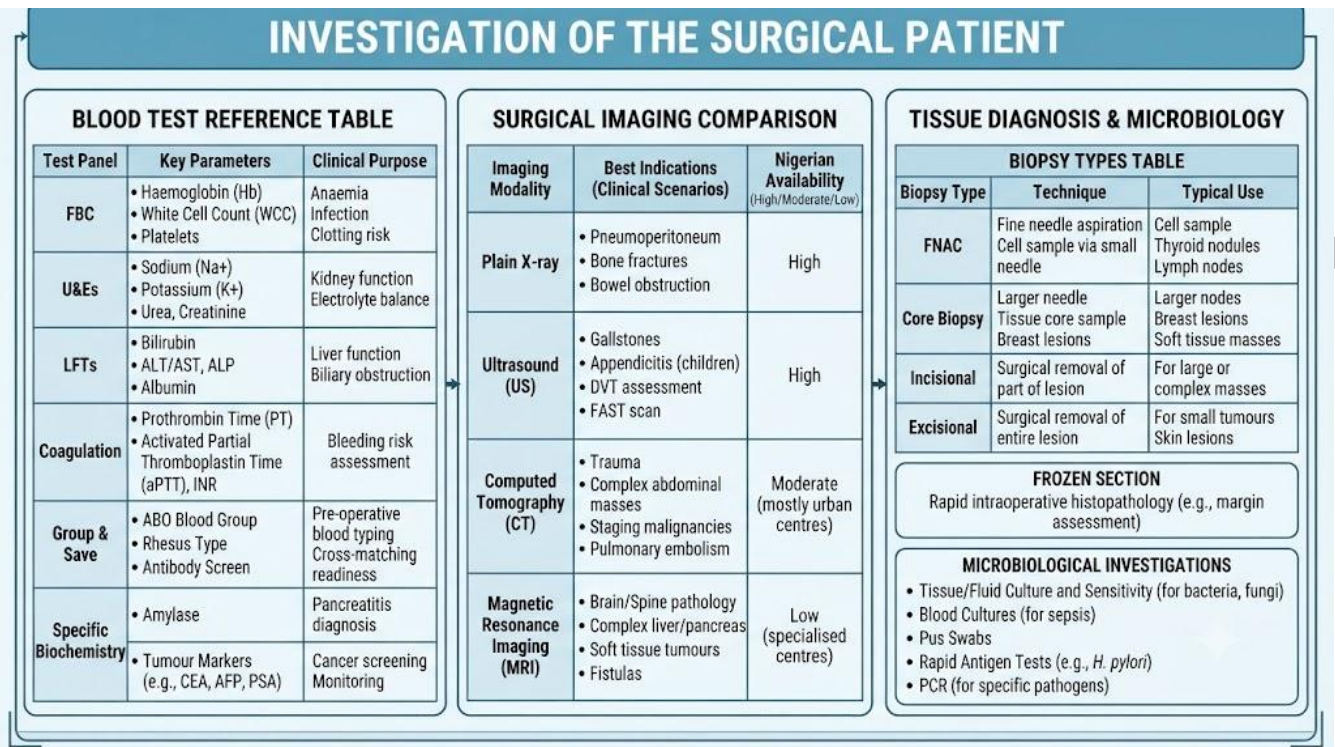


Figure 2.4: Haematological and biochemical investigations, imaging, and histopathological and microbiological investigations

Pilot questions 2.4

- Describe the preoperative blood tests required before a major elective abdominal operation and state the significance of each. (Linked to SLO 2.4)
- Describe the findings on plain abdominal X-ray in intestinal obstruction and state how small bowel differs from large bowel obstruction. (Linked to SLO 2.4)
- State the indications for ultrasound in surgical practice and explain why it is the first-line imaging in Nigerian surgery. (Linked to SLO 2.4)
- Distinguish FNAC from core needle biopsy and state the clinical indication for each. (Linked to SLO 2.4)
- Describe the microbiological investigations used in surgical practice and state the timing of blood cultures relative to antibiotic administration. (Linked to SLO 2.4)

2.5 Diagnosis in Surgery

2.5.1 Formulating a differential diagnosis



A differential diagnosis is a ranked list of possible diagnoses that could explain the patient's presenting symptoms, signs, and investigation results, arranged in order of likelihood. The process of formulating a differential diagnosis begins with identifying the key clinical features (the combination of the site, character, and radiation of pain, the associated symptoms, and the physical signs) and then generating a list of conditions that are consistent with those features. The list is then ranked by probability, taking into account the patient's age, sex, risk factors, and the prevalence of each condition in the local clinical population.

A useful framework for generating a surgical differential diagnosis is the surgical sieve: a systematic approach to categorising possible causes by aetiology (Vascular, Inflammatory or Infective, Neoplastic, Degenerative, Congenital, Autoimmune, Traumatic, Endocrine or Metabolic: the VINDICATE mnemonic, or variations thereof). For any given surgical problem, working through each category ensures that rare but important diagnoses are not overlooked. The clinician then uses additional history, examination findings, and targeted investigations to narrow the list and arrive at the most likely working diagnosis.

Fill in the blank: A differential diagnosis is a ranked list of possible diagnoses arranged in order of _____. A useful mnemonic for generating a surgical differential is VINDICATE, which stands for Vascular, Inflammatory, Neoplastic, Degenerative, _____, Congenital, Autoimmune, Traumatic, Endocrine.

2.5.2 From symptoms and signs to diagnosis

Certain symptom and sign combinations are so characteristic that they point strongly to a specific surgical diagnosis. Central abdominal pain that migrates to the right iliac fossa, associated with anorexia, nausea, low-grade fever, and localised tenderness with guarding at McBurney's point, is the classic presentation of acute appendicitis. Sudden severe epigastric pain radiating to the back, with a positive Murphy's sign and raised inflammatory markers, suggests acute pancreatitis. Colicky right hypochondrial pain radiating to the right shoulder tip, worsened by fatty foods, suggests biliary colic or acute cholecystitis. Painless progressive jaundice with a palpable non-tender gallbladder (positive Courvoisier's law) strongly suggests a malignant obstruction of the common bile duct.

These pattern recognition skills are developed through clinical experience and deliberate practice. In Nigerian practice, it is particularly important to maintain a low threshold for considering surgical emergencies such as typhoid ileal perforation (presenting as sudden perforation peritonitis in a patient with a history of prolonged fever and diarrhoea), amoebic liver abscess (presenting as right hypochondrial pain, fever, and hepatomegaly), and strangulated inguinal hernia (presenting as groin pain with an irreducible tender lump and signs of bowel obstruction). These conditions have a high prevalence in Nigeria and a high mortality if not recognised promptly.

Fill in the blank: Central abdominal pain that migrates to the right iliac fossa with anorexia, fever, and localised guarding is the classic presentation of acute _____. Painless progressive jaundice with a palpable non-tender gallbladder suggests malignant obstruction of the _____ bile duct.



2.5.3 Communicating the diagnosis to the patient

Breaking bad news (for example, a diagnosis of cancer) or communicating a serious surgical diagnosis requires both clinical skill and compassion. The SPIKES framework is widely used: Setting (ensure a private, quiet room with the patient and their family or support person; sit down at the same level as the patient), Perception (ask the patient what they already know about their condition: start from the patient's current understanding), Invitation (ask how much information the patient wants to receive at this time), Knowledge (deliver the information in plain language, in small pieces, with pauses: avoid medical jargon; deliver bad news with a clear warning: 'I have some difficult news to share with you'), Empathy (acknowledge the patient's emotional response with silence and empathic statements), and Strategy and Summary (outline the plan and the next steps clearly).

After breaking a serious diagnosis, the surgeon must provide the patient with clear written information, the opportunity to ask questions at a later appointment, and support from other members of the MDT (specialist nurse, social worker, chaplain, or counsellor where available). Documentation of what was said, to whom, and the patient's reaction in the clinical notes is a medico-legal requirement. In Nigerian practice, the involvement of the family in decision-making is culturally important, but the primary ethical obligation remains to the patient: information should be given to the patient first, and family involvement should respect the patient's preferences.

Fill in the blank: The SPIKES framework for breaking bad news begins with _____. (ensuring a private setting) and includes Perception, Invitation, Knowledge, Empathy, and _____. The primary ethical obligation when communicating a serious diagnosis is to the _____, not the family.



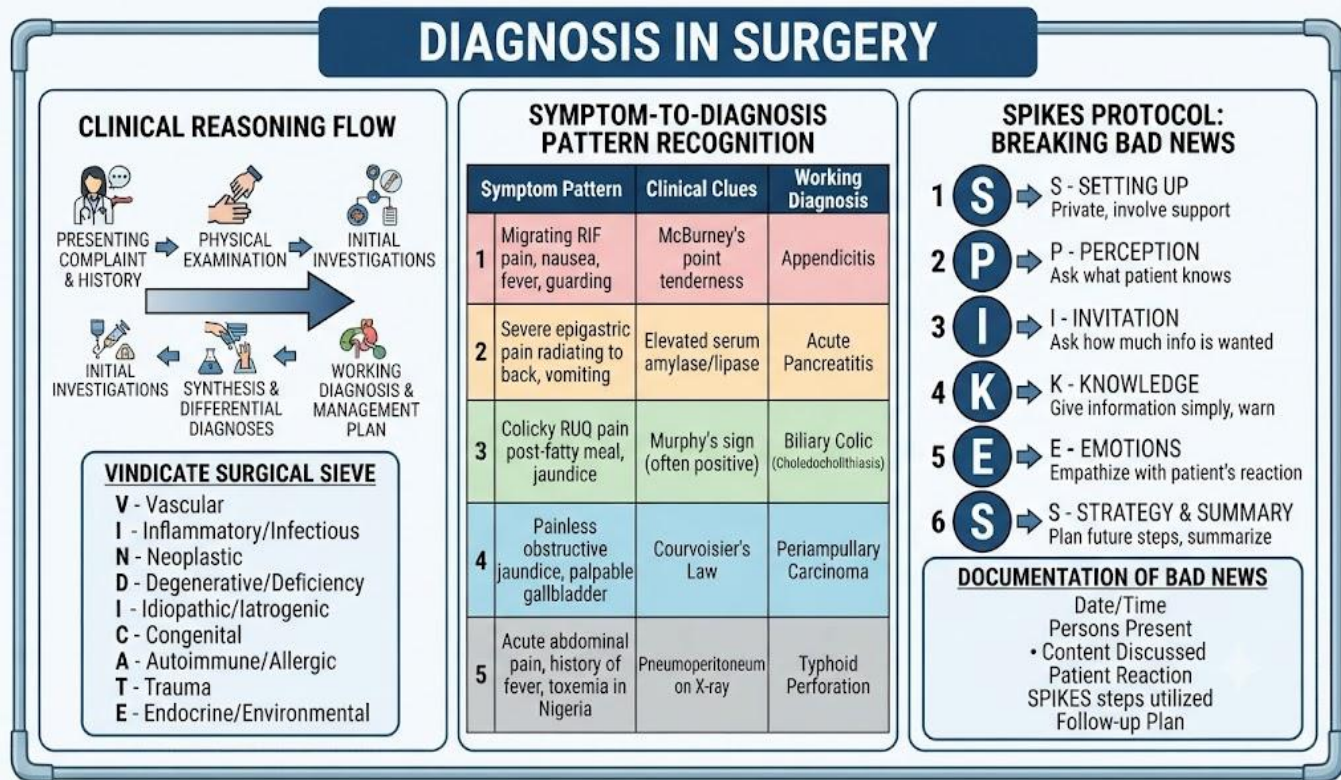


Figure 2.5: Formulating a differential diagnosis, pattern recognition, and the SPIKES framework for breaking bad news

Pilot questions 2.5

1. Describe the process of formulating a differential diagnosis in a surgical patient. (Linked to SLO 2.5)
2. Describe the VINDICATE surgical sieve and give an example in each category for abdominal pain. (Linked to SLO 2.5)
3. Describe the clinical features that suggest typhoid ileal perforation in a Nigerian patient. (Linked to SLO 2.5)
4. Describe the SPIKES framework for breaking bad news to a surgical patient. (Linked to SLO 2.5)
5. Explain the ethical and cultural considerations in communicating a serious diagnosis in Nigerian surgical practice. (Linked to SLO 2.5)

2.6 Clinical Presentation of Common Surgical Conditions



2.6.1 Acute abdomen

The acute abdomen is a clinical syndrome of sudden onset abdominal pain that requires urgent surgical assessment and potentially emergency surgery. Common causes in Nigeria include acute appendicitis (the most common surgical emergency in young adults), perforated peptic ulcer (sudden severe generalised peritonitis with board-like rigidity and loss of liver dullness), acute cholecystitis (right hypochondrial pain, positive Murphy's sign, fever, and leucocytosis), acute pancreatitis (severe epigastric pain radiating to the back with raised serum amylase and the Grey Turner and Cullen signs in severe cases), and typhoid ileal perforation (the most common cause of peritonitis in parts of Nigeria and West Africa).

Assessment of the acute abdomen follows the clinical approach described in Parts 2.1 to 2.3: a focused history (onset, site, character, radiation, and associated symptoms), full examination (vital signs, peritoneal signs, and rectal examination which must not be omitted in any patient with an acute abdomen), and targeted investigations (FBC, U&E, serum amylase, erect CXR for free air, plain AXR, and ultrasound or CT if available). Resuscitation runs in parallel with assessment: IV access, IV fluids, analgesia (opioid analgesia does not mask the signs of peritonitis and should not be withheld from a patient in pain), urinary catheter for urine output monitoring, and nil by mouth.

Fill in the blank: The most common cause of peritonitis from perforation in parts of Nigeria and West Africa is _____ ileal perforation. Opioid analgesia should _____ be withheld from a patient in pain with an acute abdomen, as it does not mask the signs of peritonitis.

2.6.2 Intestinal obstruction

Intestinal obstruction is the failure of intestinal contents to progress normally through the bowel and is classified as mechanical (a physical blockage: adhesions, hernia, tumour, volvulus, or intussusception) or functional (paralytic ileus: failure of peristalsis without a physical block, from peritonitis, hypoelectrolytaemia, retroperitoneal haematoma, or postoperative state). In Nigeria, the most common causes of small bowel obstruction are adhesions from previous abdominal surgery and strangulated inguinal herniae; the most common causes of large bowel obstruction are colorectal carcinoma and sigmoid volvulus (a particularly common cause of large bowel obstruction in Nigeria and East Africa, presenting with massive abdominal distension and a characteristic coffee-bean sign on plain AXR).

The clinical presentation of strangulation (compromise of the blood supply to the obstructed bowel) is a surgical emergency and must be recognised promptly: the pain changes from colicky to constant and severe (indicating ischaemia), the patient becomes systemically unwell (tachycardia, fever, and hypotension), and there is localised peritonism over the strangulated segment. Strangulation requires immediate fluid resuscitation, broad-spectrum antibiotics, and emergency surgery without delay. The cardinal features of intestinal obstruction are colicky abdominal pain, vomiting, abdominal distension, and absolute constipation (no passage of flatus or stool).



Fill in the blank: Sigmoid _____ is a particularly common cause of large bowel obstruction in Nigeria, presenting with massive distension and a coffee-bean sign on plain AXR. Constant severe pain replacing colicky pain in intestinal obstruction suggests _____ of the obstructed bowel segment.

2.6.3 Herniae and lumps: clinical presentation

A hernia is the protrusion of a viscus or part of a viscus through an abnormal opening in the wall of the cavity in which it normally lies. The inguinal hernia is the most common hernia in surgical practice, occurring predominantly in males (the male to female ratio is approximately 10:1 for indirect inguinal hernia). It presents as a groin swelling that appears on standing and coughing and reduces on lying down (reducible hernia). An irreducible (incarcerated) hernia cannot be returned to the abdominal cavity; a strangulated hernia has its blood supply compromised and presents with a painful, tense, irreducible groin swelling with signs of bowel obstruction and rapidly progressive local tenderness and systemic deterioration. Strangulation is a surgical emergency.

The clinical approach to any lump follows the structured examination described in Part 2.2.3. In the groin, the clinician must distinguish between an inguinal hernia (above and medial to the pubic tubercle: indirect inguinal; emerges through the deep inguinal ring lateral to the inferior epigastric vessels), a femoral hernia (below and lateral to the pubic tubercle: through the femoral canal: more common in women: higher risk of strangulation than inguinal herniae), and other groin swellings (lymph nodes, lipoma, saphena varix, femoral artery aneurysm, psoas abscess, and undescended testis). A lump anywhere in the body must be systematically characterised using the approach in Part 2.2.3 before a diagnosis is made.

Fill in the blank: An inguinal hernia presenting as a groin swelling that cannot be returned to the abdominal cavity is called an _____ hernia. A femoral hernia arises _____ and lateral to the pubic tubercle and carries a higher risk of strangulation than an inguinal hernia.



Clinical Presentation of Common Surgical Conditions

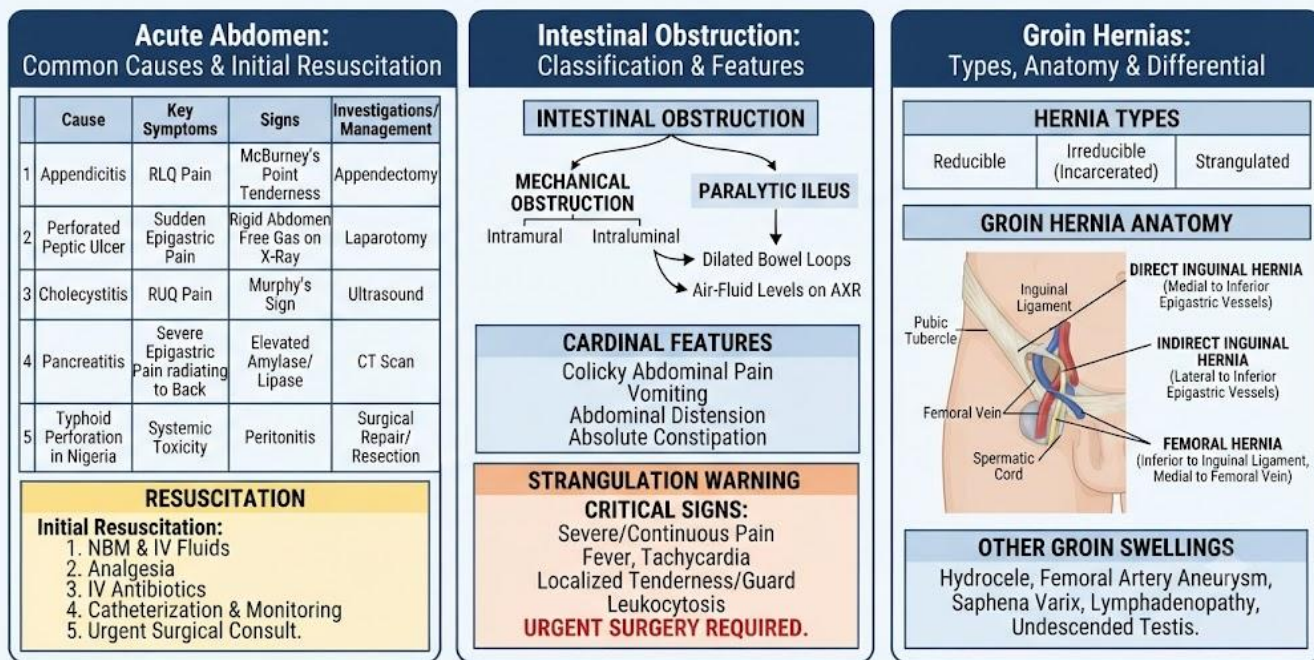


Figure 2.6: Clinical presentation of the acute abdomen, intestinal obstruction, and herniae and lumps

Pilot questions 2.6

- Describe the clinical features that distinguish acute appendicitis from a perforated peptic ulcer. (Linked to SLO 2.6)
- Describe the clinical features and management of sigmoid volvulus in Nigerian surgical practice. (Linked to SLO 2.6)
- Describe the clinical features of a strangulated inguinal hernia and state the urgency of management. (Linked to SLO 2.6)
- Distinguish an inguinal from a femoral hernia in terms of location, sex predilection, and risk of strangulation. (Linked to SLO 2.6)
- Describe the clinical approach to a patient presenting with an acute abdomen in a Nigerian hospital. (Linked to SLO 2.6)



Series Summary

This Series developed the clinical evaluation skills central to surgical practice. We examined the structured surgical history (SOCRATES for pain, surgical-specific past medical and drug history), systematic physical examination (vital signs, peripheral signs, IPPA abdominal examination, and the structured lump examination), and the major physical signs in clinical surgery (peritoneal irritation: guarding, rigidity, and rebound; intestinal obstruction signs; and eponymous signs: Murphy's, Courvoisier's law, Grey Turner's, and Cullen's). We surveyed surgical investigations from blood tests through imaging to histopathology and microbiology, and we addressed the diagnostic process including the differential diagnosis, the surgical sieve, and the SPIKES framework for communicating diagnoses.

Having completed this Series, you should now be able to take a structured surgical history (SLO 2.1), perform a systematic physical examination of the surgical patient (SLO 2.2), identify and interpret physical signs in clinical surgery (SLO 2.3), select and interpret surgical investigations (SLO 2.4), formulate a differential diagnosis and communicate it to the patient (SLO 2.5), and describe the clinical presentation of the acute abdomen, intestinal obstruction, herniae, and lumps (SLO 2.6). These skills underpin the clinical management of every condition in the subsequent Series.

Glossary of Terms

11. **Acute abdomen:** a clinical syndrome of sudden onset abdominal pain requiring urgent surgical assessment and potentially emergency surgery; caused by conditions including acute appendicitis, perforated peptic ulcer, acute cholecystitis, acute pancreatitis, and typhoid ileal perforation in Nigeria.
12. **Colicky pain:** intermittent abdominal pain that comes in waves with complete or near-complete relief between episodes, caused by obstruction of a hollow muscular viscus (bowel, ureter, or biliary tree) as smooth muscle contracts against the obstruction.
13. **Courvoisier's law:** the clinical observation that in a patient with obstructive jaundice, a palpable non-tender gallbladder is unlikely to be caused by gallstones; gallstones cause fibrosis and a shrunken gallbladder, whereas a pancreatic head tumour or bile duct obstruction distends a previously normal gallbladder.
14. **Dysphagia:** difficulty swallowing; a red-flag surgical symptom requiring urgent investigation to exclude oesophageal carcinoma and other serious oesophageal pathology.
15. **Guarding:** involuntary contraction of the abdominal wall muscles in response to palpation over an inflamed area of the peritoneum; a reflex sign of peritoneal irritation.



16. **Murphy's sign:** cessation of inspiration when the examiner's hand is placed in the right hypochondrium and the patient is asked to breathe in deeply; caused by the descending inflamed gallbladder contacting the examiner's hand; indicates acute cholecystitis.
17. **Rebound tenderness:** pain that is worse when the examining hand is suddenly released after deep palpation of the abdomen; indicates inflammation of the parietal peritoneum adjacent to the examined area.
18. **Rigidity:** board-like sustained contraction of the abdominal wall muscles, indicating diffuse inflammation of the parietal peritoneum from generalised peritonitis.
19. **SOCRATES:** a mnemonic for characterising pain in the history: Site, Onset, Character, Radiation, Associated symptoms, Timing, Exacerbating and relieving factors, Severity.
20. **SPIKES:** a structured framework for breaking bad news to patients: Setting, Perception, Invitation, Knowledge, Empathy, Strategy and Summary.
21. **Strangulated hernia:** a hernia in which the blood supply to the herniated contents is compromised, causing ischaemia and potentially infarction; a surgical emergency requiring immediate operation.
22. **Surgical sieve:** a systematic framework (using mnemonics such as VINDICATE) for generating a comprehensive differential diagnosis by categorising possible causes of a surgical problem by aetiology.



Concept Check Questions [Series 2]

Objective questions

1. The SOCRATES mnemonic used to characterise pain in a surgical history stands for Site, Onset, Character, Radiation, Associated symptoms, _____, Exacerbating and relieving factors, and Severity. (Linked to SLO 2.1)
2. Abdominal examination follows the sequence of inspection, palpation, _____, and auscultation. (Linked to SLO 2.2)
3. Loss of liver _____ on percussion, replaced by tympanism, indicates free intraperitoneal gas from a perforated viscus. (Linked to SLO 2.3)
4. A serum amylase above _____ times the upper limit of normal is diagnostic of acute pancreatitis in the appropriate clinical context. (Linked to SLO 2.4)
5. The most common cause of large bowel obstruction from volvulus in Nigeria is sigmoid _____, producing a characteristic coffee-bean sign on plain AXR. (Linked to SLO 2.6)

Short-answer questions

6. Describe the SOCRATES mnemonic and explain how colicky pain differs from constant pain in surgical significance. (Linked to SLO 2.1)
7. Describe the peripheral hand signs relevant to a surgical examination. (Linked to SLO 2.2)
8. Describe Murphy's sign: how it is elicited and what it indicates. (Linked to SLO 2.3)
9. State the indications for ultrasound in surgical practice and explain why it is the first-line imaging modality in Nigeria. (Linked to SLO 2.4)
10. Describe the clinical features of a strangulated inguinal hernia. (Linked to SLO 2.6)

Long-answer questions

11. Describe the systematic physical examination of the abdomen using the IPPA approach. (Linked to SLO 2.2)



12. Describe the structured approach to examining a lump in surgical practice. (Linked to SLO 2.2)
13. Compare the clinical features of small bowel and large bowel obstruction. (Linked to SLO 2.3 and 2.6)
14. Describe the clinical presentation and initial management of the acute abdomen in a Nigerian hospital. (Linked to SLO 2.6)
15. Describe the SPIKES framework for breaking bad news and state the medico-legal documentation required. (Linked to SLO 2.5)

Answers to Concept Check Questions [Series 2]

Objective questions

1. Timing.
2. Percussion.
3. Dullness.
4. Three.
5. Volvulus.

Short-answer questions

6. SOCRATES: Site (where exactly is the pain?), Onset (sudden or gradual; what were you doing?), Character (sharp, dull, burning, colicky), Radiation (does it spread anywhere?), Associated symptoms (nausea, vomiting, fever, change in bowel habit), Timing (constant or intermittent; duration), Exacerbating and relieving factors (food, posture, movement), Severity (score out of 10). Colicky pain comes in waves with complete relief between episodes and indicates obstruction of a hollow muscular viscus (bowel, ureter, or biliary tree). Constant severe pain indicates inflammation, ischaemia, or chemical peritoneal irritation and does not have a pain-free interval.
7. Finger clubbing (chronic suppurative lung disease, bronchogenic carcinoma, IBD, cirrhosis: the underlying cause is surgically relevant). Koilonychia: spoon-shaped nails indicating iron deficiency, which in a surgical patient suggests chronic gastrointestinal blood loss (colorectal carcinoma, peptic ulcer). Leukonychia: white nails indicating



hypoalbuminaemia from malnutrition or chronic liver disease. Palmar erythema and spider naevi: chronic liver disease. Dupuytren's contracture: palmar fibromatosis: associated with alcoholic liver disease and increased operative risk. Peripheral oedema: hypoproteinaemia, cardiac failure, or venous or lymphatic disease.

8. Murphy's sign is elicited by placing the examining hand (or two fingers) in the right hypochondrium at the tip of the ninth costal cartilage and asking the patient to take a deep breath in. The inflamed gallbladder descends during inspiration and contacts the examiner's hand, causing sharp pain that makes the patient catch their breath and stop inhaling (inspiratory arrest). A positive Murphy's sign indicates acute cholecystitis and distinguishes gallbladder tenderness from hepatomegaly, which does not cause inspiratory arrest.
9. Indications for ultrasound in surgery: gallstones and acute cholecystitis (the investigation of choice: highly sensitive for gallstones above 90 percent), liver masses (distinguishes solid from cystic; characterises hepatocellular carcinoma and metastases), appendicitis (particularly in women and children to exclude gynaecological pathology), renal and ureteric calculi, abdominal aortic aneurysm (screening and surveillance), and free peritoneal fluid. Ultrasound is first-line in Nigeria because it is widely available in most secondary and tertiary hospitals, requires no radiation, is inexpensive relative to CT, provides real-time imaging with immediate results, and can be performed at the bedside in unstable patients.
10. A strangulated inguinal hernia presents with: a painful, tense, and tender groin swelling that is irreducible (cannot be returned to the abdominal cavity on lying down or gentle pressure); the overlying skin may be erythematous and oedematous; the patient has signs of intestinal obstruction (colicky abdominal pain, vomiting, abdominal distension, and absolute constipation: no passage of flatus or stool); and there is systemic deterioration (tachycardia, fever, and hypotension in advanced cases from ischaemia and bowel necrosis). The classic teaching is that all painful irreducible herniae should be treated as strangulated until proven otherwise.

Long-answer questions

11. **Basic response:** Inspection: expose the abdomen from xiphisternum to groin; stand to the patient's right; look at the abdomen from the side and from the foot of the bed; assess for scars (note location: groin: hernia repair; right iliac fossa: appendicectomy; Kocher's subcostal: cholecystectomy; midline: laparotomy); distension (generalised: 5Fs: gas, fluid, fat, faeces, fetus; localised: hernia, mass, or organomegaly); visible peristalsis (intestinal obstruction: late sign); skin changes (Grey Turner's: retroperitoneal



haemorrhage; Cullen's: intraperitoneal haemorrhage; caput medusae: portal hypertension). Palpation: warm hands; ask about pain first and start away from it; light then deep palpation in all nine regions; assess tenderness (localised: the organ involved; generalised: peritonitis), guarding (involuntary: peritoneal irritation), rigidity (board-like: generalised peritonitis), rebound (peritoneal inflammation), organomegaly (liver: measure in finger-breadths below the costal margin; spleen: measure from left 10th rib: ballot kidneys bimanually). Percussion: tympanism (gas: normal bowel or free intraperitoneal gas: loss of liver dullness in perforation); shifting dullness: test for ascites by percussing from tympanism to dullness then turning the patient and re-percussing (dullness shifts with position in ascites: not in solid mass). Auscultation: listen for at least 30 seconds; absent bowel sounds (paralytic ileus or peritonitis); high-pitched tinkling or rushes (mechanical obstruction); normal gurgling (present for at least 30 seconds before declaring absent).

Value-added response: Rectal examination must not be omitted in any patient with an acute abdomen: it may reveal a pelvic mass, blood on the examining glove (colorectal carcinoma or inflammatory bowel disease), faecal impaction, or a tender mass in the pouch of Douglas (pelvic peritonitis from appendicitis or gynaecological cause). The dictum 'if you don't put your finger in it, you'll put your foot in it' applies strongly in Nigerian surgical practice.

12. Basic response: The structured lump examination uses the following sequence: Site (describe anatomical location precisely). Size (measure in two dimensions using a tape measure or ruler: do not estimate). Shape (round, oval, irregular). Surface (smooth: most benign lesions; nodular or bosselated: may indicate malignancy or multiple nodules). Edge (well-defined: suggests a capsule: benign; ill-defined: suggests infiltration into surrounding tissue: malignant until proven otherwise). Consistency (soft: lipoma or cystic; firm: fibrous or early malignancy; hard: calcification or sclerotic malignancy; stony-hard: malignancy or calcified stone). Fluctuance (using the cross-fluctuation technique: press on one side of the lump and feel the impulse transmitted across to the other side: positive fluctuance: fluid-filled cystic lump). Transillumination (hold a bright light firmly against one side of the lump in a darkened room: positive: lump lights up: fluid-filled cyst containing clear fluid: hydrocoele, sebaceous cyst with clear fluid). Pulsatility (feel for pulsation: expansile in two perpendicular directions: arterial aneurysm; transmitted in one direction: overlying normal artery). Reducibility (reduces on lying or on gentle pressure: hernia or varicocoele). Compressibility (empties on pressure, refills on release: venous anomaly or haemangioma). Temperature (compare with contralateral side: warmth: inflammation or vascular tumour). Fixity (to skin: tethered or dimpled: malignant attachment; to deep structures: fixed to underlying bone or muscle: malignant infiltration). Regional lymph nodes (palpate draining lymph nodes: enlarged: malignancy or active infection). Auscultation (bruit: arteriovenous malformation; bruit over thyroid: hyperthyroid goitre).



Value-added response: The single most important lump characteristic that differentiates benign from malignant disease is fixity: a lump that is tethered to the overlying skin (causing skin dimpling or puckering on movement), fixed to deep structures, or associated with hard irregular lymph nodes in the draining territory is malignant until proven otherwise and requires urgent histological investigation.

13. Basic response: Small bowel obstruction (SBO): vomiting is early (may be bilious: high obstruction) or moderately delayed (faeculent: low SBO); abdominal distension is central, involving the central abdomen around the umbilicus (distended small bowel loops); bowel sounds are high-pitched and tinkling (characteristic of mechanical obstruction); constipation may be incomplete initially (patient may pass residual stool or flatus below the obstruction level). X-ray: dilated central loops with valvulae conniventes (complete transverse mucosal folds of the small bowel, like a stack of coins or a row of arrows). Large bowel obstruction (LBO): vomiting is late or absent (the ileocaecal valve prevents reflux: a closed loop obstruction); distension is peripheral and marked (dilated colon frames the entire abdomen); bowel sounds are reduced or absent; absolute constipation (no flatus or stool): the most reliable symptom of complete LBO. X-ray: peripheral dilated large bowel with haustral markings (incomplete transverse folds); caecal diameter above 12 cm: impending perforation (Laplace's law).

Value-added response: The distinction between mechanical and paralytic (functional) ileus is clinically important: mechanical obstruction has high-pitched tinkling bowel sounds (caused by gas bubbling through fluid in distended loops) and requires surgery, whereas paralytic ileus has absent bowel sounds and is managed conservatively (treat the underlying cause, nasogastric decompression, IV fluids, correct electrolytes: paralytic ileus often resolves with correction of hypokalaemia).

14. Basic response: History: onset, site, character (colicky versus constant), radiation, associated symptoms (vomiting: its onset and character; change in bowel habit; urinary symptoms; menstrual history in women), and previous abdominal surgery (adhesions). Examination: vital signs (temperature, heart rate, blood pressure, respiratory rate, oxygen saturation); general inspection (pallor, jaundice, hydration); abdominal IPPA (scars, distension, visible peristalsis, peritoneal signs, organomegaly, bowel sounds); rectal examination (mandatory in all acute abdomens: pelvic mass, blood on glove). Investigations: FBC (leucocytosis: infection), U&E (renal function, electrolytes), serum amylase or lipase (pancreatitis), CRP, erect CXR (free air under diaphragm: perforation), plain AXR (dilated bowel loops: obstruction), ultrasound (gallbladder, appendix, free fluid), urine dipstick and pregnancy test in women. Resuscitation in parallel: IV access and IV fluid resuscitation; opioid analgesia (does not mask peritonitis and should not be withheld); urinary catheter for urine output monitoring (target above 0.5 mL per kg per hour); nil by mouth; broad-spectrum IV antibiotics if sepsis is suspected; surgical review and decision on operative versus conservative management.



Value-added response: In Nigerian practice, typhoid ileal perforation must always be considered in any patient with acute peritonitis, particularly in areas with poor sanitation: the classic history is a patient with 1 to 2 weeks of high fever and diarrhoea who then develops sudden peritonitis. The diagnostic clue on plain AXR may be free air under the diaphragm. Emergency laparotomy with perforation repair (or resection and anastomosis) and peritoneal lavage is the treatment; these patients are often severely malnourished and hypovolaemic from the preceding typhoid illness, making preoperative resuscitation critical.

15. Basic response: SPIKES framework: Setting (arrange a private, quiet room; sit at the same level as the patient; ensure that a trusted support person is present if the patient wishes; switch off pagers and phones). Perception (begin by asking what the patient already knows or suspects about their condition: 'What have you been told about your test results so far?'). Invitation (ask how much information the patient would like to receive at this time: some patients want full details; others prefer the information to be given to a family member first: respect this preference). Knowledge (prepare the patient with a warning shot before delivering bad news: 'I'm afraid I have some difficult news to share with you'; deliver the diagnosis in plain language, in small pieces, with pauses to allow the patient to absorb each piece; use simple terms and avoid jargon). Empathy (acknowledge the patient's emotional reaction with silence, empathic statements, and by offering a tissue; do not rush past the emotional moment: 'I can see this is very difficult for you'). Strategy and Summary (outline the management plan clearly and in simple terms; confirm the patient's understanding; provide written information; arrange a follow-up appointment for the patient to ask further questions; introduce other members of the MDT who will be involved in care). Documentation: record in the clinical notes what information was conveyed, to whom (patient and family members present), and the patient's immediate response; this is a medico-legal requirement.

Value-added response: In Nigerian surgical practice, it is common for family members to request that a serious diagnosis not be disclosed to the patient directly: while family involvement is culturally important and should be respected, the primary ethical obligation is to the patient who has capacity. The surgeon should meet with the patient alone first to assess their preferences regarding disclosure, then involve the family in a way that the patient consents to. Withholding a diagnosis from a competent patient who wishes to know it is ethically unjustifiable and may harm the patient by preventing them from making informed decisions about their own care.

Answers to Pilot Questions [Series 2]

Part 2.1

1. SOCRATES: Site (where is the pain located exactly?), Onset (sudden or gradual; precipitating event), Character (colicky: hollow viscus obstruction; constant burning:



peptic ulcer; sharp tearing: vascular), Radiation (epigastric to back: pancreatitis; right hypochondrial to right shoulder: biliary; loin to groin: ureteric colic), Associated symptoms (nausea, vomiting, fever, change in bowel habit, urinary symptoms), Timing (constant or intermittent; how long present), Exacerbating and relieving factors (food: worse with fatty food in biliary disease; better with antacids in peptic ulcer; posture: pancreatitis better sitting forward), Severity (verbal rating scale or 0 to 10 numeric scale).

2. Colicky pain is intermittent, coming in waves, with complete or near-complete relief between episodes; it is caused by the muscular contractions of a hollow viscus (small bowel, large bowel, ureter, or biliary tree) attempting to overcome an obstruction; it indicates mechanical obstruction of that viscus and may be managed initially without surgery if the obstruction is incomplete. Constant abdominal pain without a pain-free interval indicates inflammation (appendicitis, cholecystitis, pancreatitis), chemical peritoneal irritation (perforated peptic ulcer: gastric acid in the peritoneal cavity), or ischaemia (strangulation of bowel or mesenteric ischaemia); these conditions are generally more serious and often require early surgical intervention.
3. Epigastric pain radiating to the back: acute pancreatitis (radiation via the retroperitoneal position of the pancreas to the corresponding spinal level) or a posterior peptic ulcer penetrating into the pancreas. Right hypochondrial pain radiating to the right shoulder tip: gallbladder or biliary disease (referred pain via irritation of the right hemidiaphragm, whose sensory fibres travel with the right phrenic nerve from C3 to C5: referred to the right shoulder tip and right side of the neck). Loin pain radiating to the groin and scrotum or labium majus: ureteric colic (as the stone descends from the renal pelvis through the ureter to the vesicoureteric junction, the pain radiates along the same dermatomal distribution as the ureteric innervation from T12 to L1). Central abdominal pain migrating to the right iliac fossa: acute appendicitis (initial visceral pain from appendiceal distension is felt centrally at the umbilicus; as the inflamed appendix irritates the parietal peritoneum of the right iliac fossa, the pain becomes somatic and localises).
4. Anticoagulants (warfarin and DOACs: dabigatran, rivaroxaban, apixaban): must be stopped and reversed before elective surgery to prevent intraoperative and postoperative haemorrhage; INR must be below 1.5 before surgery for patients on warfarin; DOACs have specific bridging protocols depending on the drug and renal function. Antiplatelet drugs (aspirin and clopidogrel): these inhibit platelet aggregation and increase intraoperative bleeding; the decision to continue or stop perioperatively requires balancing the thrombotic risk (recent coronary stent placement: aspirin must not be stopped) against the surgical bleeding risk; discuss with the surgical and cardiology team. Corticosteroids (prednisolone, dexamethasone): long-term steroid use suppresses the hypothalamic-pituitary-adrenal (HPA) axis; the patient may not be able to mount a normal cortisol stress response to surgery, risking an Addisonian crisis; stress-dose hydrocortisone must be given perioperatively. Oral contraceptive pill (OCP): the



combined OCP (oestrogen-containing) increases the risk of venous thromboembolism (DVT and pulmonary embolism) perioperatively; current guidance recommends stopping the OCP 4 weeks before major elective surgery and providing alternative contraception; low molecular weight heparin thromboprophylaxis is used during the perioperative period.

5. Adhesions from a previous abdominal operation are the most common cause of small bowel obstruction in Nigeria and worldwide. Previous abdominal surgery causes fibrinous adhesions during healing, which can mature into dense fibrous bands that kink, angulate, or compress adjacent loops of small bowel, leading to obstruction. When a patient presents with acute small bowel obstruction, a previous operation scar on the abdomen immediately raises adhesions as the most likely cause, and the type of previous surgery guides the clinical assessment: operations in the lower abdomen (appendicectomy, hysterectomy, gynaecological surgery) are more likely to form adhesions involving the terminal ileum, while upper abdominal operations may form adhesions involving the jejunum or involve the duodenum.

Part 2.2

1. Temperature: fever above 38 degrees C indicates infection, inflammation, or malignancy; hypothermia below 36 degrees C in a surgical patient indicates severe sepsis (hypothermia is a sinister sign suggesting decompensated septic shock). Heart rate: tachycardia above 100 beats per minute may indicate infection and pain, haemorrhage and hypovolaemia, dehydration, anxiety, or pulmonary embolism; bradycardia may indicate cardiac disease or beta-blocker effect. Blood pressure: hypotension indicates shock (haemorrhagic, septic, cardiogenic, or neurogenic); hypertension may indicate pain, anxiety, or pre-existing hypertension. Respiratory rate: the most sensitive early indicator of deterioration; above 20 per minute suggests pain, pneumonia, pulmonary embolism, sepsis, or metabolic acidosis (compensation for metabolic acidosis by increasing minute ventilation). Oxygen saturation: below 94 percent on pulse oximetry requires assessment and supplemental oxygen.
2. Finger clubbing: increased curvature of the nail in both longitudinal and transverse planes with loss of the normal angle between the nail and the proximal nail fold; causes in surgical practice include chronic suppurative lung disease (bronchiectasis, lung abscess), bronchogenic carcinoma, IBD (Crohn's disease, ulcerative colitis), and cirrhosis. Koilonychia: spoon-shaped nails; indicates iron deficiency from chronic gastrointestinal blood loss (peptic ulcer, colorectal carcinoma). Leukonychia: white discolouration of the nail; indicates hypoalbuminaemia from malnutrition or chronic liver disease; both impair wound healing and increase surgical risk. Palmar erythema: redness of the thenar and



hypothenar eminences; indicates chronic liver disease (elevated oestrogen from impaired hepatic metabolism). Dupuytren's contracture: fibromatosis of the palmar fascia causing flexion contracture of the ring and little fingers; associated with alcoholic liver disease and thus increased operative risk from hepatic dysfunction. Peripheral pitting oedema: bilateral indicates cardiac failure or hypoproteinaemia; unilateral indicates venous or lymphatic disease in the affected limb.

3. Inspection: expose abdomen from xiphisternum to groin; assess scars (note site and type), distension (5Fs: generalised or localised), visible peristalsis, and skin changes (Grey Turner's, Cullen's, caput medusae). Palpation: warm hands; ask patient to indicate the site of pain and start away from it; light palpation in all nine regions for tenderness, guarding, and rebound; deep palpation for organomegaly (liver: size in finger-breadths below the costal margin in the mid-clavicular line; spleen: from the left 10th rib towards the right iliac fossa; kidneys: bimanual ballotement). Percussion: hepatic dullness (loss suggests free gas from perforation); splenic and renal dullness; shifting dullness (ascites: percuss from central tympanism to dullness in flanks, mark the point, turn patient onto left side, re-percuss: dullness shifts if free fluid present). Auscultation: listen in all four quadrants for at least 30 seconds; characterise bowel sounds (absent: paralytic ileus or advanced peritonitis; high-pitched tinkling or rushes: mechanical obstruction; normal: present with normal pitch).
4. Site and size (measure in two dimensions). Shape (regular or irregular). Surface (smooth: lipoma or benign cyst; nodular: multiple nodules, thyroid multinodular goitre; bosselated: irregular surface, may indicate malignancy). Edge (well-defined: suggests a capsule: benign; ill-defined: suggests infiltration of surrounding tissues: suspicious for malignancy). Consistency (soft: lipoma or fluid; firm: fibrous; hard: calcified; stony-hard: malignant or calcified stone). Fluctuance (cross-fluctuation test: fluid-filled). Transillumination (positive: clear cystic fluid: hydrocoele or epididymal cyst or sebaceous cyst with clear fluid). Pulsatility (expansile in two perpendicular directions: arterial aneurysm; transmitted pulsation: the lump merely moves with the pulse from an underlying artery). Reducibility (reduces on lying or on gentle pressure: hernia or varicocoele). Compressibility (empties on compression, refills on release: venous haemangioma or saphena varix). Temperature (warmth: inflammation or vascular tumour). Fixity to skin (skin dimpling, tethering, peau d'orange in breast carcinoma) and to deep structures (fixed to underlying muscle or bone: malignant). Regional lymph nodes (palpate all draining lymph node groups: enlargement: malignancy or infection). Auscultation (bruit: AVM or vascular tumour).
5. Expansile pulsatility: the lump expands outward in two perpendicular directions with each cardiac impulse (like a balloon being inflated from inside); this is because the lump itself contains pulsatile flow and the arterial pressure wave distends its walls; it is diagnostic of an arterial aneurysm (for example an aortic, iliac, or popliteal aneurysm).



Transmitted pulsatility: the lump moves with each cardiac impulse but does not expand; this occurs when a solid mass is overlying or adjacent to a pulsatile artery, and the arterial pulsation is transmitted through the mass (a retroperitoneal lymph node mass overlying the aorta, a pancreatic pseudocyst, or a solid paraortic mass); it is not diagnostic of an aneurysm and does not indicate arterial involvement of the mass.

Part 2.3

1. Signs of peritoneal irritation: tenderness (localised to the site of the inflamed organ or generalised in diffuse peritonitis), guarding (involuntary contraction of the abdominal wall muscles overlying the inflamed peritoneum: a reflex protective response: cannot be suppressed voluntarily), rigidity (board-like sustained contraction of the entire anterior abdominal wall musculature: indicates diffuse generalised peritonitis from free intraperitoneal infection or chemical irritation), rebound tenderness (pain is greater when the examining hand is suddenly released from deep palpation than when pressure is applied: indicates inflammation of the parietal peritoneum). Guarding versus rigidity: guarding is localised and may be voluntary (the patient tenses their abdominal muscles in anticipation of pain) or involuntary (the true sign: cannot be suppressed even when the patient is distracted or asked to relax), and it resolves with anaesthesia; rigidity is generalised, involuntary, sustained, and board-like, and it indicates advanced diffuse peritonitis.
2. Rovsing's sign: pressure applied to the left iliac fossa causes pain in the right iliac fossa; it indicates inflammation in the right iliac fossa and suggests acute appendicitis; the mechanism is that compression of the left colon increases pressure in the caecum, which displaces gas and fluid towards the inflamed appendix, stimulating the peritoneum of the right iliac fossa. Psoas sign (also called iliopsoas sign): pain is elicited by extending the right hip while the patient is lying on their left side (or by passive hyperextension of the right leg while the patient is supine); this stretches the psoas muscle; it suggests that the inflamed appendix is lying in a retrocaecal position, in contact with the psoas muscle. Obturator sign: pain is elicited by internal rotation of the flexed right hip while the patient is supine; this stretches the obturator internus muscle; it suggests that the inflamed appendix is in a pelvic position, in contact with the obturator internus.
3. Feature, Small Bowel Obstruction, Large Bowel Obstruction: Onset of vomiting (early and profuse: first gastric then bilious then faeculent in low SBO; late or absent in LBO); Distension (central, periumbilical in SBO; peripheral, framing the entire abdomen in LBO); Bowel sounds (high-pitched tinkling or rushing in SBO; reduced or absent in LBO); Constipation (may pass residual stool or flatus initially in SBO; absolute constipation: no flatus or stool in LBO); Abdominal X-ray (central dilated loops with



valvulae conniventes and no visible gas in the colon in SBO; peripheral dilated large bowel with haustral markings in LBO; caecal diameter above 12 cm in LBO: impending perforation). Common causes in Nigeria: adhesions (most common SBO), strangulated inguinal hernia (SBO), sigmoid volvulus (most common LBO by volvulus), and colorectal carcinoma (most common LBO by tumour).

4. Murphy's sign is elicited by asking the patient to take a deep breath in while the examiner places their hand (or two fingers of the right hand) firmly in the right hypochondrium below the tip of the ninth costal cartilage in the mid-clavicular line. During inspiration, the liver and gallbladder descend. If the gallbladder is inflamed (acute cholecystitis), it contacts the examiner's hand during descent and causes sudden sharp pain that makes the patient catch their breath and stop inhaling (inspiratory arrest). The test is positive when there is inspiratory arrest. The same test performed on the left side (for comparison) does not cause inspiratory arrest. Murphy's sign indicates acute cholecystitis and helps distinguish gallbladder tenderness from hepatic tenderness or hepatomegaly (which descends with respiration but does not cause inspiratory arrest).
5. Courvoisier's law states that in a patient with obstructive jaundice, the presence of a palpable, non-tender, distended gallbladder makes gallstones an unlikely cause of the obstruction; it is much more likely to be caused by a tumour of the head of the pancreas, a bile duct tumour (cholangiocarcinoma), or another cause of extrahepatic biliary obstruction. Pathophysiological basis: chronic cholelithiasis causes repeated episodes of inflammation and fibrosis of the gallbladder wall over many years, resulting in a thickened, fibrotic, and contracted gallbladder that has lost its ability to distend. When this gallstone-diseased gallbladder becomes obstructed (by a stone in the common bile duct), it cannot distend and is therefore not palpable. In contrast, a previously normal gallbladder (with no gallstone disease) that becomes obstructed by a tumour (for example at the head of the pancreas compressing the common bile duct) progressively distends under the back-pressure of bile and becomes palpable. A palpable non-tender gallbladder in an icteric patient is therefore a sign of malignant extrahepatic biliary obstruction until proven otherwise.

Part 2.4

- Full blood count (FBC): haemoglobin (anaemia below 10 g/dL increases operative risk, impairs oxygen delivery and wound healing: correct preoperatively where time permits); white cell count (leucocytosis: infection or inflammation; leucopenia: bone marrow suppression from chemotherapy); platelet count (thrombocytopaenia below 100,000 per microlitre: increased bleeding risk: inform anaesthetist). Urea and electrolytes (U&E): serum sodium and potassium must be within normal limits before elective surgery; renal



function (creatinine and eGFR: AKI risk postoperatively, affects drug dosing). Liver function tests (in jaundiced patients, known liver disease, or alcohol use: hepatic dysfunction impairs coagulation factor synthesis and drug metabolism). Coagulation (prothrombin time and APTT: in patients on anticoagulants, liver disease, or bleeding history). Group and save and cross-match (type, screen, and cross-match for all major operations where transfusion is anticipated). CRP and ESR (inflammatory markers: support diagnosis of infection or inflammation). Blood glucose (diabetes mellitus: perioperative glycaemic control: target below 10 mmol/L).

- Plain abdominal X-ray (AXR) in intestinal obstruction: general features: dilated bowel loops above the level of obstruction and collapsed bowel below it; air-fluid levels visible on an erect AXR (produced by gas and fluid in dilated loops). Small bowel obstruction: centrally located dilated loops (the small bowel occupies the central abdomen); valvulae conniventes (complete transverse folds that cross the entire width of the bowel lumen: seen in the jejunum; in the ileum the folds are less prominent); no gas visible in the large bowel (because the obstruction prevents gas from progressing distally). Large bowel obstruction: peripheral dilated loops framing the abdomen; haustral markings (incomplete folds that do not cross the entire width of the bowel lumen, creating a sacculated appearance of the distended colon); gas may still be present in the small bowel if the ileocaecal valve is incompetent. Coffee-bean sign in sigmoid volvulus: a massively dilated sigmoid colon with its apex pointing towards the right upper quadrant, resembling a coffee bean.
- Indications for ultrasound: right hypochondrial pain (gallstones, acute cholecystitis, biliary dilatation), right iliac fossa pain (appendicitis, ovarian pathology in women), liver assessment (hepatomegaly, liver mass, hepatocellular carcinoma, metastases, liver abscess), renal assessment (hydronephrosis, renal stones, renal mass), aortic aneurysm (screening and surveillance), free peritoneal fluid (ascites, haemoperitoneum), pelvic pathology (ovarian cysts, uterine fibroids), and soft tissue lumps and thyroid. Reasons for first-line use in Nigeria: widely available in most secondary and tertiary hospitals where CT is often not available or unaffordable; no ionising radiation (safe in pregnancy and children); inexpensive relative to CT; provides real-time imaging that can be used interactively (for example, compression of the right iliac fossa during appendicitis assessment); can be performed at the bedside in unstable patients without transporting them to a radiology department.
- FNAC (fine needle aspiration cytology): uses a fine gauge needle (21 to 23G) attached to a syringe; the needle is advanced into the lump and suction applied while moving the needle in a fanning motion to aspirate cells; the aspirate is spread on a glass slide, fixed, and stained for cytological examination. It provides cytological information (the appearance of individual cells) but not histological architecture (the arrangement of cells in relation to each other and to the supporting stroma). Clinical indications: thyroid



nodule (first-line investigation), breast lump (triple assessment: clinical, ultrasound, FNAC), cervical lymph node, salivary gland mass. Limitation: cannot distinguish between in situ and invasive malignancy. Core needle biopsy (Tru-Cut): uses a larger cutting needle (14 to 18G) with a spring-loaded biopsy gun to obtain a cylindrical core of tissue. It provides a histological specimen that preserves tissue architecture, allowing the pathologist to assess invasiveness, grade, receptor status (in breast carcinoma), and architectural pattern. Indications: diagnosis of breast mass (when FNAC is insufficient), prostate biopsy, liver biopsy, renal biopsy, soft tissue sarcoma (where grading requires architecture).

- Wound swab and pus culture: taken at the time of surgical drainage, debridement, or wound breakdown; the best specimen is pus from deep within the wound rather than a superficial swab of the skin surface; identifies the causative organisms and their antibiotic sensitivities to guide de-escalation. Blood cultures: the most important microbiological investigation in a febrile surgical patient with suspected bacteraemia or sepsis; take two sets (each set: one aerobic and one anaerobic bottle) from two different venepuncture sites before antibiotics are administered; taking cultures after antibiotics reduces the diagnostic yield by approximately 30 to 50 percent. Urine culture (midstream clean-catch specimen or catheter sample): before urological procedures; in patients with urinary catheters or urinary symptoms. Peritoneal fluid culture: collected from the peritoneal lavage fluid or drain fluid at laparotomy for intra-abdominal sepsis; guides antibiotic de-escalation from broad-spectrum empirical therapy to targeted therapy.

Part 2.5

- The process of formulating a surgical differential diagnosis: (1) identify the key clinical features from the history and examination (the combination of the site, character, and radiation of pain, the associated symptoms, the physical signs, the patient's age and sex, and the risk factors); (2) generate a list of conditions that could explain all the key features, using a systematic approach such as the surgical sieve; (3) rank the list in order of probability, taking into account the patient's demographics, local disease prevalence, and the prior probability of each condition in the Nigerian clinical context; (4) identify the most dangerous diagnoses on the list that must be excluded urgently (a missed appendicitis or perforated viscus can be fatal); (5) select targeted investigations to narrow the differential and confirm or exclude specific diagnoses; (6) arrive at the working diagnosis (the most likely diagnosis, which forms the basis for immediate management decisions) while remaining open to revising it as new information emerges.
- VINDICATE mnemonic for abdominal pain: Vascular (mesenteric ischaemia from arterial embolism or thrombosis: sudden severe diffuse abdominal pain out of proportion



to signs: requires urgent CT angiography and surgical or endovascular intervention). Inflammatory or Infective (acute appendicitis, acute cholecystitis, acute pancreatitis, diverticulitis, peritonitis from any cause, typhoid). Neoplastic (colorectal carcinoma causing obstruction or bleeding; gastric carcinoma; pancreatic carcinoma; lymphoma). Degenerative (incisional hernia from weakened abdominal wall; intestinal adhesions from previous surgery). Idiopathic (irritable bowel syndrome). Congenital (Meckel's diverticulum causing bleeding, intussusception, or volvulus; malrotation). Autoimmune (Crohn's disease: right iliac fossa mass and pain; ulcerative colitis: bloody diarrhoea with colicky pain). Traumatic (intestinal perforation from blunt abdominal trauma; splenic or hepatic laceration). Endocrine or Metabolic (diabetic ketoacidosis: pseudo-acute abdomen; Addisonian crisis; porphyria).

- Typhoid ileal perforation in a Nigerian patient: the typical history is a young adult (most commonly between 10 and 30 years) presenting after 1 to 3 weeks of high fever, headache, and diarrhoea (the enteric fever phase of *Salmonella typhi* infection, often inadequately treated or untreated) who then develops sudden severe generalised abdominal pain (the moment of perforation of a Peyer's patch ulcer in the terminal ileum). On examination: the patient is systemically unwell (high fever, tachycardia, hypotension), appears dehydrated and often malnourished from the preceding fever illness, and has signs of diffuse peritonitis (generalised tenderness, guarding, rigidity, and rebound tenderness). Erect CXR may show free air under the diaphragm (present in approximately 50 to 70 percent of cases). Plain AXR may show dilated bowel from associated ileus. Management: resuscitate vigorously (IV fluids, broad-spectrum antibiotics including anti-*Salmonella* cover: ciprofloxacin or ceftriaxone, and metronidazole), then emergency laparotomy for perforation closure or resection and anastomosis with peritoneal lavage.
- S (Setting): find a private, quiet room; ensure the patient has a trusted support person with them if they wish; sit at the patient's eye level; switch off pagers and phones. P (Perception): begin by finding out what the patient already knows: 'What have the doctors been telling you about your tests?' This reveals how much the patient understands and allows you to start from their level of knowledge. I (Invitation): ask how much information the patient wants: 'Would you like me to explain the test results in detail today, or would you prefer I summarise and we can discuss more later?' Respect the patient's answer. K (Knowledge): give a warning shot before the bad news: 'I'm afraid I have some difficult news to share'; deliver the diagnosis in plain language in small pieces, pausing between each piece; use the simplest possible terms: 'The lump we removed is a cancer'; check understanding regularly: 'Does that make sense so far?' E (Empathy): allow silence after the bad news; acknowledge the emotional response: 'I can see this is very distressing for you; it is completely understandable to feel that way'; offer tissues and time. S (Strategy and Summary): outline the next steps and management plan clearly;



summarise what has been discussed; provide written information; arrange a follow-up appointment soon (within 1 to 2 weeks) to allow the patient to ask further questions; introduce or refer to other relevant team members (oncologist, specialist nurse, social worker).

- Ethical considerations: the primary ethical obligation is to the patient who has decision-making capacity: a competent patient has the right to be told their diagnosis and to participate in decisions about their treatment. Providing information to family members instead of the patient (even with the family's request) without the patient's knowledge or consent is a breach of patient autonomy and confidentiality. Cultural considerations in Nigeria: it is common for family members to approach the doctor requesting that a terminal diagnosis not be disclosed to the patient, motivated by protective intent. The appropriate response is to: meet with the patient alone first to assess their preferences; ask them directly whether they would like to know their diagnosis and how much detail they want, and whether they consent to the family being involved in discussions; respect the patient's wishes; if the patient consents to family involvement, include the family in the discussion with the patient present. Withholding information from a competent patient who wishes to know their diagnosis is ethically unjustifiable in Nigerian and international law and may result in medico-legal consequences.

Part 2.6

- Acute appendicitis typically presents in young adults (most common in the second and third decades): the pain begins as a dull, colicky, central or periumbilical ache (from visceral pain: stretch of the appendiceal wall), accompanied by anorexia and nausea; over 4 to 24 hours the pain migrates to and localises in the right iliac fossa as somatic pain (parietal peritoneal irritation by the inflamed appendix); there is low-grade fever (above 37.5 degrees C: rarely above 39 degrees C) and mild leucocytosis; localised tenderness and guarding at McBurney's point; Rovsing's sign may be positive. Perforated peptic ulcer presents with sudden, dramatic onset of severe generalised abdominal pain (the patient can often state the exact time it started: perforation releases gastric acid into the peritoneal cavity), rapidly becoming board-like rigidity (generalised peritonitis from chemical irritation by the acid), generalised guarding and rebound, and loss of liver dullness on percussion (free gas under the diaphragm in approximately 70 to 80 percent of cases); the patient looks shocked and is reluctant to move; fever and leucocytosis are late signs.
- Sigmoid volvulus occurs when the sigmoid colon twists on its mesenteric axis, producing a closed-loop large bowel obstruction. It is particularly common in Nigeria and East Africa and presents in adult males (often with a history of chronic constipation or



psychiatric illness). Clinical features: rapid onset of massive abdominal distension (the sigmoid colon dilates dramatically, producing distension that can be extreme), colicky abdominal pain followed by constant pain as distension increases, absolute constipation, and late or absent vomiting (ileocaecal valve usually competent). The patient may appear systemically well early but deteriorates rapidly if strangulation occurs. Plain AXR: the classic coffee-bean sign (a massively dilated sigmoid colon with its apex pointing towards the right upper quadrant, resembling a coffee bean). Management: if not strangulated, gentle endoscopic deflation via a rigid sigmoidoscope or a flatus tube passed per rectum (a quick and effective non-operative decompression in the acute setting); after deflation, elective sigmoid colectomy is performed during the same admission to prevent recurrence (which is very common). If strangulated: emergency sigmoid colectomy with either primary anastomosis or Hartmann's procedure (end colostomy).

- A strangulated inguinal hernia presents with: a painful, tense, and tender groin swelling that is irreducible (the patient may initially notice a reducible lump that suddenly becomes impossible to reduce); the overlying skin may show erythema and oedema in the late stages; the patient has signs of mechanical small bowel obstruction (colicky central abdominal pain, vomiting, abdominal distension, and absolute constipation: no passage of flatus or stool); and systemic deterioration (tachycardia, fever, and hypotension in advanced cases from intestinal ischaemia and necrosis). Management urgency: a strangulated hernia is a surgical emergency requiring immediate resuscitation (IV fluids, IV antibiotics covering bowel flora) and urgent emergency operation (hernia repair with assessment of bowel viability: non-viable bowel is resected and an anastomosis or stoma fashioned depending on contamination and the patient's condition). Delay in surgical intervention is associated with bowel infarction, perforation, faecal peritonitis, and death.
- Inguinal hernia: the hernial sac emerges through the deep inguinal ring (lateral to the inferior epigastric vessels for indirect inguinal hernia: the most common type), travels along the inguinal canal, and may descend into the scrotum; it lies above and medial to the pubic tubercle; it is much more common in males (indirect inguinal hernia: 10:1 male to female ratio: follows the path of the descending testis through the inguinal canal); it can be controlled by pressure over the deep inguinal ring (indirect type: the most common). Femoral hernia: the hernial sac passes through the femoral ring, beneath the inguinal ligament, and into the femoral canal; it lies below and lateral to the pubic tubercle; it is more common in women (especially multiparous women: the wider female pelvis creates a larger femoral ring); it carries a higher risk of strangulation than inguinal herniae because the femoral ring is narrow and rigid, providing little room for expansion of the hernial contents; it is often small and may be missed on initial examination.
- History: obtain a focused history covering onset (sudden: perforation or strangulation; gradual: obstruction or appendicitis), site and character of pain (colicky: obstruction;



constant: inflammation or ischaemia; sudden: perforation), radiation, associated symptoms (vomiting: onset and character; change in bowel habit; absolute constipation: obstruction; urinary symptoms; menstrual history in women of childbearing age), previous abdominal surgery (adhesions as a cause of obstruction), and known comorbidities. Examination: vital signs (tachycardia and hypotension: haemorrhage or septic shock); general inspection (pallor, jaundice, dehydration); abdominal IPPA (scars; distension; visible peristalsis; peritoneal signs: guarding, rigidity, rebound; organomegaly; bowel sounds); rectal examination (mandatory: pelvic mass, blood on glove, empty rectum in obstruction). Investigations in parallel with resuscitation: FBC, U&E, serum amylase or lipase, blood glucose, CRP, coagulation, group and save, erect CXR (free air: perforation), plain AXR (dilated bowel loops and air-fluid levels: obstruction; coffee-bean: sigmoid volvulus), urine dipstick and pregnancy test in women, ultrasound (gallbladder, appendix, free fluid), CT abdomen and pelvis (if available and the patient is stable: provides the most definitive anatomical information). Resuscitation: IV access with two large-bore cannulae; IV fluid resuscitation (Hartmann's solution); opioid analgesia (does not mask peritonitis and must not be withheld); urinary catheter (urine output target above 0.5 mL per kg per hour); nil by mouth; broad-spectrum IV antibiotics if sepsis is suspected; nasogastric tube for decompression if obstruction is suspected; escalate to intensive care if haemodynamically unstable.



References and Attributions [Series 2]

Textual References

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- Buckley, O. and Doody, O. (Eds). (2014). Radiology for Undergraduates and Junior Doctors (2nd ed.). London: JP Medical Publishers.
- Bakaeen, F. G., Petersen, R. P., Bhatt, D. L. et al. (2011). Surgical Oncology: Clinically Oriented. London: Springer.

Figures, Plates, Tables, and Boxes

- Figure 2.1: Surgical history and common surgical complaints. AI-generated using the prompt: "Three-panel diagram: SOCRATES mnemonic expanded with pain radiation patterns box; five-row surgical complaint table (pain, lump, rectal bleeding, dysphagia, bowel change); past medical, drug, and social history surgical-specific boxes." Suggested OER search string: "surgical history SOCRATES abdominal pain radiation patterns surgical complaints OER."
- Figure 2.2: Physical examination of the surgical patient. AI-generated using the prompt: "Three-panel diagram: vital signs table and peripheral hand signs diagram; IPPA abdominal examination flow diagram; lump examination sequential checklist." Suggested OER search string: "abdominal examination IPPA surgical physical signs lump examination checklist OER."
- Figure 2.3: Physical signs in clinical surgery. AI-generated using the prompt: "Three-panel diagram: peritoneal irritation signs diagram (guarding, rigidity, rebound, Rovsing's, psoas, obturator, loss of liver dullness); SBO versus LBO comparison table; five-row eponymous signs table." Suggested OER search string: "peritoneal irritation signs bowel obstruction signs eponymous surgical signs Murphy Courvoisier OER."
- Figure 2.4: Investigation of the surgical patient. AI-generated using the prompt: "Three-panel diagram: blood test reference table; surgical imaging comparison table; biopsy types table with frozen section box and microbiological investigations box." Suggested



OER search string: "surgical investigations blood tests abdominal imaging biopsy microbiological investigation OER."

- Figure 2.5: Diagnosis in surgery. AI-generated using the prompt: "Three-panel diagram: clinical reasoning flow diagram and VINDICATE sieve; symptom-to-diagnosis pattern recognition table; SPIKES six-step breaking bad news diagram with documentation box." Suggested OER search string: "surgical differential diagnosis VINDICATE pattern recognition SPIKES breaking bad news OER."
- Figure 2.6: Clinical presentation of common surgical conditions. AI-generated using the prompt: "Three-panel diagram: acute abdomen causes table with resuscitation box; intestinal obstruction classification and cardinal features and strangulation warning box; hernia types table and groin hernia location diagram." Suggested OER search string: "acute abdomen Nigeria intestinal obstruction herniae lumps clinical presentation surgical diagram OER."



Series 3: Perioperative Care and Safety

1. Part 3.1: Preoperative Assessment and Optimisation

1. Sub Part 3.1.1: Goals of preoperative assessment
2. Sub Part 3.1.2: Cardiovascular and respiratory assessment
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3. Part 3.3: Intraoperative Care

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3. Sub Part 3.3.3: Blood loss and transfusion during surgery

4. Part 3.4: Postoperative Care

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3. Sub Part 3.4.3: Common postoperative complications

5. Part 3.5: Thromboembolic Disease in Surgery

1. Sub Part 3.5.1: Risk factors and pathophysiology of venous thromboembolism
2. Sub Part 3.5.2: Prevention of venous thromboembolism
3. Sub Part 3.5.3: Diagnosis and treatment of DVT and pulmonary embolism

6. Part 3.6: Enhanced Recovery After Surgery

1. Sub Part 3.6.1: Principles of enhanced recovery
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3. Sub Part 3.6.3: ERAS in Nigerian surgical practice



Introduction

Perioperative care encompasses everything that happens to the surgical patient from the decision to operate through to full postoperative recovery. Good perioperative care reduces complications, shortens hospital stay, and saves lives. In Nigerian surgical practice, where patients often present late with advanced disease and significant comorbidities, meticulous perioperative management is especially critical.

This Series covers the full perioperative journey. We begin with preoperative assessment and optimisation, then examine anaesthesia and intraoperative care. We address postoperative monitoring and analgesia, common postoperative complications, and the prevention and management of venous thromboembolism. We close with the principles of enhanced recovery after surgery and their application in Nigeria.

Series Learning Outcomes

Upon completing this Series, you should be able to:

1. **SLO 3.1:** describe the goals of preoperative assessment and outline the preoperative optimisation of a surgical patient,
2. **SLO 3.2:** describe the types of anaesthesia and the common complications of anaesthesia,
3. **SLO 3.3:** describe the principles of intraoperative patient care including monitoring and blood transfusion,
4. **SLO 3.4:** describe the immediate postoperative care of the surgical patient and the management of common postoperative complications,
5. **SLO 3.5:** describe the risk factors, prevention, diagnosis, and treatment of venous thromboembolism in surgical patients, and
6. **SLO 3.6:** describe the principles of enhanced recovery after surgery and their application in Nigerian practice.

3.1 Preoperative Assessment and Optimisation

3.1.1 Goals of preoperative assessment

Preoperative assessment is the systematic evaluation of a patient before surgery to determine fitness for the planned operation, identify modifiable risk factors, and formulate a safe



anaesthetic and surgical plan. Its three goals are to assess operative risk, to optimise the patient's condition before surgery, and to obtain valid informed consent. The **ASA physical status classification** (Series 1, Part 1.2) grades the patient's systemic health from ASA I to V and provides a simple estimate of perioperative risk.

The assessment covers the history, physical examination, and investigations. Particular attention is paid to the cardiovascular, respiratory, and renal systems, as these are the organ systems most commonly responsible for perioperative morbidity and mortality. A thorough drug history identifies medications that need to be continued, withheld, or reversed before surgery.

Fill in the blank: Preoperative assessment has three goals: to assess operative _____, to _____ the patient's condition, and to obtain valid informed consent.

3.1.2 Cardiovascular and respiratory assessment

Cardiovascular assessment focuses on identifying conditions that increase the risk of perioperative cardiac events. The key questions are whether the patient has ischaemic heart disease, heart failure, arrhythmias, or valvular disease, and whether any of these are adequately controlled. A resting **ECG** is performed in all patients above 40 years or with known cardiac disease. **Echocardiography** is indicated when significant valvular disease or impaired ventricular function is suspected.

Respiratory assessment identifies patients at high risk of postoperative pulmonary complications, which are the most common cause of postoperative mortality. Patients with asthma, COPD, or a recent chest infection need careful evaluation. **Spirometry** (measuring FEV1 and FVC) quantifies the degree of airways obstruction. Patients who smoke are counselled to stop at least four weeks before elective surgery, as smoking impairs mucociliary clearance, increases sputum production, and reduces wound healing.

Fill in the blank: A resting _____ is performed in all patients above 40 years or with known cardiac disease. Smokers should stop smoking at least _____ weeks before elective surgery.

3.1.3 Preoperative optimisation

Optimisation means correcting abnormalities identified during assessment before surgery takes place. Anaemia should be treated: iron deficiency anaemia is corrected with oral or IV iron, with a target haemoglobin above 10 g/dL before elective major surgery. Uncontrolled hypertension (blood pressure above 180/110 mmHg) should be controlled with antihypertensive medication before elective cases. Uncontrolled diabetes mellitus carries a high risk of wound infection and poor healing; the target perioperative blood glucose is below 10 mmol/L.

Nutritional status must be assessed and corrected where possible. Severely malnourished patients benefit from preoperative enteral nutritional supplementation for at least 7 to 14 days before major elective surgery. Patients on anticoagulants need a planned bridging strategy. Patients on long-term steroids need stress-dose hydrocortisone perioperatively to prevent an Addisonian crisis. All optimisation should be completed before the date of surgery is confirmed.



Fill in the blank: The target haemoglobin before major elective surgery is above _____ g/dL. The target perioperative blood glucose in a diabetic patient is below _____ mmol/L.

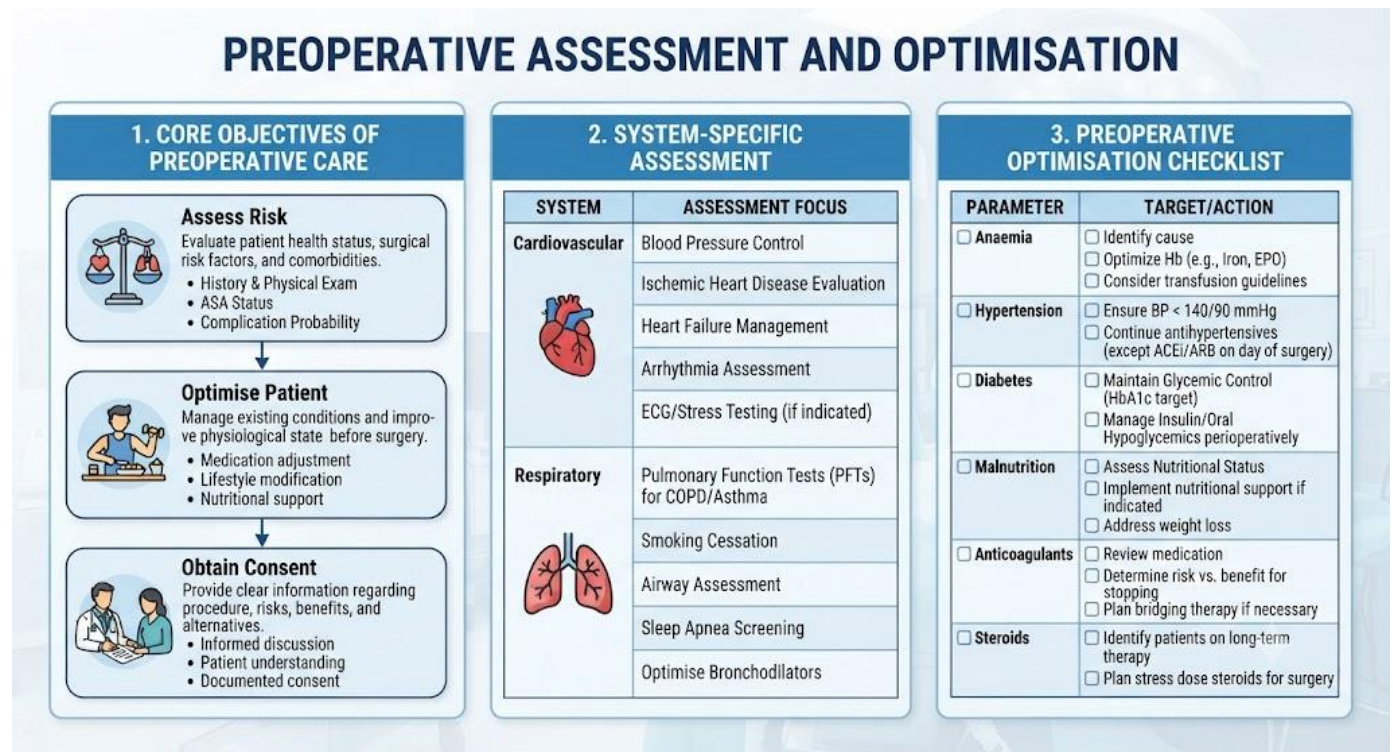


Figure 3.1: Goals of preoperative assessment, cardiovascular and respiratory evaluation, and preoperative optimisation

Pilot questions 3.1

1. State the three goals of preoperative assessment. (Linked to SLO 3.1)
2. Describe the cardiovascular investigations required before major surgery. (Linked to SLO 3.1)
3. Explain why smoking should be stopped before surgery and state the recommended interval. (Linked to SLO 3.1)
4. Describe the preoperative management of a patient with poorly controlled diabetes. (Linked to SLO 3.1)
5. Explain why patients on long-term steroids require special perioperative management. (Linked to SLO 3.1)



3.2 Anaesthesia for the Surgical Patient

3.2.1 Types of anaesthesia

General anaesthesia (GA) produces a controlled, reversible state of unconsciousness, analgesia, and muscle relaxation. It is maintained with inhalational agents (such as sevoflurane or isoflurane) or total intravenous anaesthesia (**TIVA**: propofol infusion). GA requires airway management: a **laryngeal mask airway (LMA)** for spontaneously breathing patients or **endotracheal intubation** for controlled ventilation and airway protection.

Regional anaesthesia blocks sensation in a specific area without loss of consciousness. **Spinal anaesthesia** (intrathecal injection of local anaesthetic into the subarachnoid space at L3/L4 or L4/L5) produces dense sensory and motor block from the injection level downward and is the anaesthetic of choice for lower abdominal, pelvic, and lower limb surgery in Nigeria. **Epidural anaesthesia** (catheter in the epidural space) provides continuous adjustable block and is also used for postoperative analgesia. **Local anaesthesia** (injection of local anaesthetic into the operative site) is used for minor procedures.

Fill in the blank: General anaesthesia requires airway management with either a _____ mask airway or endotracheal _____. Spinal anaesthesia involves injecting local anaesthetic into the _____ space at L3/L4.

3.2.2 The preoperative fasting rule and airway assessment

Preoperative fasting reduces the volume of gastric contents and the risk of pulmonary aspiration during anaesthesia induction. The standard rule is: no solid food for at least six hours and no clear fluids for at least two hours before surgery. In emergency surgery, the stomach is assumed to be full and rapid sequence induction (RSI) with cricoid pressure is used to protect the airway during intubation.

Airway assessment identifies patients at risk of difficult intubation. The **Mallampati score** (assessed with the patient sitting upright, mouth fully open, and tongue protruding without phonation: class I to IV based on the visibility of oropharyngeal structures) is the most widely used screening tool. Other predictors of difficult intubation include limited mouth opening, a short neck, reduced neck extension, a receding chin (micrognathia), and protruding upper teeth. Difficult airway equipment must be available before anaesthesia is induced.

Fill in the blank: Patients must fast from solid food for at least _____ hours before surgery. The _____ score assesses oropharyngeal visibility and is used to predict difficult intubation.

3.2.3 Complications of anaesthesia

Postoperative nausea and vomiting (PONV) is the most common complication of general anaesthesia, occurring in up to 30 percent of patients. It is distressing, delays recovery, and



increases the risk of aspiration. Risk factors include female sex, a history of motion sickness, non-smoking status, and the use of opioid analgesia. Prophylaxis with ondansetron or dexamethasone is given to high-risk patients. Pulmonary aspiration of gastric contents causes chemical pneumonitis (Mendelson's syndrome) and can be fatal; it is prevented by adequate preoperative fasting and RSI in at-risk patients.

Malignant hyperthermia is a rare but life-threatening pharmacogenetic disorder triggered by volatile inhalational anaesthetic agents (halothane, sevoflurane) and suxamethonium. Uncontrolled calcium release from skeletal muscle causes a rapid rise in body temperature, muscle rigidity, metabolic acidosis, and tachycardia. It is treated with **dantrolene sodium** (a skeletal muscle relaxant that blocks calcium release from the sarcoplasmic reticulum) and aggressive cooling. A family history of problems with anaesthesia must always be elicited.

Fill in the blank: Postoperative nausea and vomiting is treated with _____ or dexamethasone. Malignant hyperthermia is treated with _____ sodium and aggressive cooling.

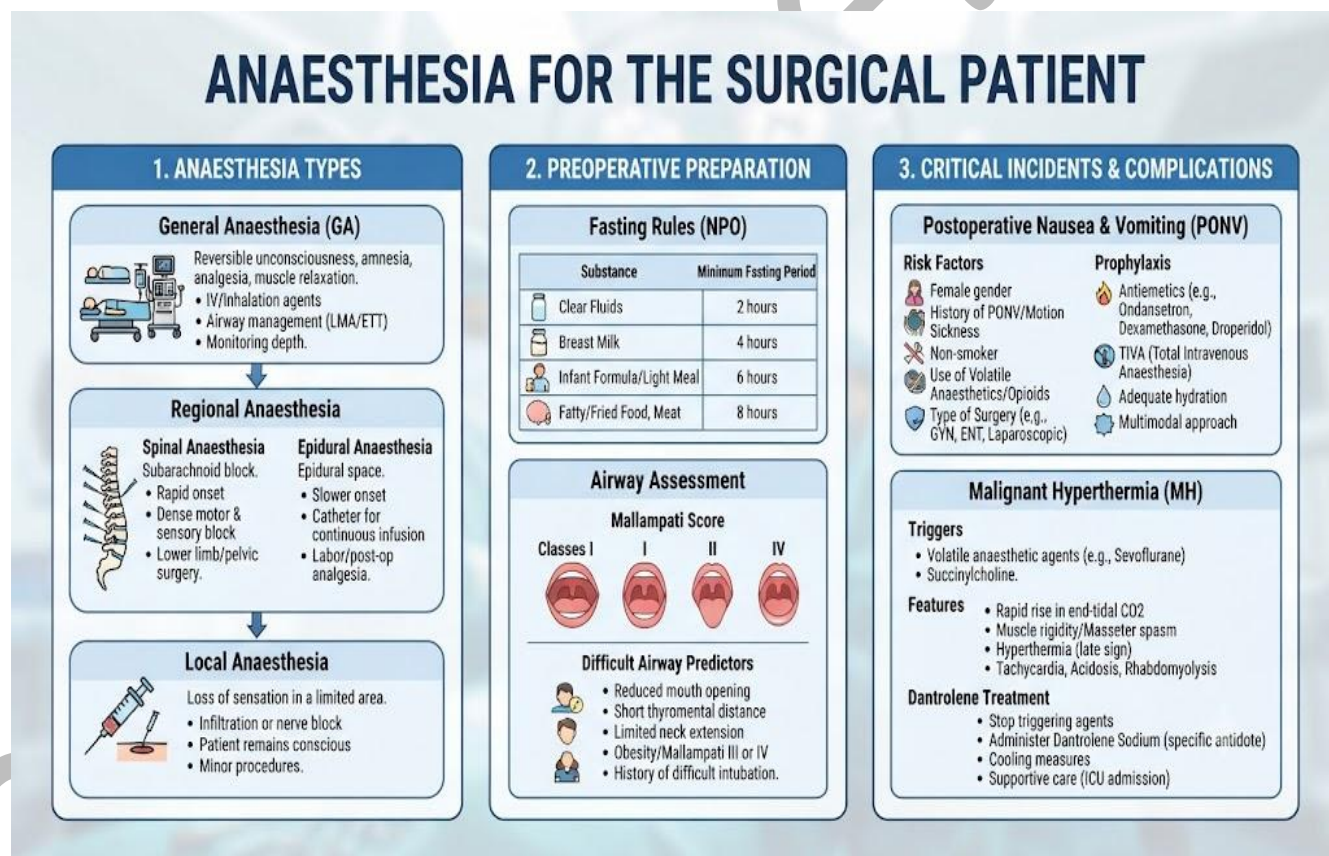


Figure 3.2: Types of anaesthesia, preoperative fasting and airway assessment, and anaesthetic complications

Pilot questions 3.2



- Distinguish general anaesthesia from spinal anaesthesia in terms of mechanism and indication. (Linked to SLO 3.2)
- State the preoperative fasting rule and explain why it is important. (Linked to SLO 3.2)
- Describe the Mallampati score and state how it is used. (Linked to SLO 3.2)
- Describe the risk factors for PONV and state the prophylactic drugs used. (Linked to SLO 3.2)
- Describe the clinical features and treatment of malignant hyperthermia. (Linked to SLO 3.2)

3.3 Intraoperative Care

3.3.1 Patient positioning and theatre safety

Correct patient positioning prevents pressure injuries, nerve damage, and vascular compromise during surgery. The common positions are supine (most abdominal and thoracic procedures), lithotomy (perineal, rectal, and gynaecological procedures: the legs are placed in stirrups with the hips flexed and abducted), lateral decubitus (thoracic and renal procedures), and prone (spinal and posterior fossa procedures). Each position carries specific risks: the lithotomy position risks common peroneal nerve palsy (from pressure at the fibular head) and compartment syndrome of the lower limb.

Theatre safety begins before the patient enters the operating room. The WHO Surgical Safety Checklist (Series 1, Part 1.5) is performed at Sign In, Time Out, and Sign Out. All implants and prostheses must be checked and available. Equipment is checked for function. Diathermy settings are confirmed and the patient plate is correctly placed to prevent diathermy burns. A fire risk assessment is conducted, particularly when oxygen and alcohol-based skin preparation agents are used simultaneously.

Fill in the blank: The lithotomy position risks _____ peroneal nerve palsy from pressure at the fibular head. The WHO Surgical Safety Checklist is performed at Sign In, Time _____, and Sign Out.

3.3.2 Monitoring during surgery

Minimum monitoring standards during surgery include continuous ECG, pulse oximetry (SpO₂), non-invasive blood pressure (NIBP) measured every 5 minutes, capnography (end-tidal CO₂: confirms correct endotracheal tube placement and monitors ventilation adequacy), and peripheral temperature. These are the AAGBI (Association of Anaesthetists of Great Britain and Ireland) minimum monitoring standards, adopted as the international standard.



For high-risk patients and major surgery, additional monitoring is used. An arterial line (intra-arterial catheter: usually in the radial artery) provides continuous beat-to-beat blood pressure monitoring and arterial blood gas sampling. A central venous catheter (CVC) measures central venous pressure (CVP), which guides fluid administration and provides access for vasoactive drugs. A urinary catheter with hourly urine output measurement is used in all major operations as a guide to organ perfusion.

Fill in the blank: Minimum intraoperative monitoring includes ECG, pulse _____, non-invasive blood pressure, and _____ (end-tidal CO₂). A urinary catheter is used in major surgery to monitor hourly _____ output.

3.3.3 Blood loss and transfusion during surgery

Intraoperative blood loss must be estimated and replaced to prevent haemodynamic compromise. Blood loss is estimated from swab weighing, suction volume, and clinical signs (tachycardia and hypotension). Crystalloid replacement is given for moderate blood loss. When blood loss is significant (typically above 10 to 15 percent of estimated blood volume), blood transfusion is required. The decision to transfuse is guided by the haemoglobin level, the rate of ongoing blood loss, and haemodynamic stability.

Autologous blood salvage (cell saver) collects the patient's own blood lost during surgery, processes it, and re-infuses it, reducing the need for donor blood transfusion. Transfusion reactions must be recognised promptly: acute haemolytic reactions (from ABO incompatibility) cause fever, rigors, loin pain, haemoglobinuria, and haemodynamic collapse; the transfusion must be stopped immediately. Transfusion-related acute lung injury (TRALI) presents as acute respiratory failure within 6 hours of transfusion and carries a high mortality.

Fill in the blank: Blood loss above _____ to 15 percent of estimated blood volume generally requires blood transfusion. An acute haemolytic transfusion reaction from ABO _____ causes fever, rigors, loin pain, and haemodynamic collapse.



INTRAOPERATIVE CARE

1. PATIENT POSITIONING & SAFETY

Patient Positioning Table

POSITION	SURGERY TYPES	RISKS
Supine 	Cardiac, Abdominal, Ortho (Upper)	Nerve injury (Ulnar/Brachial) Pressure ulcers
Lithotomy 	Gynecology, Urology, Colorectal	Nerve injury (Peroneal/Sciatic), DVT Compartment syndrome
Lateral 	Thoracic, Kidney, Ortho (Hip)	Nerve injury (Brachial) Eye injury, Pressure ulcers
Prone 	Spine, Neurosurgery	Eye injury, Airway compromise, Pressure ulcers, Nerve injury

Theatre Safety Checklist



WHO Surgical Safety Checklist
Sign In (Before Induction)
Time Out (Before Incision)
Sign Out (Before Leaving Theatre)

2. INTRAOPERATIVE MONITORING

Standard Monitoring

Monitor	Parameter/Target
 ECG	Heart Rate & Rhythm
 SpO2	Oxygen Saturation >94%
 NIBP	Blood Pressure Q5-15min
 Capnography	EtCO2 35-45 mmHg
 Temperature	Normothermia >36°C

Advanced Monitoring

 Arterial Line	Continuous BP, ABG sampling
 CVC	Central Venous Pressure, Vasoactive drugs
 Urinary Catheter	Fluid balance
 Target Urine Output	>0.5 ml/kg/hr

3. FLUID & BLOOD MANAGEMENT

Blood Loss Estimation

- Visual estimation (Swabs, Drains)
- Gravimetric (Weighing Swabs)
- Laboratory (Hb, Hct)

Cell Saver

Intraoperative Blood Recovery
Washed, filtered, and reinfused
Reduces allogenic transfusion

Acute Haemolytic Reaction
 ABO incompatibility
Symptoms: Fever, chills, flank pain, hypotension, hemoglobinuria
Action: Stop transfusion, IV fluids, supportive care

TRALI (Transfusion-Related Acute Lung Injury)
 Antibody-mediated lung injury
Symptoms: Acute respiratory distress, hypoxemia, pulmonary edema
Action: Stop transfusion, respiratory support, ICU

Figure 3.3: Patient positioning and theatre safety, intraoperative monitoring, and blood transfusion

Pilot questions 3.3

1. Describe the lithotomy position and state its specific complications. (Linked to SLO 3.3)
2. State the minimum monitoring standards during surgery and explain the purpose of capnography. (Linked to SLO 3.3)
3. Describe when intraoperative blood transfusion is indicated. (Linked to SLO 3.3)
4. Describe the clinical features of an acute haemolytic transfusion reaction and state the immediate management. (Linked to SLO 3.3)
5. Explain the principle of autologous blood salvage (cell saver) and state its advantage. (Linked to SLO 3.3)

3.4 Postoperative Care

3.4.1 Immediate postoperative monitoring

After surgery, the patient is transferred to a recovery area where trained nursing staff monitor for the effects of anaesthesia and early postoperative complications. The priority in the immediate



postoperative period is airway, breathing, and circulation. Level of consciousness is monitored using the AVPU scale (Alert, responds to Voice, responds to Pain, Unresponsive) until the patient is fully awake. Vital signs are recorded every 15 minutes initially.

The early warning score (EWS), also called the Modified Early Warning Score (MEWS), is a track-and-trigger system that assigns points to abnormal vital signs. A rising MEWS score indicates physiological deterioration and triggers escalation to a more senior clinician. Urine output is monitored hourly (target 0.5 mL per kg per hour). The surgical drain output is recorded. Pain is assessed using a visual analogue scale (VAS 0 to 10) and treated promptly.

Fill in the blank: Consciousness is assessed using the _____ scale (Alert, Voice, Pain, Unresponsive) in the immediate postoperative period. The target urine output after major surgery is _____ mL per kg per hour.

3.4.2 Postoperative analgesia

Effective postoperative analgesia reduces suffering, enables early mobilisation, prevents respiratory complications from splinting, and shortens hospital stay. The World Health Organisation analgesic ladder provides a framework: step 1 (paracetamol and NSAIDs for mild pain), step 2 (weak opioids such as tramadol or codeine for moderate pain), and step 3 (strong opioids such as morphine for severe pain). Multimodal analgesia (combining drugs from different classes at lower doses) is superior to single-agent treatment.

Patient-controlled analgesia (PCA) allows the patient to self-administer small IV bolus doses of morphine within preset safety limits, providing effective analgesia with less opioid use than nurse-administered boluses. **Epidural analgesia** (a continuous infusion of local anaesthetic and opioid through an epidural catheter) provides excellent analgesia for thoracic and major abdominal surgery and is the gold standard for postoperative pain control in these settings. NSAIDs must be used with caution in patients with renal impairment, peptic ulcer disease, or cardiovascular disease.

Fill in the blank: The WHO analgesic ladder uses paracetamol and NSAIDs for mild pain at step 1 and strong _____ such as morphine for severe pain at step 3. _____ analgesia combines drugs from different classes at lower doses for superior pain control.

3.4.3 Common postoperative complications

Postoperative complications are classified by timing as immediate (within 24 hours), early (1 to 7 days), and late (beyond 7 days). The most important immediate complications are haemorrhage (primary: from incomplete surgical haemostasis) and airway obstruction (from residual anaesthetic, laryngospasm, or haematoma after neck surgery). Reactionary haemorrhage occurs within 24 hours as the blood pressure rises and displaces a clot; secondary haemorrhage occurs at 7 to 10 days from infection eroding a vessel.

Early postoperative complications include wound infection (most common surgical complication: presents with erythema, swelling, and purulent discharge at days 5 to 7), chest



infection (atelectasis progressing to pneumonia: prevented by chest physiotherapy and early mobilisation), urinary retention (especially in elderly men after spinal anaesthesia or pelvic surgery), anastomotic leak (presents at days 3 to 5 with fever, tachycardia, and abdominal pain after bowel surgery: a serious complication requiring urgent reoperation or drainage), and deep vein thrombosis.

Fill in the blank: Primary haemorrhage occurs within _____ hours of surgery from incomplete surgical haemostasis. Secondary haemorrhage occurs at _____ to 10 days and is caused by infection eroding a vessel.

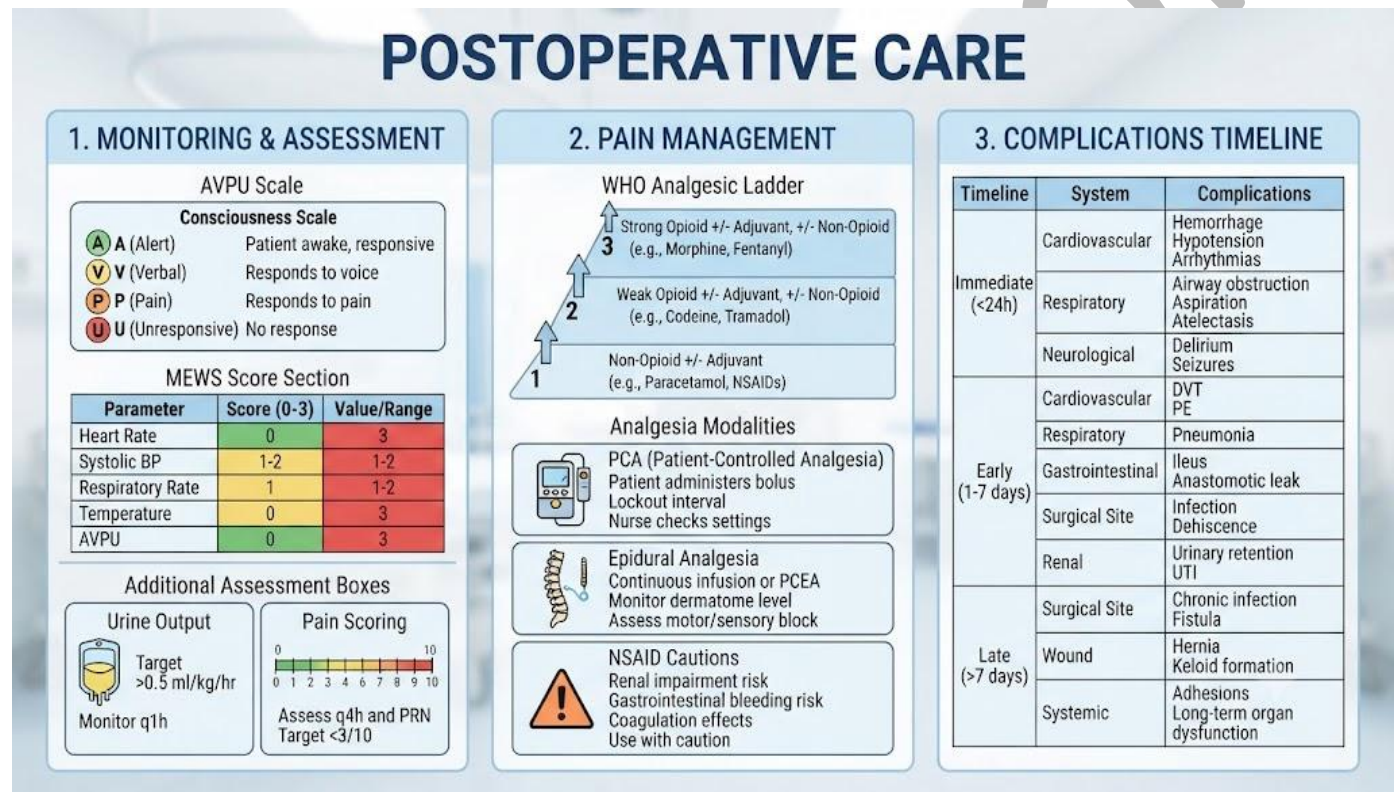


Figure 3.4: Immediate postoperative monitoring, postoperative analgesia, and postoperative complications

Pilot questions 3.4

6. Describe the immediate postoperative monitoring priorities in the recovery area. (Linked to SLO 3.4)
7. Describe the WHO analgesic ladder and state the drugs used at each step. (Linked to SLO 3.4)
8. Distinguish primary from reactionary from secondary haemorrhage. (Linked to SLO 3.4)
9. Describe the clinical features and management of an anastomotic leak. (Linked to SLO 3.4)



10. Describe the prevention of postoperative chest infection. (Linked to SLO 3.4)

3.5 Thromboembolic Disease in Surgery

3.5.1 Risk factors and pathophysiology of venous thromboembolism

Venous thromboembolism (VTE) encompasses **deep vein thrombosis (DVT)** and **pulmonary embolism (PE)**. It is a major cause of preventable postoperative mortality. The pathophysiology is explained by **Virchow's triad**: venous stasis (immobility, prolonged surgery, and prolonged recumbency), endothelial injury (surgical trauma to vessel walls), and hypercoagulability (surgical stress response, cancer, and thrombophilia).

Surgical patients carry a particularly high risk of VTE because surgery combines all three elements of Virchow's triad simultaneously. Additional risk factors include advanced age, obesity, malignancy, a personal or family history of VTE, thrombophilia (factor V Leiden, protein C or S deficiency, antiphospholipid syndrome), oral contraceptive pill use, hormone replacement therapy, and prolonged immobility. Orthopaedic surgery (hip and knee replacement) and pelvic surgery (prostatectomy, gynaecological cancer surgery) carry the highest VTE risk.

Fill in the blank: The pathophysiology of VTE is explained by Virchow's triad: venous _____, endothelial injury, and _____. Orthopaedic surgery (hip and knee replacement) and _____ surgery carry the highest VTE risk.

3.5.2 Prevention of venous thromboembolism

VTE prophylaxis is stratified by risk. All surgical inpatients receive mechanical prophylaxis: anti-embolism stockings (thromboembolic deterrent or TED stockings) apply graduated compression to the calf and reduce venous stasis, and intermittent pneumatic compression (IPC) devices alternately inflate and deflate sleeves around the lower limbs, actively promoting venous return. Both are applied before surgery and continued until the patient is fully mobile.

Pharmacological prophylaxis uses low molecular weight heparin (LMWH: enoxaparin or dalteparin), given subcutaneously once daily. It is commenced 12 hours before or 6 to 12 hours after surgery, depending on the surgical bleeding risk, and continued until the patient is fully mobile or for a fixed period (28 days for major orthopaedic surgery: extended prophylaxis). LMWH is contraindicated when the risk of surgical haemorrhage is very high. Early mobilisation is the single most effective non-pharmacological VTE prevention measure.

Fill in the blank: Anti-embolism stockings and intermittent _____ compression are mechanical VTE prophylaxis measures. Low molecular weight heparin is given _____ once daily for pharmacological VTE prophylaxis.



3.5.3 Diagnosis and treatment of DVT and pulmonary embolism

DVT typically presents with unilateral calf pain, swelling, warmth, and erythema. Clinical probability is assessed using the Wells score (a validated scoring system based on clinical features). A low Wells score combined with a negative D-dimer effectively excludes DVT. A high Wells score or positive D-dimer requires duplex ultrasonography (the definitive non-invasive investigation for DVT).

Pulmonary embolism (PE) presents with sudden dyspnoea, pleuritic chest pain, haemoptysis, tachycardia, and hypoxia. Massive PE causes cardiovascular collapse and death. The **CT pulmonary angiogram (CTPA)** is the gold standard investigation. Treatment: therapeutic dose LMWH or unfractionated heparin immediately, followed by oral anticoagulation (warfarin or a direct oral anticoagulant) for at least 3 months. Massive PE with haemodynamic compromise is treated with systemic thrombolysis (alteplase) as a life-saving measure.

Fill in the blank: The _____ score is used to assess the clinical probability of DVT. The gold standard investigation for pulmonary embolism is CT _____ angiogram.

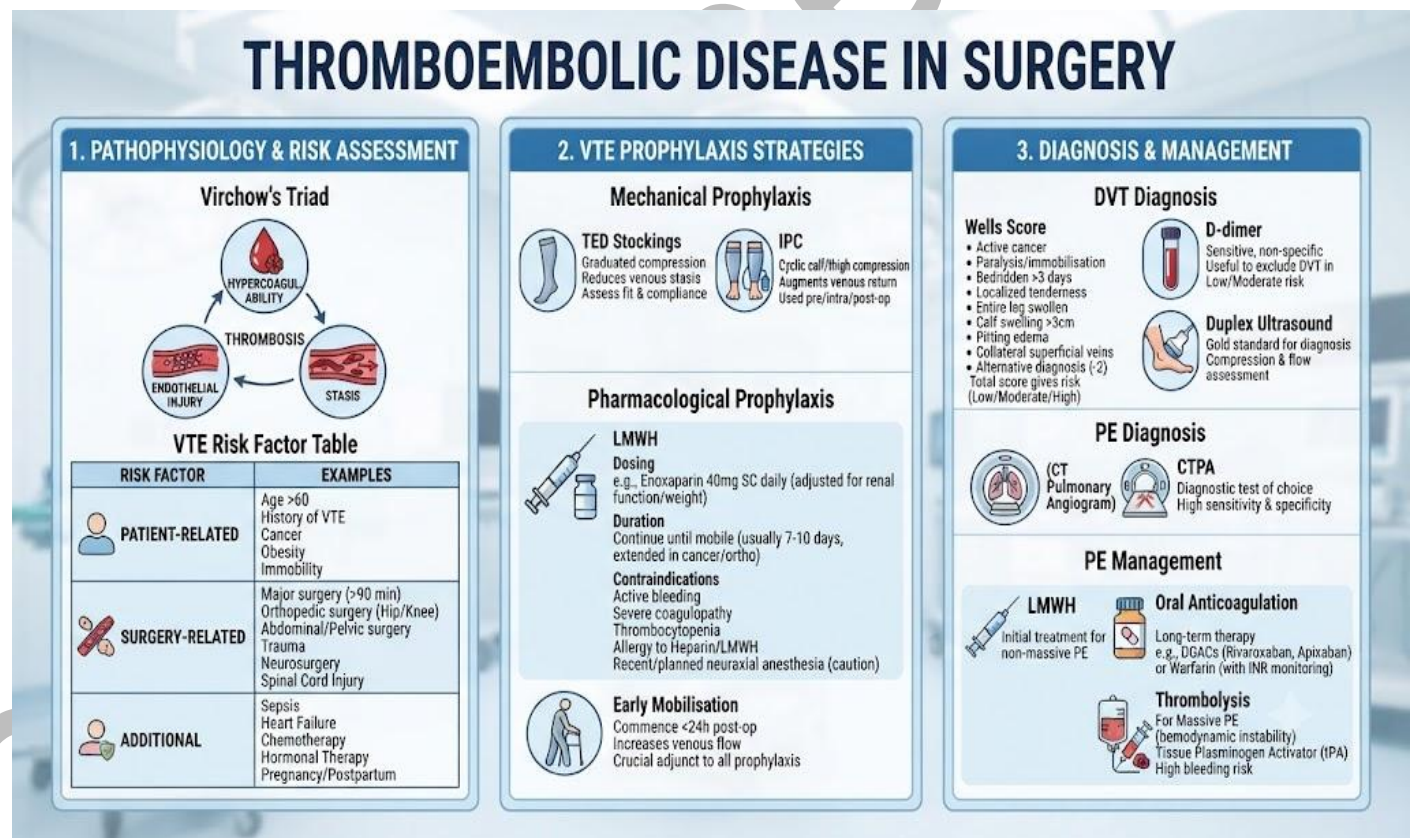


Figure 3.5: VTE risk factors and Virchow's triad, VTE prophylaxis, and diagnosis and treatment of DVT and PE



Pilot questions 3.5

11. Explain Virchow's triad and describe how surgery predisposes to VTE. (Linked to SLO 3.5)
12. Describe the mechanical methods of VTE prophylaxis used in surgical patients. (Linked to SLO 3.5)
13. Describe the pharmacological prophylaxis for VTE and state when it is commenced. (Linked to SLO 3.5)
14. Describe the clinical features and investigation of a suspected DVT. (Linked to SLO 3.5)
15. Describe the clinical features and treatment of a massive pulmonary embolism. (Linked to SLO 3.5)

3.6 Enhanced Recovery After Surgery

3.6.1 Principles of enhanced recovery

Enhanced Recovery After Surgery (ERAS), also known as fast-track surgery, is a multimodal, evidence-based care pathway designed to reduce the physiological and psychological stress of surgery, accelerate recovery, and shorten hospital stay. It was first developed for colorectal surgery by Professor Henrik Kehlet in Denmark and has since been extended to most major surgical specialties. ERAS replaces traditional practices (such as prolonged preoperative fasting, nasogastric tubes, and prolonged bed rest) that have no evidence base and delay recovery.

The core principle of ERAS is that the surgical stress response, which drives postoperative catabolism, immunosuppression, organ dysfunction, and delayed recovery, can be attenuated by a combination of preoperative optimisation, minimal invasive surgery, multimodal analgesia, and early restoration of normal physiology. Each individual ERAS element has a modest effect, but when implemented together as a bundle, the cumulative impact on recovery is substantial.

Fill in the blank: ERAS was first developed for _____ surgery by Professor Henrik Kehlet. The core principle of ERAS is to attenuate the surgical _____ response through a bundle of evidence-based interventions.

3.6.2 Components of the ERAS protocol

ERAS interventions are divided into preoperative, intraoperative, and postoperative elements. Preoperative elements include patient education and counselling (reducing anxiety and improving compliance), carbohydrate loading (a carbohydrate-rich clear drink 2 to 3 hours before surgery: reduces insulin resistance and catabolism), preoperative optimisation of anaemia and nutrition, and avoidance of unnecessary bowel preparation (which causes dehydration and electrolyte disturbance). The traditional practice of prolonged preoperative fasting (nil by mouth from midnight) is replaced by the 6-hour solid and 2-hour clear fluid rule.



Intraoperative elements include the use of minimally invasive surgery (laparoscopic or robotic: reduces physiological stress and pain), goal-directed fluid therapy (using cardiac output monitoring to administer the correct volume of fluid rather than fixed regimens), short-acting anaesthetic agents to allow rapid recovery, avoidance of nasogastric tubes (unless clinically indicated), and warming to prevent hypothermia. Postoperative elements include early oral feeding from the day of surgery, early removal of drains and catheters (which restrict mobility), multimodal analgesia (minimising opioids), and early mobilisation from the first postoperative day.

Fill in the blank: Carbohydrate loading before surgery reduces _____ resistance and catabolism. Early _____ feeding from the day of surgery is a key postoperative ERAS element.

3.6.3 ERAS in Nigerian surgical practice

ERAS protocols are being progressively introduced in Nigerian tertiary hospitals, particularly in colorectal and upper gastrointestinal surgery. The implementation faces specific challenges: limited availability of laparoscopic equipment, inconsistent drug supply (particularly for regional anaesthesia agents and LMWH), inadequate nursing-to-patient ratios to support intensive postoperative monitoring, and cultural expectations of prolonged bed rest and hospital admission after major surgery. Despite these barriers, several ERAS elements are low-cost and immediately implementable in any Nigerian hospital.

The ERAS elements most readily adoptable in resource-limited Nigerian settings include patient education and counselling (which costs nothing), early oral feeding and early mobilisation (which require only a change in practice), the 6-hour fasting rule (already implemented in many centres), and multimodal analgesia with paracetamol and NSAIDs to reduce opioid use. Abandoning routine nasogastric tube insertion, routine abdominal drains, and prolonged catheterisation are also immediately achievable. Nigerian surgical teams are encouraged to implement ERAS elements incrementally and to audit their outcomes.

Fill in the blank: The ERAS elements most immediately adoptable in Nigerian practice include patient _____, early oral feeding, and early _____. Routine _____ tube insertion and prolonged catheterisation should be abandoned as part of ERAS.



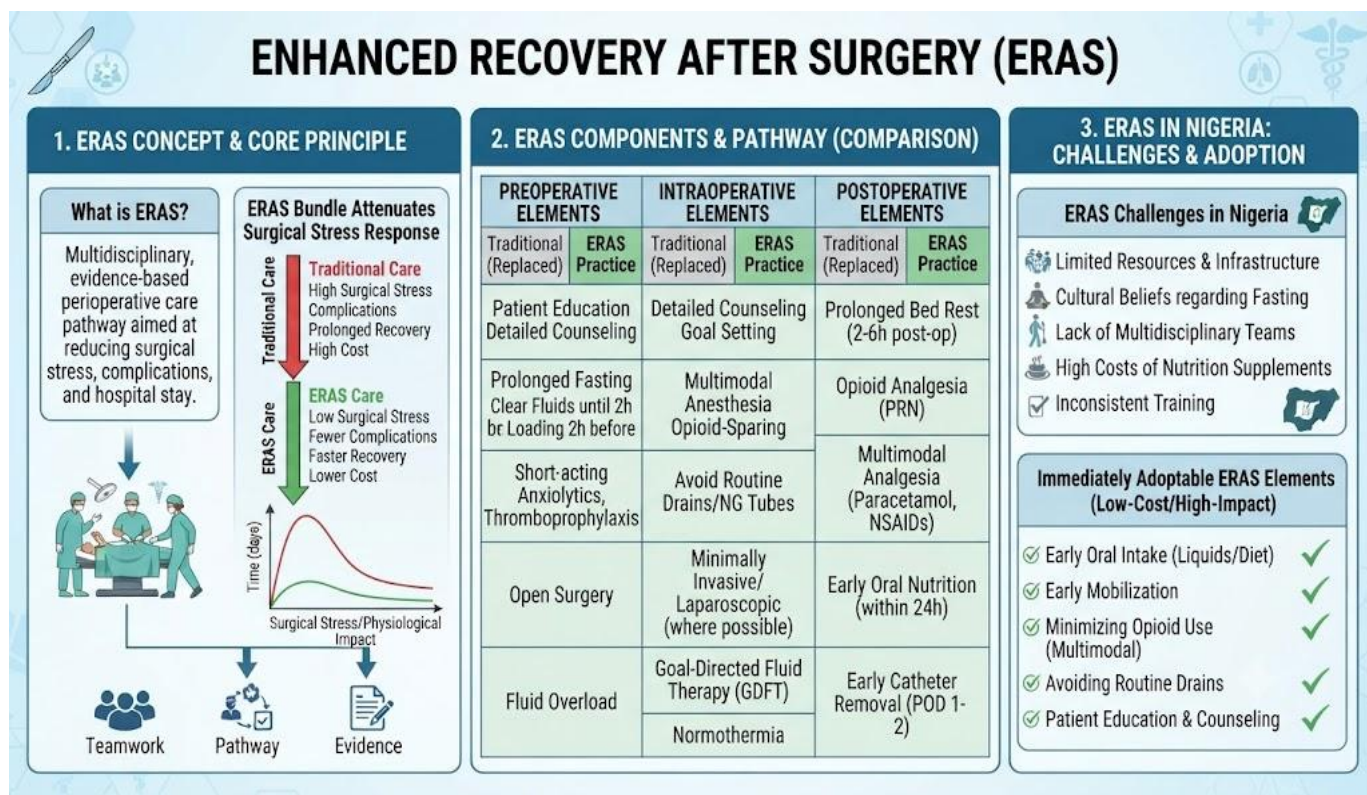


Figure 3.6: Principles of ERAS, the ERAS protocol components, and ERAS implementation in Nigerian surgical practice

Pilot questions 3.6

1. Define ERAS and state who first developed it. (Linked to SLO 3.6)
2. Describe the preoperative elements of the ERAS protocol. (Linked to SLO 3.6)
3. Describe the postoperative elements of the ERAS protocol. (Linked to SLO 3.6)
4. State the challenges to implementing ERAS in Nigerian tertiary hospitals. (Linked to SLO 3.6)
5. State five ERAS elements immediately adoptable in any Nigerian hospital. (Linked to SLO 3.6)



Series Summary

This Series covered the perioperative journey from preoperative assessment through to enhanced recovery. We addressed preoperative assessment and optimisation (risk stratification, cardiovascular and respiratory evaluation, and correction of anaemia, hyperglycaemia, and malnutrition), types of anaesthesia and their complications (GA, spinal, epidural, malignant hyperthermia, PONV), intraoperative care (positioning, monitoring, and blood transfusion), and postoperative care (MEWS monitoring, multimodal analgesia, and common complications including haemorrhage, wound infection, and anastomotic leak).

You should now be able to describe preoperative assessment and optimisation (SLO 3.1), describe types of anaesthesia and their complications (SLO 3.2), describe intraoperative monitoring and transfusion (SLO 3.3), describe postoperative care and complications (SLO 3.4), describe VTE prevention and treatment (SLO 3.5), and describe the principles and practice of ERAS in Nigeria (SLO 3.6). These skills prepare you for the clinical management of any surgical patient across all specialties.

Glossary of Terms

6. **Anastomotic leak:** breakdown of a surgical join between two segments of bowel, presenting 3 to 5 days postoperatively with fever, tachycardia, and abdominal pain; a serious complication requiring urgent reoperation or radiological drainage.
7. **Capnography:** continuous measurement of end-tidal carbon dioxide during anaesthesia; confirms correct endotracheal tube placement and monitors the adequacy of ventilation.
8. **Carbohydrate loading:** a pre-operative nutritional intervention in which a carbohydrate-rich clear drink is taken 2 to 3 hours before surgery to reduce insulin resistance and attenuate postoperative catabolism.
9. **ERAS (Enhanced Recovery After Surgery):** a multimodal, evidence-based perioperative care pathway designed to reduce the surgical stress response and accelerate recovery; developed by Professor Henrik Kehlet for colorectal surgery and now extended to most surgical specialties.
10. **Goal-directed fluid therapy:** an intraoperative fluid administration strategy guided by real-time cardiac output monitoring, giving the precise volume of fluid needed to optimise cardiac output without causing fluid overload or deficit.
11. **Malignant hyperthermia:** a life-threatening pharmacogenetic disorder triggered by volatile anaesthetic agents and suxamethonium, causing uncontrolled calcium release from skeletal muscle; treated with dantrolene sodium and aggressive cooling.



12. **MEWS (Modified Early Warning Score):** a track-and-trigger scoring system that assigns points to abnormal vital signs; a rising score indicates physiological deterioration and prompts escalation to a senior clinician.
13. **Multimodal analgesia:** a pain management strategy combining analgesic drugs from different pharmacological classes (paracetamol, NSAIDs, and opioids) to provide superior pain control at lower doses of each individual agent.
14. **Patient-controlled analgesia (PCA):** a device that allows the patient to self-administer small IV bolus doses of opioid analgesia within preset safety limits.
15. **Pulmonary embolism (PE):** obstruction of the pulmonary vasculature by a thrombus, typically arising from a DVT; presents with dyspnoea, pleuritic chest pain, tachycardia, and hypoxia; diagnosed by CTPA; treated with anticoagulation.
16. **Rapid sequence induction (RSI):** an anaesthetic technique using a pre-calculated dose of induction agent and suxamethonium followed immediately by cricoid pressure to secure the airway rapidly in patients at risk of pulmonary aspiration.
17. **Virchow's triad:** the three pathophysiological factors predisposing to venous thrombosis: venous stasis, endothelial injury, and hypercoagulability.

Concept Check Questions [Series 3]

Objective questions

11. The three goals of preoperative assessment are to assess operative risk, to _____ the patient, and to obtain valid informed consent. (Linked to SLO 3.1)
12. Spinal anaesthesia involves injecting local anaesthetic into the _____ space at L3 or L4. (Linked to SLO 3.2)
13. Minimum intraoperative monitoring includes ECG, pulse oximetry, NIBP, and _____ (end-tidal CO₂). (Linked to SLO 3.3)
14. The pathophysiology of VTE is explained by Virchow's triad: venous stasis, endothelial injury, and _____. (Linked to SLO 3.5)
15. ERAS was first developed for _____ surgery by Professor Henrik Kehlet. (Linked to SLO 3.6)

Short-answer questions



1. Describe the preoperative optimisation of a patient with poorly controlled diabetes. (Linked to SLO 3.1)
2. Describe the clinical features and treatment of malignant hyperthermia. (Linked to SLO 3.2)
3. Distinguish primary from secondary haemorrhage in the postoperative period. (Linked to SLO 3.4)
4. Describe the mechanical methods of VTE prophylaxis in surgical patients. (Linked to SLO 3.5)
5. State five ERAS elements immediately adoptable in Nigerian surgical practice. (Linked to SLO 3.6)

Long-answer questions

1. Describe the preoperative cardiovascular and respiratory assessment of a patient for major elective surgery. (Linked to SLO 3.1)
2. Describe the WHO analgesic ladder and the principles of postoperative analgesia. (Linked to SLO 3.4)
3. Describe the risk factors, prevention, and treatment of venous thromboembolism in surgical patients. (Linked to SLO 3.5)
4. Describe the clinical features and management of a postoperative anastomotic leak. (Linked to SLO 3.4)
5. Describe the components of the ERAS protocol and the challenges to its implementation in Nigeria. (Linked to SLO 3.6)

Answers to Concept Check Questions [Series 3]

Objective questions

1. Optimise.
2. Subarachnoid.
3. Capnography.
4. Hypercoagulability.



5. Colorectal.

Short-answer questions

6. The perioperative blood glucose target is below 10 mmol/L. An insulin sliding scale or variable rate insulin infusion is used intraoperatively and postoperatively to maintain this. HbA1c above 8.5 percent suggests poor long-term control and elective surgery should be deferred until control improves. The diabetes team should be involved preoperatively.
7. Malignant hyperthermia is triggered by volatile anaesthetic agents and suxamethonium. It causes a rapid rise in body temperature, muscle rigidity, metabolic acidosis, and tachycardia from uncontrolled skeletal muscle calcium release. Treatment is immediate cessation of the triggering agent and administration of dantrolene sodium plus aggressive cooling.
8. Primary haemorrhage occurs at the time of surgery or within the first 24 hours from incomplete surgical haemostasis. Reactionary haemorrhage occurs within 24 hours as blood pressure rises and dislodges a clot from an inadequately secured vessel. Secondary haemorrhage occurs at 7 to 10 days from infection eroding a vessel wall.
9. Anti-embolism stockings apply graduated compression to reduce venous stasis in the calf. Intermittent pneumatic compression devices alternately inflate and deflate sleeves around the lower limbs to actively promote venous return. Both are applied before surgery and continued until the patient is fully mobile.
10. Patient education and counselling, early oral feeding from the day of surgery, early mobilisation from the first postoperative day, abandoning routine nasogastric tube insertion, and applying the 6-hour solid and 2-hour clear fluid fasting rule.

Long-answer questions

11. **Basic response:** Cardiovascular assessment covers ischaemic heart disease, heart failure, arrhythmias, and valvular disease. A resting ECG is performed in all patients above 40 years or with known cardiac disease. Echocardiography is arranged if significant valvular disease or poor ventricular function is suspected. Uncontrolled hypertension above 180/110 mmHg should be treated before elective surgery. Respiratory assessment identifies asthma, COPD, and recent chest infection. Spirometry measures FEV1 and FVC to quantify airway obstruction. Smokers should stop at least four weeks before elective surgery.



Value-added response: The Goldman Cardiac Risk Index and the Lee Revised Cardiac Risk Index are validated scoring tools that estimate the risk of a major adverse cardiac event from non-cardiac surgery. They guide decisions on whether to proceed with surgery, defer for cardiology optimisation, or arrange further cardiac investigations such as stress echocardiography before a major elective operation.

12. **Basic response:** The WHO analgesic ladder has three steps. Step 1 uses paracetamol and NSAIDs for mild pain. Step 2 adds weak opioids such as tramadol or codeine for moderate pain. Step 3 uses strong opioids such as morphine for severe pain. Multimodal analgesia combines drugs from different classes at lower individual doses for superior pain control with fewer side effects. PCA allows the patient to self-administer IV morphine boluses within safety limits. Epidural analgesia is the gold standard for thoracic and major abdominal surgery. NSAIDs are avoided in renal impairment and peptic ulcer disease.

Value-added response: Opioid-sparing analgesia is a central ERAS principle because opioids delay return of bowel function, cause nausea and sedation, and increase the risk of respiratory complications. Combining paracetamol, NSAIDs, and regional anaesthetic techniques allows effective pain control while minimising these effects and enabling earlier mobilisation and oral intake.

13. **Basic response:** VTE risk factors include advanced age, obesity, malignancy, personal or family history of VTE, thrombophilia, OCP or HRT use, prolonged immobility, and high-risk surgery such as hip and knee replacement or pelvic surgery. Virchow's triad explains the pathophysiology: venous stasis, endothelial injury, and hypercoagulability. Prevention uses mechanical measures (TED stockings and IPC devices applied before surgery) and pharmacological prophylaxis (LMWH subcutaneously once daily, commenced 12 hours before or 6 to 12 hours after surgery, continued until mobile or for 28 days after major orthopaedic surgery). DVT is investigated with duplex ultrasonography after clinical probability assessment using the Wells score. PE is confirmed by CTPA and treated with therapeutic LMWH then oral anticoagulation for at least 3 months. Massive PE with haemodynamic collapse is treated with systemic thrombolysis using alteplase.

Value-added response: In Nigerian surgical practice, LMWH availability and cost can be barriers to pharmacological VTE prophylaxis. When LMWH is not available, unfractionated heparin 5000 units subcutaneously twice or three times daily is an effective and inexpensive alternative. Mechanical prophylaxis with early mobilisation should be used in all patients regardless of drug availability.

14. **Basic response:** An anastomotic leak presents at days 3 to 5 after bowel surgery with fever, tachycardia, and worsening abdominal pain or tenderness. The patient may develop peritonitis with guarding and rigidity if the leak is free, or a localised collection if it is contained. CT of the abdomen with contrast (oral or rectal contrast leak visible) is the



investigation of choice. Management depends on severity. A small contained leak may be managed with IV antibiotics and CT-guided percutaneous drainage. A large free leak with peritonitis requires urgent return to the operating theatre, lavage of the peritoneal cavity, repair or resection of the anastomosis, and formation of a defunctioning stoma.

Value-added response: Anastomotic leak carries a mortality rate of 10 to 20 percent in published series and is the most feared complication of bowel surgery. Modifiable risk factors include malnutrition, anaemia, poor tissue perfusion from hypotension, and tension or ischaemia at the anastomosis; addressing these before and during surgery is the best preventive strategy.

15. Basic response: Preoperative ERAS elements include patient education, carbohydrate loading (clear carbohydrate drink 2 to 3 hours before surgery), optimisation of anaemia and nutrition, and abandoning routine bowel preparation. Intraoperative elements include minimally invasive surgery, goal-directed fluid therapy, avoidance of nasogastric tubes, short-acting anaesthetics, and patient warming. Postoperative elements include early oral feeding from the day of surgery, early drain and catheter removal, multimodal opioid-sparing analgesia, and early mobilisation from day 1. Challenges in Nigeria include limited laparoscopic equipment, inconsistent drug supply, inadequate nursing ratios, and cultural expectations of prolonged hospitalisation. Low-cost adoptable elements include patient education, early feeding and mobilisation, the 6-hour fasting rule, multimodal analgesia, and abandoning routine NG tubes and drains.

Value-added response: Studies from Nigerian and West African teaching hospitals have shown that even partial ERAS implementation reduces hospital stay and complication rates without increasing readmissions. The key to success is a multidisciplinary team approach, sustained clinical leadership, and regular audit of outcomes against pre-ERAS baselines.

Answers to Pilot Questions [Series 3]

Part 3.1

1. The three goals are to assess operative risk using tools such as the ASA classification, to optimise the patient's condition by correcting anaemia, hyperglycaemia, hypertension, and malnutrition before surgery, and to obtain valid informed consent.
2. A resting ECG is performed in all patients above 40 years or with known cardiac disease. Echocardiography is arranged if valvular disease or impaired ventricular function is suspected. Blood pressure should be controlled below 180/110 mmHg before elective surgery.



3. Smoking impairs mucociliary clearance, increases sputum production, reduces tissue oxygenation, and impairs wound healing. Stopping smoking at least four weeks before elective surgery significantly reduces postoperative pulmonary complications and improves wound healing outcomes.
4. The perioperative blood glucose target is below 10 mmol/L. An insulin sliding scale is used intraoperatively and postoperatively. The diabetes team should be involved preoperatively. If HbA1c is above 8.5 percent, elective surgery should be deferred to allow better glucose control.
5. Long-term steroid use suppresses the hypothalamic-pituitary-adrenal axis. The patient cannot mount a normal cortisol stress response to surgery and may develop an Addisonian crisis with cardiovascular collapse. Stress-dose hydrocortisone must be given perioperatively to cover the physiological demand.

Part 3.2

- General anaesthesia produces controlled unconsciousness, analgesia, and muscle relaxation and is used for all major and intra-abdominal operations. Spinal anaesthesia injects local anaesthetic into the subarachnoid space, producing dense sensory and motor block below the level of injection; it is the preferred technique for lower abdominal, pelvic, and lower limb surgery in Nigeria and avoids the systemic effects of GA.
- Patients must not eat solid food for at least six hours and must not drink clear fluids for at least two hours before surgery. This reduces the volume of gastric contents and minimises the risk of pulmonary aspiration of gastric material during anaesthesia induction, which causes Mendelson's syndrome, a chemical pneumonitis that can be fatal.
- The Mallampati score is assessed with the patient sitting upright, mouth fully open, and tongue protruding without phonation. Class I (full visibility of soft palate, uvula, and faucial pillars) to class IV (soft palate not visible) indicates increasing difficulty of laryngoscopy and intubation. A class III or IV score predicts a potentially difficult airway and triggers preparation of difficult airway equipment before induction.
- Risk factors for PONV include female sex, a history of motion sickness or PONV, non-smoking status, and the use of opioid analgesia. High-risk patients receive prophylaxis with ondansetron (a 5-HT₃ antagonist) and dexamethasone given at induction of anaesthesia. Total intravenous anaesthesia with propofol also reduces PONV compared with inhalational anaesthesia.
- Malignant hyperthermia causes a rapid rise in body temperature, severe muscle rigidity, metabolic acidosis, and tachycardia. Treatment is immediate cessation of the triggering



agent (volatile anaesthetic or suxamethonium), administration of dantrolene sodium (which blocks calcium release from the sarcoplasmic reticulum), active cooling, correction of the metabolic acidosis, and transfer to ICU.

Part 3.3

- In the lithotomy position the patient lies supine with the hips flexed, abducted, and externally rotated, and the legs are placed in stirrups. Specific complications include common peroneal nerve palsy from pressure at the fibular head (presents as foot drop postoperatively), compartment syndrome of the lower limb from prolonged elevation impairing venous return and perfusion, and hip dislocation in patients with prosthetic hips.
- Minimum monitoring standards are continuous ECG, pulse oximetry (SpO₂), non-invasive blood pressure measured every 5 minutes, capnography (end-tidal CO₂), and peripheral temperature. Capnography confirms correct placement of the endotracheal tube (a normal waveform confirms tracheal rather than oesophageal intubation) and provides continuous monitoring of ventilation adequacy (a rising end-tidal CO₂ indicates hypoventilation).
- Blood transfusion is indicated when blood loss exceeds approximately 10 to 15 percent of the estimated blood volume, when the haemoglobin falls below a trigger level (typically 7 to 8 g/dL in stable patients or 10 g/dL in patients with cardiac disease), or when haemodynamic instability persists despite crystalloid resuscitation. The decision is clinical and takes into account the rate of ongoing blood loss and symptoms of anaemia.
- An acute haemolytic transfusion reaction is caused by ABO incompatibility, usually from an administrative error in blood sampling or labelling. Features include fever, rigors, loin pain, haemoglobinuria (dark red urine), hypotension, and haemodynamic collapse. The transfusion must be stopped immediately, IV fluids and vasopressors given, urine output maintained above 1 mL per kg per hour, the blood bank notified, and the used blood bag and a new patient blood sample sent urgently for investigation.
- A cell saver collects blood lost during surgery through suction, anticoagulates and filters it, centrifuges it to concentrate red blood cells, washes the red cells with saline, and re-infuses them into the patient. It reduces the need for donor blood transfusion and avoids the risks of transfusion reactions, blood-borne virus transmission, and transfusion-related immunomodulation. It is particularly valuable in major vascular surgery, cardiac surgery, and orthopaedic procedures with high expected blood loss.



Part 3.4

- The immediate priorities are airway, breathing, and circulation. The airway is assessed for patency and oxygen saturation is measured. Level of consciousness is assessed using the AVPU scale until the patient is fully awake. Vital signs are recorded every 15 minutes. Urine output is monitored hourly with a target of 0.5 mL per kg per hour. Pain is scored on a visual analogue scale and treated promptly. Any deterioration triggers escalation using the MEWS system.
- Step 1 uses paracetamol and NSAIDs for mild pain. Step 2 adds weak opioids such as tramadol for moderate pain. Step 3 uses strong opioids such as morphine for severe pain. Multimodal analgesia combines drugs from different classes at lower individual doses for superior pain control with fewer side effects. Epidural analgesia is the gold standard for thoracic and major abdominal surgery.
- Primary haemorrhage occurs at the time of surgery or within the first 24 hours from incomplete surgical haemostasis. Reactionary haemorrhage occurs within 24 hours as blood pressure recovers and dislodges a poorly secured clot. Secondary haemorrhage occurs at 7 to 10 days from infection eroding a vessel wall. Secondary haemorrhage is the most dangerous because it is unexpected and the surrounding tissues are friable from infection.
- An anastomotic leak presents at days 3 to 5 with fever, tachycardia, and worsening abdominal pain. CT of the abdomen with contrast confirms the diagnosis. A small contained leak is managed with IV antibiotics and CT-guided percutaneous drainage. A large free leak with peritonitis requires urgent return to the operating theatre for peritoneal lavage, repair or resection of the anastomosis, and formation of a defunctioning stoma.
- Preoperatively, patients who smoke should stop at least four weeks before surgery. After surgery, chest physiotherapy is commenced from the first postoperative day to clear secretions and expand atelectatic lung. Deep breathing exercises and incentive spirometry are taught preoperatively. Early mobilisation from the first postoperative day is the most effective preventive measure. Adequate postoperative analgesia prevents respiratory splinting and enables the patient to breathe deeply and cough effectively.

Part 3.5

- Virchow's triad describes three factors that predispose to venous thrombosis: venous stasis, endothelial injury, and hypercoagulability. Surgery combines all three simultaneously: anaesthesia and immobility cause venous stasis, surgical dissection



causes endothelial injury, and the systemic surgical stress response (coagulation factor activation, platelet aggregation, and reduced fibrinolysis) causes hypercoagulability. This makes the postoperative period a high-risk window for VTE formation.

- Anti-embolism stockings apply graduated external compression to the calf, with the highest pressure at the ankle decreasing progressively towards the thigh, to reduce venous stasis and increase venous flow velocity. Intermittent pneumatic compression devices wrap around the lower limbs and alternately inflate and deflate, actively milking venous blood towards the heart and reducing stasis. Both are applied before surgery and worn continuously until the patient is fully ambulant.
- Low molecular weight heparin (enoxaparin 40 mg or dalteparin 2500 to 5000 units) is given subcutaneously once daily. It is commenced 12 hours before surgery for high-risk patients or 6 to 12 hours after surgery when the surgical haemorrhage risk is lower. It is continued until the patient is fully mobile, or for 28 days after major orthopaedic surgery (extended prophylaxis). LMWH is contraindicated when surgical haemorrhage risk is very high.
- DVT typically presents with unilateral calf pain, swelling, warmth, and erythema. The Wells score assesses clinical probability based on risk factors and clinical findings. A low Wells score combined with a negative D-dimer effectively excludes DVT and no further investigation is needed. A high Wells score or positive D-dimer requires duplex ultrasonography of the affected limb, which is the definitive non-invasive diagnostic investigation.
- Massive pulmonary embolism presents with sudden cardiovascular collapse, severe dyspnoea, hypoxia, and haemodynamic instability (hypotension and tachycardia). The diagnosis is clinical in the emergency setting; CTPA confirms it when the patient is stable enough. Treatment is systemic thrombolysis with alteplase (a tissue plasminogen activator) as a life-saving measure to dissolve the clot and restore right ventricular outflow. Therapeutic anticoagulation with unfractionated heparin is started once thrombolysis is completed.

Part 3.6

1. ERAS (Enhanced Recovery After Surgery) is a multimodal, evidence-based perioperative care pathway designed to reduce the physiological and psychological stress of surgery, accelerate recovery, and shorten hospital stay. It was first developed for elective colorectal surgery by Professor Henrik Kehlet in Denmark in the 1990s.



2. Preoperative ERAS elements include patient education and counselling to reduce anxiety and improve adherence, carbohydrate loading with a clear carbohydrate drink 2 to 3 hours before surgery to reduce insulin resistance, optimisation of anaemia and nutritional status, and avoidance of routine bowel preparation (which causes dehydration and electrolyte disturbance without reducing anastomotic leak or infection rates).
3. Postoperative ERAS elements include early oral feeding starting on the day of surgery (replacing the traditional nil by mouth until bowel sounds return), early removal of drains and urinary catheters to enable mobility, multimodal analgesia with opioid-sparing drugs (paracetamol, NSAIDs, and regional techniques), and early mobilisation from the first postoperative day.
4. Challenges to ERAS implementation in Nigeria include limited availability of laparoscopic equipment for minimally invasive surgery, inconsistent drug supply for LMWH and regional anaesthesia agents, inadequate nursing-to-patient ratios for intensive postoperative monitoring, and cultural expectations from patients and families that recovery requires prolonged bed rest and hospitalisation. Staff training and buy-in at all levels also requires sustained effort.
5. Five immediately adoptable ERAS elements in any Nigerian hospital are patient education and counselling (zero cost), early oral feeding from the day of surgery, early mobilisation from the first postoperative day, applying the 6-hour solid and 2-hour clear fluid fasting rule instead of nil from midnight, and abandoning routine nasogastric tube insertion after abdominal surgery.



References and Attributions [Series 3]

Textual References

- Bailey, H. and Love, R. J. M. (2018). Bailey and Love's Short Practice of Surgery (27th ed.). Boca Raton: CRC Press.
- Townsend, C. M., Beauchamp, R. D., Evers, B. M. and Mattox, K. L. (2017). Sabiston Textbook of Surgery (20th ed.). Philadelphia: Elsevier.
- Gustafsson, U. O., Scott, M. J., Hubner, M. et al. (2019). Guidelines for Perioperative Care in Elective Colorectal Surgery: Enhanced Recovery After Surgery (ERAS) Society Recommendations: 2018. World Journal of Surgery, 43(3), 659 to 695.
- Association of Anaesthetists of Great Britain and Ireland (AAGBI). (2015). Anaesthesia and Perioperative Care of the High-Risk Patient (3rd ed.). London: AAGBI.

Figures, Plates, Tables, and Boxes

- Figure 3.1: Preoperative assessment and optimisation. AI-generated using the prompt: "Three-panel diagram: three preoperative assessment goal boxes; cardiovascular and respiratory assessment two-column table; preoperative optimisation checklist table (anaemia, hypertension, diabetes, malnutrition, anticoagulants, steroids)." Suggested OER search string: "preoperative assessment optimisation cardiovascular respiratory anaemia diabetes surgery OER."
- Figure 3.2: Anaesthesia for the surgical patient. AI-generated using the prompt: "Three-panel diagram: three anaesthesia type sections (GA, regional, local); fasting rules box and Mallampati score diagram with difficult airway predictors; PONV risk and prophylaxis box and malignant hyperthermia features and treatment box." Suggested OER search string: "types of anaesthesia spinal epidural Mallampati airway assessment anaesthetic complications OER."
- Figure 3.3: Intraoperative care. AI-generated using the prompt: "Three-panel diagram: patient positioning table with specific risks and theatre safety checklist; standard and advanced intraoperative monitoring boxes; blood loss estimation and cell saver and transfusion reaction boxes." Suggested OER search string: "intraoperative patient positioning monitoring blood transfusion reactions surgical OER."
- Figure 3.4: Postoperative care. AI-generated using the prompt: "Three-panel diagram: AVPU scale and MEWS track-and-trigger section; WHO analgesic ladder three-step diagram with PCA and epidural boxes; postoperative complications timeline table"



(immediate, early, late)." Suggested OER search string: "postoperative care MEWS analgesia ladder postoperative complications timeline OER."

- Figure 3.5: Thromboembolic disease in surgery. AI-generated using the prompt: "Three-panel diagram: Virchow's triad three-circle diagram and VTE risk factor table; mechanical and pharmacological VTE prophylaxis sections; DVT and PE diagnosis and treatment boxes." Suggested OER search string: "Virchow's triad VTE prophylaxis DVT pulmonary embolism surgery diagnosis treatment OER."
- Figure 3.6: Enhanced recovery after surgery. AI-generated using the prompt: "Three-panel diagram: ERAS definition box and surgical stress response attenuation diagram; three-column ERAS components table (preoperative, intraoperative, postoperative); ERAS challenges in Nigeria box and immediately adoptable ERAS elements box." Suggested OER search string: "enhanced recovery after surgery ERAS protocol components implementation Nigeria OER."



Series 4: Surgery in Infectious Contexts

1. Part 4.1: Principles of Infection Control in Surgery

1. Sub Part 4.1.1: The chain of infection and asepsis
2. Sub Part 4.1.2: Sterilisation and disinfection
3. Sub Part 4.1.3: Theatre hygiene and environmental control

2. Part 4.2: Specific Surgical Infections

1. Sub Part 4.2.1: Intra-abdominal sepsis
2. Sub Part 4.2.2: Soft tissue infections of surgical importance
3. Sub Part 4.2.3: Bone and joint infections

3. Part 4.3: HIV/AIDS and the Surgeon

1. Sub Part 4.3.1: HIV transmission risk in the operating theatre
2. Sub Part 4.3.2: Surgical management of the HIV-positive patient
3. Sub Part 4.3.3: Ethical and legal considerations

4. Part 4.4: COVID-19 and Surgical Practice

1. Sub Part 4.4.1: Impact of COVID-19 on surgical decision-making
2. Sub Part 4.4.2: Enhanced IPC measures in the COVID-19 era
3. Sub Part 4.4.3: Triage and prioritisation of surgical patients

5. Part 4.5: Tropical Surgical Infections

1. Sub Part 4.5.1: Typhoid ileal perforation
2. Sub Part 4.5.2: Amoebiasis and amoebic liver abscess
3. Sub Part 4.5.3: Surgical complications of tuberculosis

6. Part 4.6: Antimicrobial Resistance in Surgical Practice

1. Sub Part 4.6.1: Mechanisms of antimicrobial resistance
2. Sub Part 4.6.2: MRSA and resistant Gram-negative organisms
3. Sub Part 4.6.3: Antibiotic stewardship in the surgical ward



Introduction

Surgery and infection are inseparable. Every surgical procedure creates a portal of entry for microorganisms, and surgical patients are inherently vulnerable to infection from their underlying disease, malnutrition, and immunosuppression. In Nigeria, tropical infectious diseases such as typhoid ileal perforation and amoebic liver abscess present unique surgical challenges, while HIV/AIDS and COVID-19 add complex dimensions to the management of both the patient and the operating team.

This Series examines surgery in infectious contexts. We begin with infection control principles and sterilisation. We then cover the major specific surgical infections, followed by HIV/AIDS and COVID-19 in surgical practice. Moving on, we address the tropical surgical infections most relevant to Nigerian practice. We close with antimicrobial resistance and antibiotic stewardship.

Series Learning Outcomes

Upon completing this Series, you should be able to:

- **SLO 4.1:** describe the chain of infection, principles of asepsis, sterilisation, and theatre hygiene,
- **SLO 4.2:** describe the clinical features and surgical management of intra-abdominal sepsis, soft tissue infections, and bone and joint infections,
- **SLO 4.3:** describe the surgical risks of HIV/AIDS, the management of the HIV-positive surgical patient, and the ethical considerations involved,
- **SLO 4.4:** describe the impact of COVID-19 on surgical decision-making and outline enhanced IPC measures in the operating theatre,
- **SLO 4.5:** describe the clinical features and surgical management of typhoid ileal perforation, amoebic liver abscess, and surgical tuberculosis, and
- **SLO 4.6:** describe the mechanisms of antimicrobial resistance and the principles of antibiotic stewardship in surgical practice.

4.1 Principles of Infection Control in Surgery

4.1.1 The chain of infection and asepsis

The chain of infection describes the sequence required for infection to occur: a causative agent (pathogen), a reservoir (source), a portal of exit, a mode of transmission, a portal of entry, and a



susceptible host. Breaking any link in this chain prevents infection. In surgery, the most important links to break are the mode of transmission (hand hygiene, PPE) and the portal of entry (sterile technique at the operative site).

Asepsis is the absence of pathogenic microorganisms and is the fundamental goal of sterile surgical technique. The aseptic technique includes: surgical scrubbing of hands and forearms for a minimum of 3 to 5 minutes with antiseptic solution (chlorhexidine or povidone-iodine), donning sterile gown and gloves, draping the patient with sterile drapes to create a sterile field, and handling only sterile instruments within the sterile field.

Fill in the blank: The chain of infection requires a causative agent, a reservoir, a portal of exit, a mode of _____, a portal of entry, and a susceptible _____. The surgical hand scrub is performed for a minimum of _____ to 5 minutes.

4.1.2 Sterilisation and disinfection

Sterilisation is the complete destruction or removal of all microorganisms including bacterial spores. Methods include autoclaving (steam under pressure at 121 degrees C for 15 minutes or 134 degrees C for 3 minutes: the most reliable and widely used method), ethylene oxide gas (for heat-sensitive instruments), dry heat (160 degrees C for 2 hours: for powders and oils), gamma irradiation (for single-use disposable items), and hydrogen peroxide plasma.

Disinfection reduces the number of microorganisms but does not necessarily destroy spores. High-level disinfection (glutaraldehyde, hydrogen peroxide) is used for semi-critical items such as endoscopes. Low-level disinfection (70 percent alcohol, hypochlorite) is used for environmental surfaces. The Spaulding classification categorises items by infection risk: critical items (enter sterile tissue: must be sterilised), semi-critical (contact mucous membranes: high-level disinfection), and non-critical (contact intact skin: low-level disinfection).

Fill in the blank: Autoclaving at 134 degrees C for _____ minutes is the most reliable sterilisation method for surgical instruments. The Spaulding classification requires that critical items (those entering sterile tissue) must be _____.

4.1.3 Theatre hygiene and environmental control

The operating theatre is a controlled environment designed to minimise microbial contamination. Ventilation uses positive-pressure laminar airflow to direct filtered air downward over the operative field, preventing airborne contamination. Traffic is strictly controlled: the theatre is divided into restricted (scrubbed team and sterile instruments only), semi-restricted (theatre staff in scrubs), and unrestricted zones. Theatre discipline includes limiting the number of personnel, minimising door openings during surgery, and restricting conversation.

Theatre cleaning follows a standardised protocol: spot cleaning between cases (blood and fluid spills cleaned with hypochlorite solution), terminal cleaning at the end of each operating list (thorough cleaning of all surfaces, floors, and equipment), and weekly deep cleaning. Surgical



instruments are decontaminated by cleaning (removal of gross contamination), disinfection, and sterilisation in the central sterile services department (CSSD) before return to the theatre.

Fill in the blank: The operating theatre uses _____ pressure laminar airflow to prevent airborne contamination of the operative field. _____ cleaning at the end of each operating list involves thorough cleaning of all surfaces, floors, and equipment.

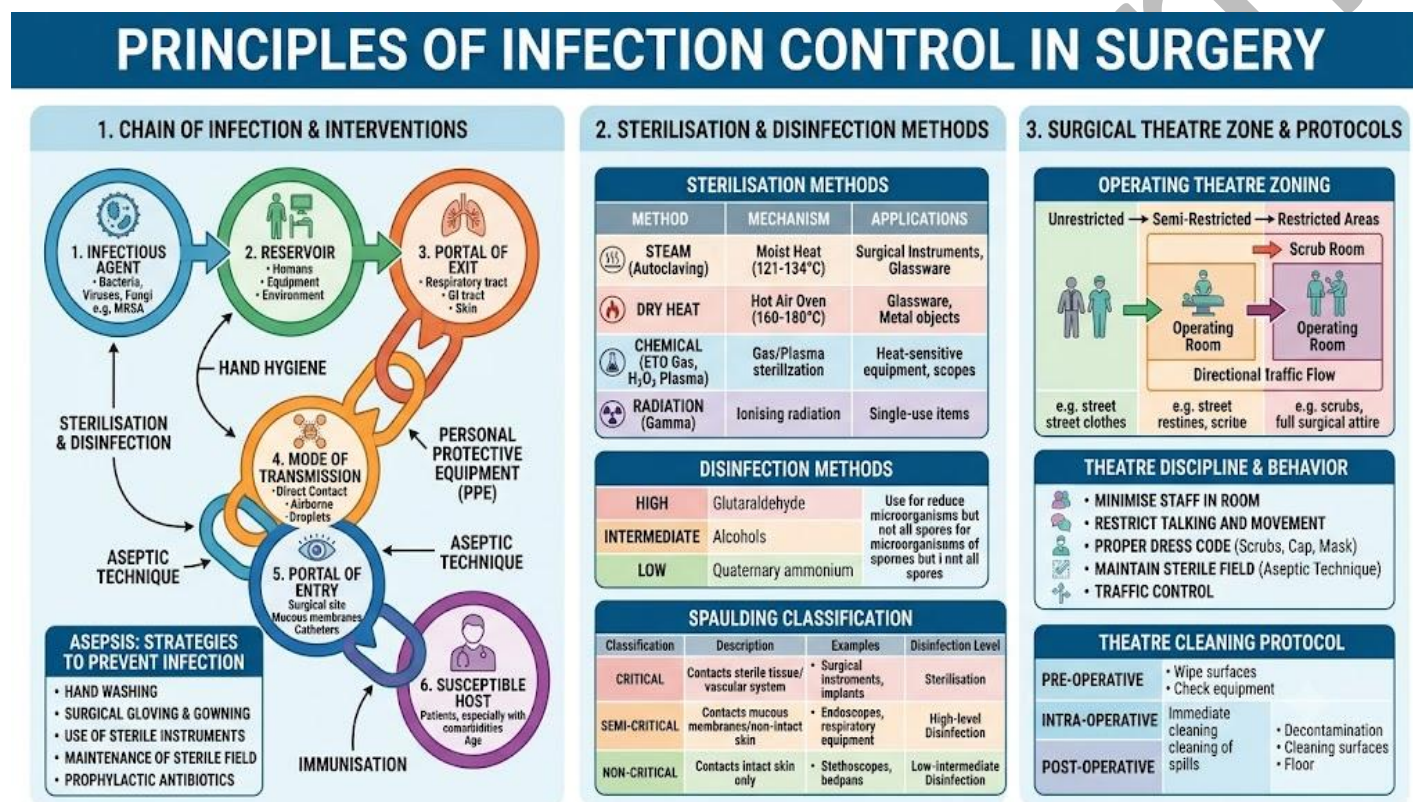


Figure 4.1: Chain of infection, asepsis, sterilisation and disinfection, and theatre hygiene

Pilot questions 4.1

- Describe the chain of infection and state how each link can be broken in surgical practice. (Linked to SLO 4.1)
- Describe the aseptic surgical technique. (Linked to SLO 4.1)
- Compare sterilisation with disinfection and describe three methods of sterilisation. (Linked to SLO 4.1)
- Describe the Spaulding classification and give an example of each category. (Linked to SLO 4.1)
- Describe the theatre cleaning protocol and the zone structure of the operating theatre. (Linked to SLO 4.1)



4.2 Specific Surgical Infections

4.2.1 Intra-abdominal sepsis

Intra-abdominal sepsis encompasses peritonitis (generalised or localised infection of the peritoneal cavity) and intra-abdominal abscess. Primary peritonitis (spontaneous bacterial peritonitis: in patients with ascites from cirrhosis) is treated with antibiotics alone. Secondary peritonitis (from a perforated hollow viscus, anastomotic leak, or penetrating trauma) requires surgical source control. Tertiary peritonitis (persistent peritoneal infection despite adequate surgery: often resistant organisms) is managed with prolonged antibiotics and nutritional support.

Management of secondary peritonitis: resuscitate (IV fluids, IV antibiotics covering aerobes and anaerobes: piperacillin-tazobactam or meropenem plus metronidazole), perform emergency laparotomy for source control (close the perforation, resect necrotic bowel, drain and lavage the peritoneal cavity), leave the abdomen open (damage control laparotomy) in severely contaminated or unstable cases, and provide postoperative ICU-level care. Intra-abdominal abscess (post-operative or secondary to bowel perforation) is managed by CT-guided percutaneous drainage where accessible, with IV antibiotics.

Fill in the blank: _____ peritonitis (from a perforated viscus) requires surgical source control. Intra-abdominal abscess is ideally managed by CT-guided _____ drainage with IV antibiotics.

4.2.2 Soft tissue infections of surgical importance

Fournier's gangrene is a rapidly progressive polymicrobial necrotising fasciitis of the perineum and genitalia, involving the scrotum, penis, perineum, and perianal region. It is most common in diabetic, immunocompromised, and obese males. Clinical features: severe perineal pain, swelling, erythema progressing to skin necrosis, crepitus, and systemic sepsis. Management is identical to necrotising fasciitis elsewhere: urgent surgical debridement, broad-spectrum IV antibiotics, and ICU care. Skin loss after debridement is managed with vacuum-assisted closure (VAC) and subsequent split-skin grafting.

Hidradenitis suppurativa is a chronic, recurrent, inflammatory disease of the skin in areas bearing apocrine glands (axillae, groin, perineum, and inframammary region), presenting with painful nodules, abscesses, and sinus tracts. Acute episodes are treated with incision and drainage and antibiotics. Definitive surgical management requires wide excision of all affected skin and subcutaneous tissue, with healing by secondary intention or skin grafting. Pilonidal sinus is a sinus tract in the natal cleft, typically infected with hair and skin bacteria; acute pilonidal abscess is treated by incision and drainage, followed by elective excision of the sinus once the infection has resolved.



Fill in the blank: Fournier's gangrene is a necrotising fasciitis of the _____ and genitalia, requiring urgent surgical _____. Pilonidal sinus is found in the _____ cleft and is treated by incision and drainage in the acute phase.

4.2.3 Bone and joint infections

Acute haematogenous osteomyelitis is a bacterial infection of bone spread via the bloodstream, most common in children (metaphysis of long bones: distal femur and proximal tibia). The causative organism is most commonly *Staphylococcus aureus*. It presents with fever, bone pain, localised tenderness, and swelling over the affected bone. Investigations: raised WBC and CRP and ESR, blood cultures (positive in approximately 50 percent), X-ray (normal in the first 10 to 14 days; periosteal reaction later), MRI (most sensitive early investigation). Treatment: IV antibiotics (flucloxacillin or cloxacillin) started promptly; surgical drainage if a subperiosteal or soft tissue abscess has formed.

Septic arthritis is a bacterial infection within a joint space, constituting an orthopaedic emergency because articular cartilage is destroyed within hours by bacterial enzymes and inflammatory mediators. It presents with a hot, red, swollen, exquisitely tender joint with greatly restricted and painful movement. The most common organism is *Staphylococcus aureus*. Management: immediate joint aspiration and culture, IV antibiotics, and urgent surgical washout (arthroscopic or open) of the joint. Any suspected septic arthritis must be treated as an emergency.

Fill in the blank: Acute haematogenous osteomyelitis most commonly affects the _____ of long bones in children and is most often caused by _____. Septic arthritis is an orthopaedic _____ because articular cartilage is destroyed within hours.



'SPECIFIC SURGICAL INFECTIONS'

1. PERITONITIS: CLASSIFICATION & MANAGEMENT

PERITONITIS CLASSIFICATION TABLE		
CLASSIFICATION	ETIOLOGY	COMMON ORGANISMS
PRIMARY	Spontaneous Bacterial Peritonitis (SBP)	<i>E. coli</i> , <i>Pneumococcus</i>
SECONDARY	Perforation, Anastomotic Leak, Traumatic	<i>E. coli</i> , <i>Bacteroides</i>
TERTIARY	Persistent or recurrent infection	<i>Enterococcus</i> , <i>Candida</i> , <i>Pseudomonas</i>

SECONDARY PERITONITIS MANAGEMENT

Treatment:

- Source Control (e.g. Surgery, Laparoscopy)
- Resuscitation (IV Fluids)
- Antibiotics (Broad-spectrum)
- Monitoring

ABSCESS DRAINAGE TECHNIQUES

Percutaneous (CT/US guided) or Surgical methods

2. SOFT TISSUE & SKIN INFECTIONS

FOURNIER'S GANGRENE

Rapidly progressive necrotising fasciitis of the genital/perineal area.

Treatment:

- Aggressive surgical debridement
- IV antibiotics

HIDRADENITIS SUPPURATIVA

Chronic inflammatory condition of apocrine glands.

Treatment:

- Medical (Antibiotics, biologics)
- Surgical (Excision, drainage)

PILONIDAL SINUS DISEASE

Infection in the sacrococcygeal region.

Treatment:

- Drainage of abscess
- Surgical excision for chronic cases

3. BONE & JOINT INFECTIONS

ACUTE HAEMATOGENOUS OSTEOMYELITIS

Infection of the bone via blood. Common in children.

Diagnosis:

- MRI, Blood cultures

Treatment:

- IV antibiotics, possible surgical drainage

SEPTIC ARTHRITIS

**!! MEDICAL EMERGENCY !!
SURGICAL EMERGENCY !!**

Purulent joint infection.

Management:

- URGENT joint aspiration for culture and sensitivity
- INTRAVENOUS ANTIBIOTICS
- Surgical drainage and washout

Figure 4.2: Intra-abdominal sepsis, soft tissue infections, and bone and joint infections

Pilot questions 4.2

- Distinguish primary from secondary peritonitis and state the management of each. (Linked to SLO 4.2)
- Describe the clinical features and management of Fournier's gangrene. (Linked to SLO 4.2)
- Describe the clinical features and investigations of acute haematogenous osteomyelitis. (Linked to SLO 4.2)
- Describe the management of septic arthritis and explain why it is an orthopaedic emergency. (Linked to SLO 4.2)
- Describe the management of an intra-abdominal abscess. (Linked to SLO 4.2)



4.3 HIV/AIDS and the Surgeon

4.3.1 HIV transmission risk in the operating theatre

The risk of HIV transmission to a surgeon from a single hollow-bore needlestick injury from an HIV-positive source is approximately 0.3 percent. Risk is increased by deep injuries, hollow-bore needles, visible blood on the device, and a high source patient viral load. Surgeons performing open procedures with prolonged hand-in-cavity exposure are at highest risk. Universal precautions (double-gloving, eye protection, impermeable gown, neutral zone for sharps, blunt suture needles) must be applied to every patient regardless of known HIV status.

Post-exposure prophylaxis (PEP) must be started within 72 hours of a needlestick injury, ideally within 2 hours. The Nigerian recommended regimen is TLD (tenofovir 300 mg plus lamivudine 300 mg plus dolutegravir 50 mg) once daily for 28 days. Following the injury: wash the wound with soap and water for 2 minutes, allow it to bleed freely, report to the occupational health officer, determine the source patient's HIV status, and start PEP immediately. Follow-up HIV testing is performed at 6 weeks, 12 weeks, and 6 months.

Fill in the blank: The risk of HIV transmission from a single needlestick injury is approximately _____ percent. PEP must be started within _____ hours of exposure to be effective.

4.3.2 Surgical management of the HIV-positive patient

HIV-positive patients may require surgery for HIV-related complications (opportunistic infections, Kaposi's sarcoma, lymphoma) or for unrelated surgical conditions. Their surgical risk is influenced by the CD4 count (a CD4 count above 200 cells per microlitre is associated with acceptable perioperative outcomes; below 200 increases the risk of infections and poor wound healing). They should be on antiretroviral therapy (ART) and have their viral load suppressed before elective surgery where possible.

Perioperative considerations: continue ART throughout the perioperative period (do not interrupt therapy), anticipate impaired wound healing and increased SSI risk, consider prophylactic antibiotics for a broader range of procedures, and plan for a longer postoperative recovery. Nutritional support is particularly important. A surgeon who is HIV-positive and on ART with an undetectable viral load may continue to operate with additional precautions, provided they comply with occupational health guidelines.

Fill in the blank: A CD4 count below _____ cells per microlitre increases the risk of perioperative infections and poor wound healing in HIV-positive patients. ART should _____ be interrupted during the perioperative period.

4.3.3 Ethical and legal considerations

Every patient has the right to refuse an HIV test, and a surgeon cannot refuse to operate on an HIV-positive patient solely on the basis of their HIV status. Such refusal constitutes discrimination and is a violation of the patient's rights. The duty of care extends equally to all



patients. HIV status is confidential medical information; it must not be disclosed to third parties (including family members) without the patient's informed consent, except where required by law.

Pre-operative HIV testing should be offered (not mandated) to all surgical patients, framed as part of routine preoperative assessment and explained as being in the patient's interest (to enable appropriate perioperative management, not to exclude them from surgery). In Nigerian practice, voluntary confidential testing with pre- and post-test counselling is the standard. Healthcare workers have a reciprocal duty to know their own HIV status and to comply with occupational health guidelines if they are positive.

Fill in the blank: A surgeon _____ refuse to operate on an HIV-positive patient solely on the basis of their HIV status, as this constitutes _____. HIV status is _____ medical information and must not be disclosed without the patient's consent.

HIV/AIDS AND THE SURGEON

A Comprehensive Guide for Surgical Practice.

1. TRANSMISSION RISK & IMMEDIATE MANAGEMENT

HIV TRANSMISSION RISK (Surgical Environment)

Exposure Type	Source Fluid	Estimated Risk/Transmission
Needlestick/Sharp Injury	Blood	~0.3%
Mucous Membrane Splash	Blood	~0.09%
Intact Skin Contact	Blood/Fluid	<0.1%

UNIVERSAL PRECAUTIONS (Surgical Team)

HAND HYGIENE

PERSONAL PROTECTIVE EQUIPMENT (PPE)

SHARPS SAFETY

- Safe handling, disposal
- Neutral zone passing

SHARPS SAFETY

- Safe handling, disposal
- Neutral zone passing

NEEDLESTICK INJURY MANAGEMENT FLOWCHART

EMERGENCY PROTOCOL

```

graph LR
    A[1. WASH WOUND] --> B[2. REPORT INCIDENT]
    B --> C[3. EVALUATE SOURCE]
    C -- "If HIV+ or Unknown" --> D[4. COUNSEL & START PEP  
(within 2 hours)]
    D --> E[5. FOLLOW-UP TESTING  
(6 wks, 3 months, 6 months)]
  
```

2. PREOPERATIVE & PERIOPERATIVE CARE

PREOPERATIVE ASSESSMENT

CD4 COUNT

Immune Function Indicator

- Optimize if CD4 < 200
- Optimize CD4 < 200
- Significance if CD4 < 200

VIRAL LOAD

Infectivity & Progress Indicator

- Undetectable = minimal risk
- Undetectable = minimal risk programmer

PERIOPERATIVE CARE STRATEGIES

- SURGICAL OPTIMIZATION**
 - Nutrition, control comorbidities or nutrition
- MINIMISE PROCEDURE TIME**
- METICULOUS HEMOSTASIS**
- ANTIBIOTIC PROPHYLAXIS**

COMMON HIV-RELATED SURGICAL CONDITIONS

PERIANAL DISEASE

- Abscesses, fistulae

LYMPHADENOPATHY

- Biopsy

SPLENOMEGALY

NEOPLASMS

- Kaposi's sarcoma
- Lymphoma

MUSCULOSKELETAL

- Pyomyositis
- osteomyelitis
- avascular necrosis

3. ETHICS, RIGHTS & DUTIES

PATIENT RIGHTS & CONFIDENTIALITY

PATIENT RIGHTS

- Consent for testing
- Right to care
- Privacy

CONFIDENTIALITY

- Secure records
- Need-to-know disclosure

PREOPERATIVE HIV TESTING OFFER

PROTOCOL & CONSENT

Discuss testing with all surgical patients

Explain benefits (treatment, optimization)

Obtain informed, voluntary consent

DOCUMENT

HEALTHCARE WORKER (HCW) DUTIES

PROFESSIONAL RESPONSIBILITY

- Duty to care without discrimination
- Protect self & others (Universal Precautions)
- Report exposures
- Maintain confidentiality
- If HCW is HIV+:**
 - Manage health
 - Adhere to guidelines for exposure-prone procedures

Figure 4.3: HIV transmission risk, surgical management of the HIV-positive patient, and ethical considerations

Pilot questions 4.3

- State the risk of HIV transmission per needlestick injury and describe three factors that increase it. (Linked to SLO 4.3)



12. Describe the immediate management of a needlestick injury in the operating theatre. (Linked to SLO 4.3)
13. Describe the perioperative management of an HIV-positive patient scheduled for elective surgery. (Linked to SLO 4.3)
14. Explain why a surgeon cannot refuse to operate on an HIV-positive patient. (Linked to SLO 4.3)
15. Describe the principles of preoperative HIV testing in Nigerian surgical practice. (Linked to SLO 4.3)

4.4 COVID-19 and Surgical Practice

4.4.1 Impact of COVID-19 on surgical decision-making

Patients with active COVID-19 infection have significantly higher rates of postoperative mortality (approximately 24 percent in large international studies), pulmonary complications, and thromboembolic events compared with COVID-negative patients undergoing the same procedures. These elevated risks persist for up to 7 weeks after the acute infection. Elective surgery should therefore be deferred for at least 7 weeks after confirmed COVID-19 infection to allow perioperative risk to return to baseline.

Emergency surgery cannot be deferred regardless of COVID-19 status. Risk stratification is critical: low-risk procedures (local anaesthesia, superficial operations) carry minimal additional risk in COVID-positive patients, whereas major abdominal, thoracic, or cardiac surgery in active COVID-19 carries the highest risk. The surgical team must weigh the risk of proceeding against the risk of deferral (progression of the surgical condition) on an individual patient basis, with full informed consent.

Fill in the blank: Postoperative mortality in patients with active COVID-19 is approximately _____ percent. Elective surgery should be deferred for at least _____ weeks after COVID-19 infection.

4.4.2 Enhanced IPC measures in the COVID-19 era

Enhanced infection prevention and control (IPC) measures are required when operating on COVID-19-positive or suspected patients. All theatre personnel must wear FFP2 or FFP3 respirators (N95 equivalent) rather than standard surgical masks for aerosol-generating procedures (AGPs: intubation, extubation, laparoscopic surgery with gas insufflation, and bronchoscopy). Full PPE (impermeable gown, double gloves, and full face shield or visor) is mandatory for the anaesthetic team during airway management.



Additional measures include: performing surgery in a designated COVID-19 theatre with negative-pressure ventilation where available, minimising theatre personnel to essential staff only, using rapid sequence induction (RSI) with video laryngoscopy to reduce intubation attempts and aerosolisation, ensuring strict donning and doffing protocols with a buddy system, and pre-operative SARS-CoV-2 testing for all elective surgical patients. Laparoscopic surgery generates aerosols when the pneumoperitoneum is released and requires a smoke evacuation system.

Fill in the blank: _____ or FFP3 respirators must be worn for aerosol-generating procedures in COVID-19-positive patients. A designated COVID-19 theatre should ideally have _____ pressure ventilation to prevent spread of contaminated air.

4.4.3 Triage and prioritisation of surgical patients

During the COVID-19 pandemic, health systems worldwide developed systems to prioritise surgical patients according to clinical urgency. The Royal College of Surgeons of England priority classification is widely used: Priority 1 (immediate life-saving surgery: within hours), Priority 2 (urgent surgery: within 72 hours), Priority 3 (expedited surgery: within 4 weeks), and Priority 4 (elective surgery: can wait more than 4 weeks). In pandemic conditions, elective Priority 4 procedures are typically suspended to preserve hospital capacity.

In Nigerian practice, surgical triage during the COVID-19 pandemic required balancing pandemic infection control with the risk of harm from deferring surgery for conditions such as cancer, symptomatic herniae, and gallbladder disease. Telephone and video consultations were used to screen patients before attendance. Preoperative COVID-19 testing, where available, allowed stratification of operative risk and allocation to COVID-positive or COVID-negative operative pathways.

Fill in the blank: Priority _____ surgery (immediate life-saving) must proceed within hours regardless of COVID-19 status. Priority 4 (_____ surgery) was typically suspended during pandemic surges to preserve hospital capacity.



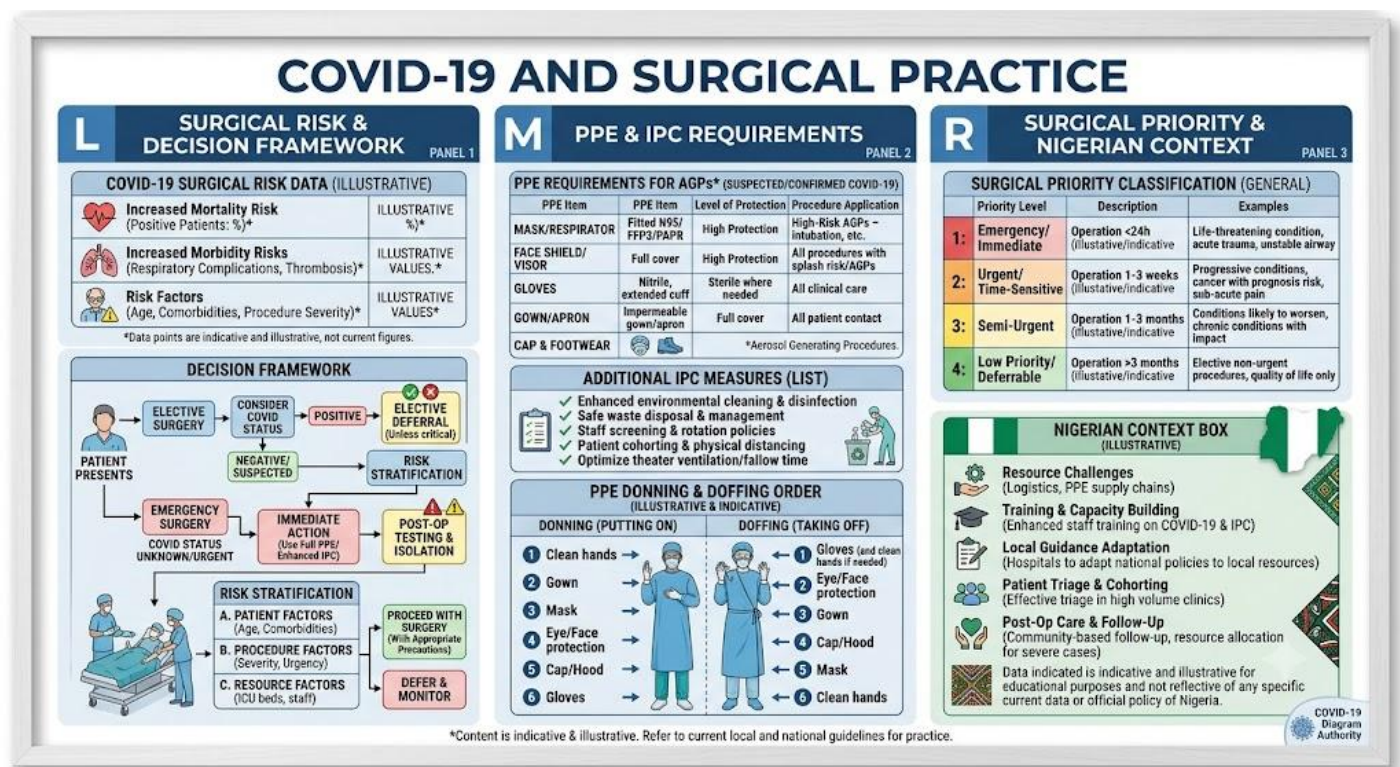


Figure 4.4: Impact of COVID-19 on surgical decision-making, enhanced IPC measures, and surgical triage

Pilot questions 4.4

1. State the postoperative mortality risk in active COVID-19 and explain why elective surgery should be deferred. (Linked to SLO 4.4)
2. Describe the PPE requirements for operating on a COVID-19-positive patient. (Linked to SLO 4.4)
3. Explain why laparoscopic surgery is considered an aerosol-generating procedure in COVID-19-positive patients. (Linked to SLO 4.4)
4. Describe the surgical priority classification system and give an example of each priority level. (Linked to SLO 4.4)
5. Describe the impact of the COVID-19 pandemic on surgical triage in Nigerian practice. (Linked to SLO 4.4)



4.5 Tropical Surgical Infections

4.5.1 Typhoid ileal perforation

Typhoid ileal perforation is caused by *Salmonella typhi* ulcerating through the Peyer's patches of the terminal ileum during enteric fever. It is the most common cause of peritonitis from perforation in many parts of Nigeria and West Africa. The typical patient is a young adult with a 1 to 3 week history of high fever, headache, and diarrhoea (enteric fever phase) who develops sudden severe generalised abdominal pain (the moment of perforation). On examination: diffuse peritonitis (generalised tenderness, guarding, and rigidity), signs of systemic sepsis, and often severe dehydration and malnutrition from the preceding illness.

Investigation: erect CXR (free air under the diaphragm in approximately 50 to 70 percent of cases), plain AXR (dilated bowel from associated ileus). Management: vigorous resuscitation (IV fluids, IV ceftriaxone for *Salmonella* cover plus metronidazole for anaerobic cover), then emergency laparotomy. Surgical options depend on intraoperative findings: simple closure of a single small perforation with omental patch, resection and anastomosis for multiple perforations or a devitalised segment, or resection and stoma in heavily contaminated fields. The peritoneal cavity is lavaged thoroughly with warm saline.

Fill in the blank: Typhoid ileal perforation is caused by _____ ulcerating through the Peyer's patches of the terminal ileum. Free air under the diaphragm is seen on erect CXR in approximately _____ to 70 percent of cases.

4.5.2 Amoebiasis and amoebic liver abscess

Amoebiasis is caused by *Entamoeba histolytica*, transmitted by the faecal-oral route via contaminated food and water. Intestinal amoebiasis causes amoebic colitis (bloody diarrhoea, cramping pain, and tenesmus). Surgical complications include toxic megacolon (requiring emergency colectomy), amoeboma (a tumour-like inflammatory mass of the caecum that may mimic carcinoma), and perforation (rare but life-threatening: requires emergency laparotomy).

Amoebic liver abscess (ALA) is the most common extraintestinal manifestation of amoebiasis and is the most common cause of liver abscess in Nigeria. It presents with fever, right hypochondrial pain and tenderness, and hepatomegaly. Ultrasound shows a hypoechoic lesion (typically in the right lobe). Medical treatment with metronidazole (400 mg three times daily for 5 to 10 days) is effective in the majority of cases. Indications for aspiration or drainage: failure to respond to metronidazole after 72 hours, large abscess (above 5 cm) at risk of rupture, left lobe abscess (risk of pericardial rupture), and diagnostic uncertainty. Ruptured ALA into the peritoneal cavity or pleural space requires emergency surgery.

Fill in the blank: Amoebic liver abscess is most commonly found in the _____ lobe of the liver and is treated first with _____. A left lobe amoebic liver abscess is drained more urgently due to risk of _____ rupture.

4.5.3 Surgical complications of tuberculosis



Tuberculosis (TB) causes a wide range of surgical complications. Abdominal TB presents with non-specific symptoms (weight loss, abdominal pain, diarrhoea, and low-grade fever) and may cause intestinal TB (strictures causing obstruction, or perforations), peritoneal TB (ascites with a doughy abdomen: matted loops of bowel with adhesions), and TB of mesenteric lymph nodes (causing pain and a right iliac fossa mass that may mimic appendicitis or Crohn's disease). Definitive diagnosis requires histology (caseating granuloma with Langhans giant cells) or positive GeneXpert on tissue.

Spinal TB (Pott's disease) is caused by haematogenous spread of *Mycobacterium tuberculosis* to the vertebral bodies, most commonly the thoracic and upper lumbar spine. It presents with back pain, spinal tenderness, kyphosis (gibbus deformity from vertebral collapse), and neurological deficit from cord compression (Pott's paraplegia). MRI is the investigation of choice. Treatment: standard anti-TB chemotherapy (2HRZE/4HR), surgical decompression and spinal stabilisation for neurological deficit or spinal instability. Peripheral lymph node TB (scrofula) presents as a firm, painless cervical or axillary lymph node mass; diagnosis by excision biopsy; treatment with anti-TB drugs.

Fill in the blank: Spinal TB is also called _____ disease and most commonly affects the _____ and upper lumbar vertebrae. Peritoneal TB presents with ascites and a _____ abdomen from matted bowel loops with adhesions.



Tropical Surgical Infections

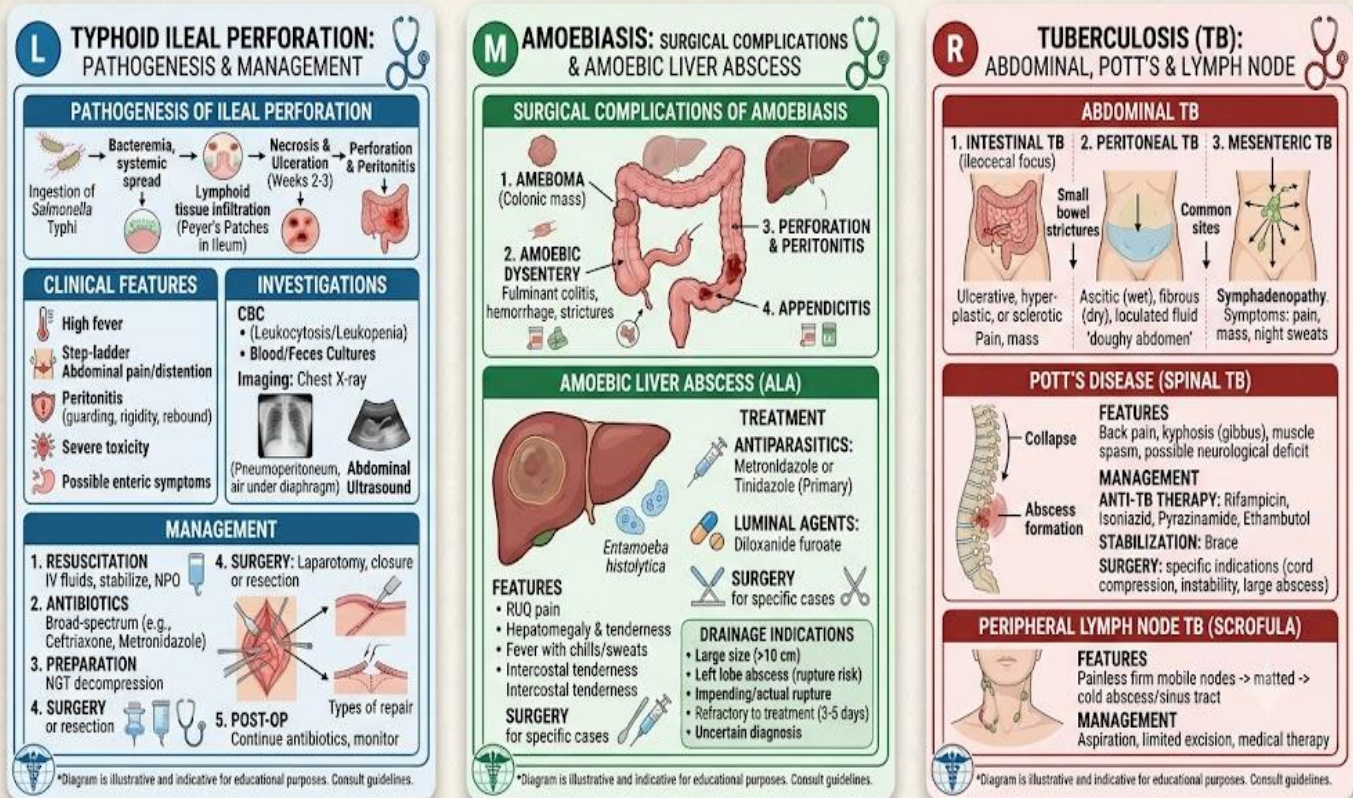


Figure 4.5: Typhoid ileal perforation, amoebiasis and amoebic liver abscess, and surgical tuberculosis

Pilot questions 4.5

6. Describe the clinical presentation and management of typhoid ileal perforation. (Linked to SLO 4.5)
7. Describe the clinical features and treatment of amoebic liver abscess and state the indications for drainage. (Linked to SLO 4.5)
8. Describe the surgical complications of intestinal and peritoneal tuberculosis. (Linked to SLO 4.5)
9. Describe Pott's disease: its clinical features, investigation, and management. (Linked to SLO 4.5)
10. Compare typhoid ileal perforation with perforated peptic ulcer in terms of clinical history and management. (Linked to SLO 4.5)



4.6 Antimicrobial Resistance in Surgical Practice

4.6.1 Mechanisms of antimicrobial resistance

Antimicrobial resistance (AMR) occurs when microorganisms evolve mechanisms to withstand the effects of antibiotics. The main mechanisms are: enzymatic inactivation (bacteria produce enzymes that destroy the antibiotic, for example beta-lactamases that hydrolyse penicillins and cephalosporins; extended-spectrum beta-lactamases or ESBLs inactivate most penicillins and cephalosporins), efflux pumps (bacterial membrane pumps actively expel the antibiotic before it can act), target modification (bacteria alter the antibiotic's target, for example altered penicillin-binding proteins in MRSA), and reduced membrane permeability (bacteria reduce entry of the antibiotic).

Resistance is accelerated by inappropriate antibiotic use: using antibiotics when not indicated, using the wrong antibiotic, using sub-therapeutic doses, and failing to complete courses. In Nigerian hospitals, the high burden of infectious diseases, limited diagnostic capacity, and the availability of antibiotics without prescription are major drivers of AMR. AMR directly affects surgical outcomes by limiting effective treatment options for postoperative infections, SSIs, and sepsis, and by increasing mortality, morbidity, length of stay, and cost.

Fill in the blank: Enzymes that destroy beta-lactam antibiotics (penicillins and cephalosporins) are called _____. Altered penicillin-binding proteins are the resistance mechanism of _____.

4.6.2 MRSA and resistant Gram-negative organisms

Methicillin-resistant Staphylococcus aureus (MRSA) is resistant to all beta-lactam antibiotics due to the *mecA* gene encoding an altered penicillin-binding protein (PBP2a). It is a major cause of SSIs, bloodstream infections, and healthcare-associated infections. Treatment: vancomycin (IV: the standard treatment for serious MRSA infections) or teicoplanin; linezolid for soft tissue MRSA. Prevention: MRSA screening of high-risk patients before elective surgery, contact precautions (patient in a side room, apron and gloves for all contacts), and nasal decolonisation with mupirocin ointment.

Resistant Gram-negative organisms of greatest surgical concern include ESBL-producing Enterobacteriaceae (*Escherichia coli* and *Klebsiella pneumoniae*: resistant to penicillins and cephalosporins; treated with carbapenems), Carbapenem-resistant Enterobacteriaceae (CRE: resistant to carbapenems: treatment options very limited: polymyxins or colistin), and *Pseudomonas aeruginosa* (intrinsically resistant to many antibiotics; treat with piperacillin-tazobactam or meropenem or ceftazidime guided by sensitivity). In Nigerian surgical wards, ESBL-producing organisms are increasingly prevalent in postoperative infections.

Fill in the blank: MRSA is resistant to all _____ antibiotics and is treated with _____ for serious infections. ESBL-producing organisms are resistant to penicillins and cephalosporins and are treated with _____.



4.6.3 Antibiotic stewardship in the surgical ward

Antibiotic stewardship is the coordinated effort to improve antibiotic prescribing in order to optimise patient outcomes while minimising the emergence of resistance. Core stewardship principles in surgical practice: prescribe antibiotics only when there is a clear indication, choose the narrowest effective spectrum agent, use the correct dose and route, limit duration to the minimum effective period, de-escalate from broad-spectrum to targeted therapy once culture results are available, and avoid prolonged surgical prophylaxis.

Practical stewardship interventions in Nigerian surgical wards include: daily review of antibiotic prescriptions on ward rounds (stop antibiotics when there is no longer an indication), mandatory culture before starting antibiotics in confirmed or suspected infection, routine review of culture results and de-escalation, restriction of broad-spectrum agents (carbapenems, vancomycin) to approved indications, and regular feedback of local antibiogram data to clinical teams to guide empirical prescribing. The surgical team must lead by example in antibiotic stewardship.

Fill in the blank: The principle of switching from broad-spectrum empirical antibiotics to a narrower targeted agent on culture results is called _____. Mandatory _____ before starting antibiotics in confirmed infection is a core stewardship intervention.

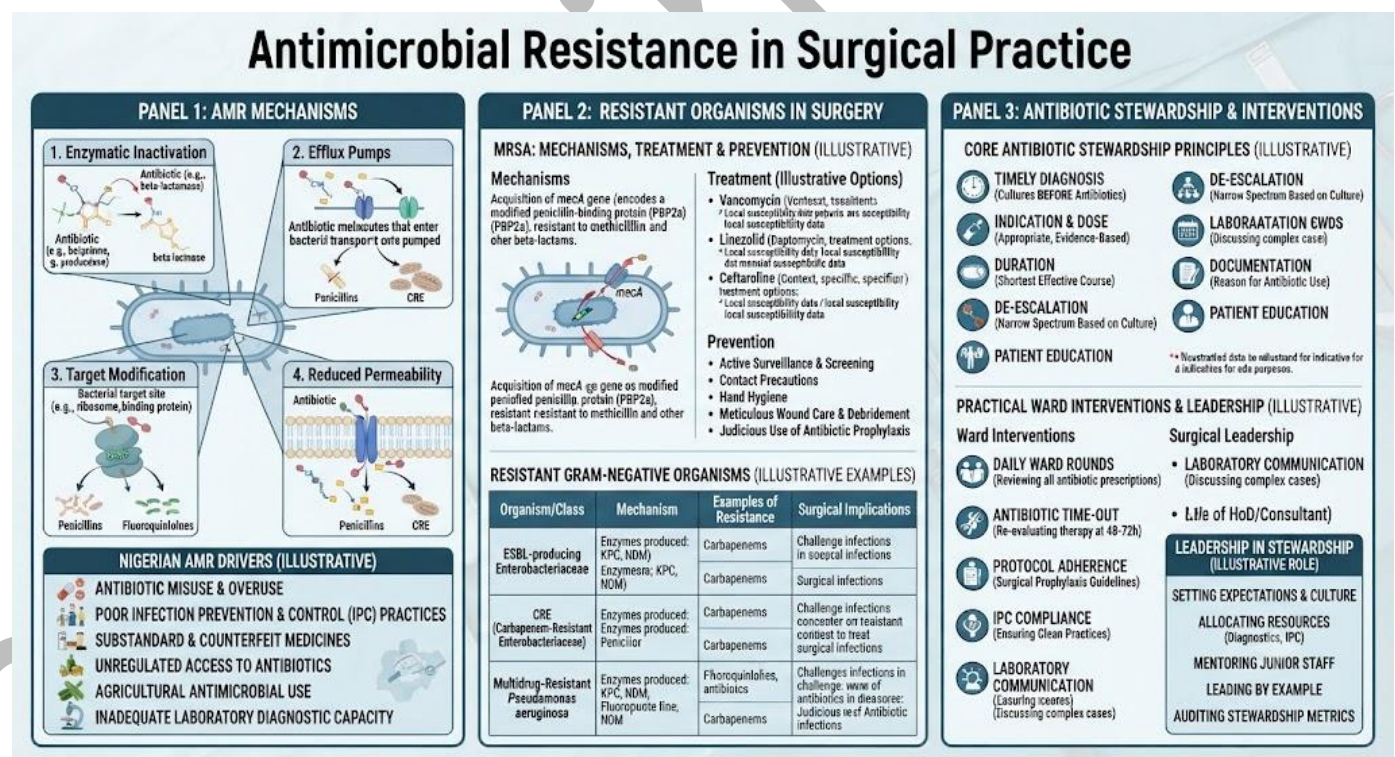


Figure 4.6: Mechanisms of AMR, MRSA and resistant Gram-negative organisms, and antibiotic stewardship

Pilot questions 4.6



11. Describe the four main mechanisms of antimicrobial resistance. (Linked to SLO 4.6)
12. Describe the clinical significance of MRSA in surgical practice and outline its management. (Linked to SLO 4.6)
13. State the treatment for ESBL-producing organisms and carbapenem-resistant Enterobacteriaceae. (Linked to SLO 4.6)
14. Describe the core principles of antibiotic stewardship in surgical practice. (Linked to SLO 4.6)
15. Describe three practical antibiotic stewardship interventions in a Nigerian surgical ward. (Linked to SLO 4.6)



Series Summary

This Series examined surgery in infectious contexts. We covered infection control fundamentals (chain of infection, asepsis, sterilisation, disinfection, and theatre hygiene), specific surgical infections (intra-abdominal sepsis, Fournier's gangrene, hidradenitis suppurativa, osteomyelitis, and septic arthritis), and HIV/AIDS in surgical practice (transmission risk, PEP, perioperative management of HIV-positive patients, and ethics of non-discrimination). We then addressed COVID-19 (perioperative mortality risk, enhanced IPC with FFP2/FFP3 respirators, and surgical priority triage), tropical surgical infections (typhoid ileal perforation, amoebic liver abscess, and surgical TB including Pott's disease), and antimicrobial resistance (resistance mechanisms, MRSA and ESBL organisms, and antibiotic stewardship).

You should now be able to describe infection control principles and sterile technique (SLO 4.1), manage specific surgical infections (SLO 4.2), address HIV/AIDS risks and ethics in surgery (SLO 4.3), apply COVID-19 IPC measures and surgical triage (SLO 4.4), describe the major tropical surgical infections in Nigeria (SLO 4.5), and apply antibiotic stewardship principles in the surgical ward (SLO 4.6).

Glossary of Terms

1. **Amoebic liver abscess:** the most common extraintestinal complication of *Entamoeba histolytica* infection; typically a single right-lobe hypoechoic lesion on ultrasound; treated with metronidazole; drainage is reserved for large abscesses or those failing medical therapy.
2. **Asepsis:** the absence of pathogenic microorganisms; the fundamental goal of sterile surgical technique involving surgical hand scrub, sterile gown and gloves, and sterile draping.
3. **Autoclaving:** sterilisation by steam under pressure at 121 degrees C for 15 minutes or 134 degrees C for 3 minutes; the most reliable and widely used method for heat-stable surgical instruments.
4. **Carbapenem-resistant Enterobacteriaceae (CRE):** Enterobacteriaceae resistant to carbapenems; very limited treatment options (polymyxins or colistin); a major global public health threat.
5. **ESBL (extended-spectrum beta-lactamase):** an enzyme produced by resistant bacteria (typically *E. coli* and *Klebsiella*) that inactivates most penicillins and cephalosporins; infections require carbapenem treatment.
6. **Fournier's gangrene:** polymicrobial necrotising fasciitis of the perineum and genitalia; requires urgent surgical debridement, broad-spectrum IV antibiotics, and ICU care.



7. **MRSA (methicillin-resistant Staphylococcus aureus):** Staphylococcus aureus resistant to all beta-lactam antibiotics via the mecA gene; a major cause of healthcare-associated infections; treated with vancomycin or linezolid.
8. **Pott's disease:** spinal tuberculosis from haematogenous spread to the vertebral bodies; causes back pain, kyphosis (gibbus deformity), and Pott's paraplegia from cord compression; treated with anti-TB chemotherapy and surgical decompression for neurological deficit.
9. **Secondary peritonitis:** peritoneal infection from a perforated hollow viscus, anastomotic leak, or penetrating trauma; requires surgical source control.
10. **Septic arthritis:** bacterial infection within a joint space; an orthopaedic emergency requiring immediate aspiration, IV antibiotics, and urgent surgical joint washout.
11. **Spaulding classification:** categorises medical items by infection risk: critical (enters sterile tissue: must be sterilised), semi-critical (contacts mucous membranes: high-level disinfection), and non-critical (contacts intact skin: low-level disinfection).
12. **Typhoid ileal perforation:** perforation of Salmonella typhi ulcers in the Peyer's patches of the terminal ileum; the most common cause of peritonitis by perforation in Nigeria and West Africa; requires emergency laparotomy after resuscitation.

Concept Check Questions [Series 4]

Objective questions

1. Autoclaving at 134 degrees C for _____ minutes is the most reliable sterilisation method for heat-stable surgical instruments. (Linked to SLO 4.1)
2. Typhoid ileal perforation is caused by _____ ulcerating through the Peyer's patches of the terminal ileum. (Linked to SLO 4.5)
3. MRSA is resistant to all beta-lactam antibiotics and is treated with _____ for serious systemic infections. (Linked to SLO 4.6)
4. HIV post-exposure prophylaxis must be started within _____ hours of a needlestick injury to be effective. (Linked to SLO 4.3)
5. Elective surgery should be deferred for at least _____ weeks after confirmed COVID-19 infection. (Linked to SLO 4.4)



Short-answer questions

1. Describe the Spaulding classification of medical items and give an example of each category. (Linked to SLO 4.1)
2. Describe the management of secondary peritonitis. (Linked to SLO 4.2)
3. Describe the immediate management of a needlestick injury in the operating theatre. (Linked to SLO 4.3)
4. State the indications for drainage of an amoebic liver abscess. (Linked to SLO 4.5)
5. Describe three practical antibiotic stewardship interventions in a surgical ward. (Linked to SLO 4.6)

Long-answer questions

1. Describe the theatre hygiene principles and zone structure of the operating theatre. (Linked to SLO 4.1)
2. Describe the clinical features and management of Fournier's gangrene. (Linked to SLO 4.2)
3. Describe the ethical and legal considerations when managing an HIV-positive surgical patient in Nigeria. (Linked to SLO 4.3)
4. Describe the clinical presentation, investigation, and surgical management of typhoid ileal perforation. (Linked to SLO 4.5)
5. Describe the mechanisms of antimicrobial resistance and the principles of antibiotic stewardship in surgical practice. (Linked to SLO 4.6)

Answers to Concept Check Questions [Series 4]

Objective questions

- 3.
- Salmonella typhi.
- Vancomycin.
- 72.



- 7.

Short-answer questions

- Critical items enter sterile tissue and must be sterilised (example: surgical instruments and implants). Semi-critical items contact mucous membranes and require high-level disinfection (example: endoscopes). Non-critical items contact intact skin only and require low-level disinfection (example: blood pressure cuffs and stethoscopes).
- Resuscitate with IV fluids and start IV antibiotics covering aerobes and anaerobes (piperacillin-tazobactam or meropenem plus metronidazole). Perform emergency laparotomy for surgical source control: close the perforation, resect necrotic bowel, and lavage the peritoneal cavity thoroughly with warm saline. In severely contaminated or unstable cases, damage control laparotomy (pack and close temporarily) is used.
- Wash the wound immediately with soap and running water for 2 minutes and allow it to bleed freely. Report to the occupational health officer. Determine the source patient's HIV, hepatitis B, and hepatitis C status. Start HIV PEP (TLD: tenofovir plus lamivudine plus dolutegravir once daily) within 2 hours, no later than 72 hours, for 28 days. Arrange follow-up HIV testing at 6 weeks, 12 weeks, and 6 months.
- Failure to respond to metronidazole after 72 hours. Large abscess above 5 cm at risk of rupture. Left lobe abscess (risk of rupture into the pericardium). Diagnostic uncertainty (to obtain material for culture and histology to exclude pyogenic abscess or malignancy). Ruptured amoebic liver abscess into the peritoneal or pleural cavity (requires emergency surgical intervention).
- Daily review of antibiotic prescriptions on ward rounds and stopping antibiotics when there is no longer a clear indication. Mandatory blood or wound cultures before starting antibiotics in confirmed or suspected infection, and routine de-escalation from broad-spectrum to narrower targeted therapy once culture results are available. Restriction of carbapenem and vancomycin prescriptions to approved indications with consultant authorisation.

Long-answer questions

- **Basic response:** Theatre zone structure: Restricted zone (scrubbed team and sterile instruments only: entry requires surgical scrub, sterile gown, and gloves), Semi-restricted zone (theatre staff in scrubs and masks: no street clothes), Unrestricted zone (general access with appropriate clothing: reception and changing areas). Theatre discipline: limit personnel numbers, minimise door openings during surgery, and restrict unnecessary



conversation. Ventilation: positive-pressure laminar airflow directs filtered air downward over the operative field to prevent airborne contamination. Theatre cleaning: spot cleaning between cases with hypochlorite solution for blood and fluid spills; terminal cleaning at the end of each operating list (all surfaces, floors, and equipment cleaned thoroughly); weekly deep cleaning. Instruments are processed in the CSSD: gross contamination removed, then disinfection, then autoclaving before return to theatre.

Value-added response: Positive-pressure laminar airflow theatres reduce SSI rates by up to 50 percent in orthopaedic implant surgery (joint replacement and spinal instrumentation) compared with conventional ventilation theatres; their installation and maintenance in Nigerian teaching hospitals should be prioritised for high-risk implant procedures.

- **Basic response:** Fournier's gangrene is a rapidly progressive polymicrobial necrotising fasciitis of the perineum and genitalia, involving the scrotum, penis, perineum, and perianal region. It is most common in diabetic, immunocompromised, and obese males. Clinical features: severe perineal pain, swelling, skin erythema progressing to necrosis, crepitus on palpation (gas in tissues), foul-smelling discharge, and rapid systemic deterioration with high fever, tachycardia, and hypotension. The LRINEC score may assist diagnosis when the presentation is atypical. Management: do not delay for imaging if the diagnosis is clinically clear. Take the patient to theatre immediately for urgent surgical debridement of all necrotic tissue (extensive excision of skin, subcutaneous tissue, and fascia: the wound is left open). Start broad-spectrum IV antibiotics covering aerobes and anaerobes (piperacillin-tazobactam plus metronidazole or meropenem plus metronidazole). Provide ICU-level haemodynamic and nutritional support. Wound management: VAC therapy followed by split-skin grafting once the wound is clean and granulating.

Value-added response: Mortality from Fournier's gangrene remains high (15 to 30 percent) even with optimal management. The single most important determinant of survival is the speed of surgical debridement: any delay is associated with exponentially higher mortality. In Nigerian practice, the combination of late presentation, diabetes, and limited ICU resources contributes to the high case fatality rate.

- **Basic response:** Patient rights: every patient has the right to refuse an HIV test and a surgeon cannot refuse to operate on an HIV-positive patient based on HIV status alone; such refusal constitutes discrimination and violates the patient's fundamental rights; the duty of care is equal for all patients. Confidentiality: HIV status is confidential medical information and must not be disclosed to third parties (including family members) without the patient's informed consent, except where required by law. Pre-operative HIV testing: should be offered (not mandated) to all surgical patients as part of routine preoperative assessment; voluntary confidential testing with pre- and post-test counselling is the standard. If the test is refused, the patient must still receive the same



standard of surgical care with full universal precautions applied. HIV-positive surgeon: a surgeon who is HIV-positive and on ART with an undetectable viral load may continue to operate with additional precautions and regular occupational health monitoring; disclosure to patients is not required.

Value-added response: The ethical duty of non-discrimination is firmly established in Nigerian and international law. Practically, refusing to operate on an HIV-positive patient is also counterproductive from an infection control standpoint: universal precautions are far more effective at preventing transmission than HIV-status-based screening, because many infected patients are in the window period (HIV-negative test but actively infectious) and because the greatest source of unrecognised HIV in the surgical setting is the unknown undiagnosed patient.

- **Basic response:** Clinical presentation: a young adult with 1 to 3 weeks of enteric fever (high fever, headache, diarrhoea) who develops sudden severe generalised abdominal pain at the moment of perforation. Examination reveals diffuse peritonitis (generalised tenderness, guarding, rigidity), systemic sepsis (fever, tachycardia, hypotension), and often severe dehydration and malnutrition. Investigations: erect CXR shows free air under the diaphragm in 50 to 70 percent; plain AXR shows dilated bowel from ileus; blood tests show leucocytosis and raised CRP; blood cultures (Salmonella) and Widal test (rising titres). Surgical management: vigorous IV resuscitation with fluids. Start IV ceftriaxone (Salmonella cover) plus metronidazole (anaerobic cover). Perform emergency laparotomy once the patient is adequately resuscitated. Surgical options: single small perforation: closure with interrupted absorbable sutures and omental patch; multiple perforations or devitalised terminal ileum: resection and primary anastomosis (if minimal contamination) or resection with ileostomy (if heavily contaminated); thorough peritoneal lavage with warm saline. Postoperatively: continue antibiotics, nutritional support, and close monitoring.

Value-added response: Typhoid ileal perforation carries a mortality of 10 to 30 percent in Nigerian practice, largely due to late presentation with advanced peritoneal contamination and severe malnutrition. Pre-operative resuscitation is critical but should not delay surgery for more than 2 to 3 hours, as ongoing peritoneal contamination worsens outcomes exponentially with time.

- **Basic response:** Mechanisms of AMR: enzymatic inactivation (bacteria produce enzymes destroying the antibiotic: beta-lactamases and ESBLs destroying penicillins and cephalosporins), efflux pumps (membrane pumps expelling antibiotics before they act), target modification (MRSA: mecA gene encoding altered PBP2a resistant to beta-lactams), and reduced membrane permeability (bacteria limit antibiotic entry). Antibiotic stewardship principles in surgical practice: prescribe only when there is a clear clinical indication; choose the narrowest effective spectrum; use the correct dose and route; limit duration to the minimum effective period; de-escalate from broad-spectrum to targeted



therapy on culture results; avoid prolonged prophylaxis (stop within 24 hours). Practical ward interventions: daily antibiotic prescription review (stop when no longer indicated), mandatory cultures before starting antibiotics in infection, routine de-escalation on culture results, restriction of broad-spectrum agents (carbapenems and vancomycin) to approved indications, and regular antibiogram feedback to guide empirical prescribing.

Value-added response: AMR is a direct threat to surgical safety: a future in which common surgical infections cannot be treated with available antibiotics would make even routine operations life-threatening. The surgical team occupies a unique position of leadership in antibiotic stewardship within Nigerian hospitals and must champion rational antibiotic use in daily clinical practice.

Answers to Pilot Questions [Series 4]

Part 4.1

- The chain has six links: causative agent (pathogen), reservoir (source of the organism), portal of exit (route the organism leaves the reservoir), mode of transmission (how the organism spreads), portal of entry (route into the new host), and susceptible host (person who can be infected). Breaking any link prevents infection. In surgery: kill the causative agent (sterilisation), eliminate the reservoir (wound irrigation), block the mode of transmission (hand hygiene and PPE), and close the portal of entry (sterile wound closure).
- The surgical scrub: wash hands and forearms for 3 to 5 minutes with antiseptic solution (chlorhexidine gluconate or povidone-iodine). Don a sterile gown (assistant ties the back). Don sterile gloves using the closed glove technique. Drape the patient with sterile drapes to create a sterile operative field. Within the sterile field, handle only sterile instruments and avoid contact with non-sterile surfaces.
- Sterilisation destroys all microorganisms including bacterial spores; disinfection reduces microbial numbers but does not destroy all spores. Three sterilisation methods: autoclaving (steam under pressure: 121 degrees C for 15 minutes or 134 degrees C for 3 minutes: most reliable for heat-stable instruments), ethylene oxide gas (for heat-sensitive instruments such as flexible scopes and plastic components), and dry heat (160 degrees C for 2 hours: for powders and oils).
- Critical items enter sterile tissue and must be sterilised (example: scalpels, sutures, implants). Semi-critical items contact intact mucous membranes and require high-level disinfection (example: endoscopes, laryngoscopes). Non-critical items contact intact skin



only and require low-level disinfection (example: blood pressure cuffs, stethoscopes, operating table surfaces).

- Theatre zone structure: Restricted zone (scrubbed team and sterile instruments only), Semi-restricted zone (theatre staff in scrubs and masks), Unrestricted zone (general access with appropriate dress code). Theatre cleaning: spot cleaning between cases (blood and fluid spills with hypochlorite solution), terminal cleaning at end of each operating list (all surfaces, floors, and equipment), and weekly deep cleaning. Instruments are returned to CSSD for cleaning, disinfection, and re-sterilisation.

Part 4.2

- Primary peritonitis is spontaneous bacterial infection of the peritoneal cavity without a breach of a hollow viscus (typically in cirrhotic patients with ascites); diagnosed by ascitic tap (neutrophil count above 250 per microlitre); treated with IV antibiotics alone (cefotaxime or ceftriaxone). Secondary peritonitis is peritoneal contamination from a perforated hollow viscus, anastomotic leak, or trauma; it requires surgical source control (close the perforation, resect necrotic bowel, lavage the peritoneal cavity) in addition to IV antibiotics and resuscitation.
- Fournier's gangrene is a polymicrobial necrotising fasciitis of the perineum and genitalia. Clinical features: severe perineal pain, skin erythema progressing to necrosis, crepitus, foul-smelling discharge, and rapid systemic sepsis. Management: immediately take to theatre for urgent surgical debridement of all necrotic tissue (extensive, leave wound open), start broad-spectrum IV antibiotics (piperacillin-tazobactam plus metronidazole or meropenem), provide ICU support, apply VAC dressing, and plan for skin grafting once the wound is clean.
- Acute haematogenous osteomyelitis: fever, localised bone pain, tenderness, and swelling over the affected bone (most commonly the metaphysis of the distal femur or proximal tibia in children). Investigations: raised WBC, CRP, and ESR; blood cultures (positive in approximately 50 percent); X-ray (normal in the first 10 to 14 days, then shows periosteal reaction and bone destruction); MRI (most sensitive early investigation, shows marrow oedema and any abscess formation).
- Septic arthritis is an orthopaedic emergency because articular cartilage is destroyed by bacterial enzymes and inflammatory mediators within hours of infection. Immediate management: aspirate the joint immediately for Gram stain and culture. Start IV antibiotics empirically (flucloxacillin or cloxacillin for suspected Staphylococcus). Perform urgent surgical washout of the joint (arthroscopic or open) to remove pus and debris and prevent cartilage destruction. Monitor closely for clinical improvement.



- Intra-abdominal abscess is managed by CT-guided percutaneous drainage where the abscess is accessible (a drain is placed under CT guidance to evacuate the pus) combined with IV antibiotics guided by culture of the drained material. Surgery (laparotomy or laparoscopy) is reserved for abscesses not accessible percutaneously, those failing to resolve with drainage, or those associated with ongoing source of contamination (such as an unrepaired bowel perforation).

Part 4.3

- The risk of HIV transmission per needlestick injury from an HIV-positive source is approximately 0.3 percent. Three factors increasing risk: hollow-bore needle (carries a column of blood injected into the wound), deep injury (larger inoculum delivered into the tissue), and high source patient viral load (more virus per millilitre of blood).
- Immediately wash the wound with soap and running water for 2 minutes and allow it to bleed freely (do not squeeze or suck). Irrigate mucosal splashes with copious water or saline. Report to the occupational health officer. Determine the source patient's HIV and hepatitis B status. Start HIV PEP (TLD once daily) within 2 hours (no later than 72 hours) for 28 days. Arrange follow-up HIV testing at 6 weeks, 12 weeks, and 6 months.
- Preoperative: check CD4 count (above 200 is acceptable risk), ensure the patient is on ART with suppressed viral load, assess nutritional status and optimise if needed. Perioperative: continue ART without interruption, anticipate impaired wound healing and increased SSI risk, consider prophylactic antibiotics for a broader range of procedures. Postoperative: provide nutritional support, plan for a longer recovery, and monitor closely for infection.
- Refusing to operate on an HIV-positive patient solely because of their HIV status constitutes discrimination and violates the patient's fundamental right to healthcare. The duty of care is equal for all patients regardless of HIV status. Refusal may also be illegal under Nigerian law and international human rights frameworks. Universal precautions provide effective protection for the surgical team and should be applied to every patient regardless of HIV status.
- HIV testing should be offered (not mandated) to all surgical patients as part of routine preoperative assessment. It must be framed as being in the patient's interest (to enable optimal perioperative management) rather than as a screening tool to deny surgery. Testing is voluntary and confidential. Pre-test counselling explains the purpose and implications of the test. Post-test counselling is provided for all results. A patient who refuses testing must still receive the same standard of surgical care with full universal precautions applied.



Part 4.4

1. Data from the COVIDSurg collaborative showed 30-day postoperative mortality of approximately 24 percent in patients with active COVID-19, compared with approximately 2 percent in COVID-negative patients undergoing comparable procedures. Elevated risk from pulmonary complications, thromboembolic events, and systemic inflammation persists for up to 7 weeks after the acute infection. Deferring elective surgery for at least 7 weeks allows perioperative risk to return to near-baseline and prevents a preventable death.
2. All theatre personnel must wear FFP2 or FFP3 respirators (N95 equivalent) rather than standard surgical masks. The anaesthetic team managing the airway wears full PPE: FFP3 respirator, impermeable gown, double gloves, and full face shield or visor. Standard theatre staff wear FFP2 respirators, surgical gowns, and gloves. All personnel must follow strict donning and doffing protocols with a buddy system to prevent self-contamination.
3. During laparoscopic surgery, CO₂ is insufflated into the peritoneal cavity to create the pneumoperitoneum. When this gas is released at the end of the procedure (desufflation) or through port sites during the operation, it carries aerosolised blood and body fluid particles into the operating theatre environment. These aerosols may contain viable SARS-CoV-2 virus in a COVID-19-positive patient, creating a transmission risk for theatre personnel. A smoke evacuation system traps the released gas before it enters the theatre air.
4. Priority 1 (immediate life-saving surgery within hours): ruptured abdominal aortic aneurysm and bowel perforation with peritonitis. Priority 2 (urgent surgery within 72 hours): strangulated hernia and acute appendicitis with perforation. Priority 3 (expedited surgery within 4 weeks): cancer resection and symptomatic hernia repair. Priority 4 (elective surgery more than 4 weeks): varicose vein surgery and elective cholecystectomy for asymptomatic gallstones.
5. During pandemic surges, Nigerian hospitals faced the challenge of balancing COVID-19 infection control against patient harm from deferring essential surgery. Telephone and video consultations replaced face-to-face preoperative assessments to screen patients before hospital attendance. Where available, preoperative SARS-CoV-2 testing allowed stratification into COVID-positive and COVID-negative operative pathways. Priority 4 elective procedures were suspended to preserve hospital capacity. Priority 1 to 3 procedures continued with enhanced IPC measures.



Part 4.5

1. Clinical presentation: a young adult with 1 to 3 weeks of enteric fever (high fever, headache, and diarrhoea from *Salmonella typhi* infection) who develops sudden severe generalised abdominal pain (the moment of Peyer's patch perforation in the terminal ileum). Examination: diffuse peritonitis, systemic sepsis, dehydration, and malnutrition. Management: vigorous IV fluid resuscitation; IV ceftriaxone plus metronidazole; emergency laparotomy. Surgical options: single small perforation: close with sutures and omental patch; multiple perforations or devitalised bowel: resection with anastomosis or stoma depending on contamination; thorough peritoneal lavage with warm saline.
2. Clinical features: fever, right hypochondrial pain and tenderness, and hepatomegaly. Ultrasound shows a hypoechoic lesion typically in the right lobe. Treatment: metronidazole 400 mg three times daily for 5 to 10 days is effective in most cases. Indications for drainage: failure to respond to metronidazole after 72 hours, large abscess above 5 cm at risk of rupture, left lobe abscess (risk of pericardial rupture), diagnostic uncertainty, and ruptured abscess (emergency surgery).
3. Intestinal TB causes strictures leading to small bowel obstruction (presenting with colicky abdominal pain, vomiting, and distension) or rarely perforation requiring emergency laparotomy. Peritoneal TB causes ascites and a doughy abdomen with matted bowel loops and adhesions on examination; adhesive obstruction may require surgery. Mesenteric lymph node TB causes a right iliac fossa mass that clinically mimics appendicitis or Crohn's disease; laparotomy or laparoscopy with excision biopsy confirms the diagnosis.
4. Pott's disease (spinal TB) results from haematogenous spread of *Mycobacterium tuberculosis* to the vertebral bodies, most commonly in the thoracic and upper lumbar spine. Clinical features: back pain, localised vertebral tenderness, kyphosis (gibbus deformity from vertebral collapse), and Pott's paraplegia (neurological deficit from spinal cord compression by pus, granulation tissue, or bone fragments). Investigation: MRI is the most sensitive investigation (shows vertebral destruction, disc involvement, and cord compression). Management: standard anti-TB chemotherapy (2HRZE/4HR); surgical decompression and spinal stabilisation are indicated for progressive neurological deficit, spinal instability, or failure to respond to chemotherapy.
5. History: typhoid perforation follows 1 to 3 weeks of documented or suspected enteric fever (fever, headache, diarrhoea) in a young patient in an endemic area, followed by sudden peritonitis; perforated peptic ulcer typically occurs in an older patient with a prior history of dyspepsia or NSAID/steroid use or *Helicobacter pylori* infection, with sudden epigastric pain radiating throughout the abdomen. Management difference: both require emergency laparotomy, but antibiotic cover differs (typhoid: ceftriaxone for *Salmonella*;



peptic ulcer: standard anaerobic and Gram-negative cover), and the surgical repair differs (typhoid: ileal closure or resection; peptic ulcer: omental patch closure of the perforation and peritoneal lavage).

Part 4.6

1. Enzymatic inactivation: bacteria produce enzymes that destroy the antibiotic before it can act (example: beta-lactamases and ESBLs destroying penicillins and cephalosporins). Efflux pumps: bacterial membrane pumps actively expel the antibiotic out of the bacterial cell before it can reach its target. Target modification: bacteria alter the antibiotic's binding site so it can no longer bind effectively (example: *mecA* gene in MRSA encodes an altered penicillin-binding protein, PBP2a, with low affinity for beta-lactams). Reduced membrane permeability: bacteria modify their outer membrane porins to reduce the entry of antibiotics into the cell.
2. MRSA causes serious healthcare-associated infections including SSIs, bloodstream infections, pneumonia, and septic arthritis; it is a significant cause of postoperative morbidity and mortality and is difficult to treat because it is resistant to all beta-lactam antibiotics. Management: treat serious MRSA infections with IV vancomycin (or teicoplanin); use linezolid for soft tissue infections. Prevention: pre-operative screening of high-risk patients (previous MRSA, recent hospitalisation, healthcare workers), contact precautions (isolate in a side room, apron and gloves for all contacts), and nasal decolonisation with mupirocin ointment and chlorhexidine body wash before elective surgery.
3. ESBL-producing organisms (*E. coli* and *Klebsiella pneumoniae*) are resistant to most penicillins and cephalosporins; they are treated with carbapenems (meropenem or imipenem). Carbapenem-resistant Enterobacteriaceae (CRE) are resistant to carbapenems: treatment options are severely limited and include polymyxins (colistin or polymyxin B), ceftazidime-avibactam (where available), and combination therapy guided by sensitivity results. CRE infections are associated with very high mortality and strict contact precautions are essential.
4. Prescribe antibiotics only when there is a clear clinical indication. Choose the narrowest effective spectrum agent for the likely organism. Use the correct dose and route of administration. Limit the duration of antibiotic therapy to the minimum effective period. De-escalate from broad-spectrum empirical therapy to targeted narrow-spectrum therapy once culture and sensitivity results are available. Avoid prolonging surgical prophylaxis beyond 24 hours after the operation.



5. Daily antibiotic prescription review on ward rounds: identify patients on antibiotics, review the indication, and stop antibiotics when they are no longer clinically indicated. Mandatory cultures before starting antibiotics in confirmed or suspected infection: blood cultures, wound swabs, or pus cultures taken before the first antibiotic dose, with routine review and de-escalation once results are available. Restriction of broad-spectrum agents: require consultant authorisation for carbapenems and vancomycin, limiting their use to culture-confirmed resistant organisms or clinically appropriate situations.



References and Attributions [Series 4]

Textual References

1. Bailey, H. and Love, R. J. M. (2018). Bailey and Love's Short Practice of Surgery (27th ed.). Boca Raton: CRC Press.
2. Townsend, C. M., Beauchamp, R. D., Evers, B. M. and Mattox, K. L. (2017). Sabiston Textbook of Surgery (20th ed.). Philadelphia: Elsevier.
3. World Health Organization. (2020). Infection Prevention and Control During Health Care When Novel Coronavirus (nCoV) Infection is Suspected. Geneva: WHO.
4. Federal Ministry of Health Nigeria. (2021). National Guidelines for HIV Prevention, Treatment and Care. Abuja: FMOH.

Figures, Plates, Tables, and Boxes

- Figure 4.1: Infection control principles. AI-generated using the prompt: "Three-panel diagram: chain of infection six-link diagram with intervention arrows and asepsis box; sterilisation methods table and disinfection box and Spaulding classification; theatre zone diagram and cleaning protocol." Suggested OER search string: "surgical infection control chain of infection asepsis sterilisation disinfection theatre hygiene OER."
- Figure 4.2: Specific surgical infections. AI-generated using the prompt: "Three-panel diagram: peritonitis classification and management box; Fournier's gangrene box and hidradenitis box and pilonidal sinus box; osteomyelitis box and septic arthritis emergency box." Suggested OER search string: "intra-abdominal sepsis Fournier's gangrene osteomyelitis septic arthritis surgical infection OER."
- Figure 4.3: HIV and the surgeon. AI-generated using the prompt: "Three-panel diagram: HIV transmission risk table and needlestick injury management flowchart; perioperative HIV-positive patient management boxes; patient rights and confidentiality box and preoperative testing offer box." Suggested OER search string: "HIV AIDS surgeon surgical risk needlestick PEP HIV positive patient management ethics OER."
- Figure 4.4: COVID-19 and surgical practice. AI-generated using the prompt: "Three-panel diagram: COVID-19 surgical risk data and decision framework; PPE requirements table and additional IPC measures and donning-doffing order box; surgical priority classification table and Nigerian context box." Suggested OER search string: "COVID-19 surgical practice IPC measures PPE surgical triage priority classification OER."



- Figure 4.5: Tropical surgical infections. AI-generated using the prompt: "Three-panel diagram: typhoid ileal perforation pathogenesis and clinical features and management box; amoebiasis surgical complications and amoebic liver abscess boxes; abdominal TB and Pott's disease and scrofula boxes." Suggested OER search string: "typhoid ileal perforation amoebic liver abscess tuberculosis surgical complications Nigeria OER."
- Figure 4.6: Antimicrobial resistance and stewardship. AI-generated using the prompt: "Three-panel diagram: four AMR mechanisms diagram and Nigerian AMR drivers box; MRSA box and resistant Gram-negative organisms table; core stewardship principles box and practical ward interventions list." Suggested OER search string: "antimicrobial resistance mechanisms MRSA ESBL antibiotic stewardship surgical ward OER."



Series 5: Principles and Common Surgical Conditions

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2. Sub Part 5.1.2: Surgical principles in cancer treatment
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3. Sub Part 5.6.3: Anorectal conditions



Introduction

This final Series brings together the common surgical conditions encountered in Nigerian clinical practice, applying the foundations laid in previous Series to specific diseases and operative principles. A sound knowledge of these conditions is essential for every clinician, whether or not they intend to specialise in surgery.

We begin with the principles of surgical oncology, then examine herniae and lumps in depth. We revisit the acute abdomen with a focus on appendicitis, biliary emergencies, and bowel obstruction. We then survey upper gastrointestinal surgery and close with colorectal surgery and anorectal conditions.

Series Learning Outcomes

Upon completing this Series, you should be able to:

1. **SLO 5.1:** describe the surgical principles in cancer management, including staging and the multidisciplinary approach,
2. **SLO 5.2:** classify herniae, describe the clinical features of inguinal, femoral, and abdominal wall herniae, and outline their management,
3. **SLO 5.3:** describe the clinical approach to skin lumps, neck lumps, and breast lumps,
4. **SLO 5.4:** describe the clinical features, investigation, and management of acute appendicitis, biliary emergencies, and bowel obstruction,
5. **SLO 5.5:** describe the surgical complications of peptic ulcer disease, the features of gastric carcinoma, and the presentation of oesophageal disease, and
6. **SLO 5.6:** describe the clinical features and management of colorectal carcinoma, diverticular disease, and common anorectal conditions.

5.1 Principles of Surgical Oncology

5.1.1 Biology of cancer relevant to surgery

Cancer arises from uncontrolled cell proliferation due to mutations in proto-oncogenes (which normally promote cell growth: when mutated, become oncogenes), tumour suppressor genes (which normally inhibit growth: TP53 is the most commonly mutated tumour suppressor in



human cancer), and DNA repair genes. Carcinogenesis is a multi-step process (initiation, promotion, and progression) involving accumulation of genetic mutations over time.

Surgically relevant concepts include tumour invasion (growth into surrounding tissues), metastasis (spread to distant sites via lymphatics or blood: the most important determinant of prognosis), angiogenesis (tumour formation of new blood vessels enabling growth beyond 1 to 2 mm), and the concept of surgical margins (the clear tissue boundary around an excised tumour: a clear margin indicates all macroscopic tumour has been removed).

Fill in the blank: The most commonly mutated _____ suppressor gene in human cancer is TP53. Spread of cancer to distant sites via lymphatics or blood is called _____, and it is the most important determinant of prognosis.

5.1.2 Surgical principles in cancer treatment

Surgery remains the cornerstone of curative treatment for most solid tumours. The principles of cancer surgery are: achieve clear margins (the resection must include a cuff of normal tissue around the tumour), avoid tumour spillage (breaching the tumour capsule disseminates cancer cells and worsens prognosis), perform en bloc resection (remove the primary tumour and its regional lymph nodes together as a single specimen), and use a no-touch technique (ligate the venous drainage early to prevent haematogenous dissemination during operative manipulation).

Surgery is also used for staging (diagnostic laparoscopy to assess resectability and peritoneal spread), palliation (bypass of an obstructing tumour, feeding jejunostomy, or defunctioning colostomy to relieve symptoms without curative intent), and surgical emergencies related to cancer (perforation, obstruction, or bleeding). Neoadjuvant therapy (chemotherapy or radiotherapy given before surgery to downstage the tumour) and adjuvant therapy (given after surgery to eradicate micrometastases) are integral parts of the multidisciplinary treatment plan.

Fill in the blank: Removal of the primary tumour and its regional lymph nodes as a single specimen is called _____ resection. Chemotherapy given before surgery to downstage a tumour is called _____ therapy.

5.1.3 Staging and multidisciplinary management

Cancer staging determines the extent of disease and guides treatment decisions. The TNM system is the international standard: T describes the primary tumour size and local invasion (T1 to T4), N describes regional lymph node involvement (N0: no nodes; N1 to N3: increasing nodal involvement), and M describes distant metastasis (M0: absent; M1: present). TNM categories are combined to assign an overall stage (I to IV), with stage IV indicating distant metastasis.

The multidisciplinary team (MDT) meeting, attended by surgeons, oncologists, radiologists, pathologists, and specialist nurses, is the standard of care for cancer management. Treatment decisions are made collectively based on the patient's clinical stage, fitness, and preferences. In Nigerian practice, MDT meetings are increasingly being established in tertiary hospitals, though access to oncological resources (radiotherapy, targeted therapy) remains limited.



Fill in the blank: In the TNM staging system, M1 indicates the presence of distant _____.
The international meeting where surgeons, oncologists, radiologists, and pathologists collectively decide cancer treatment is called the _____ team meeting.

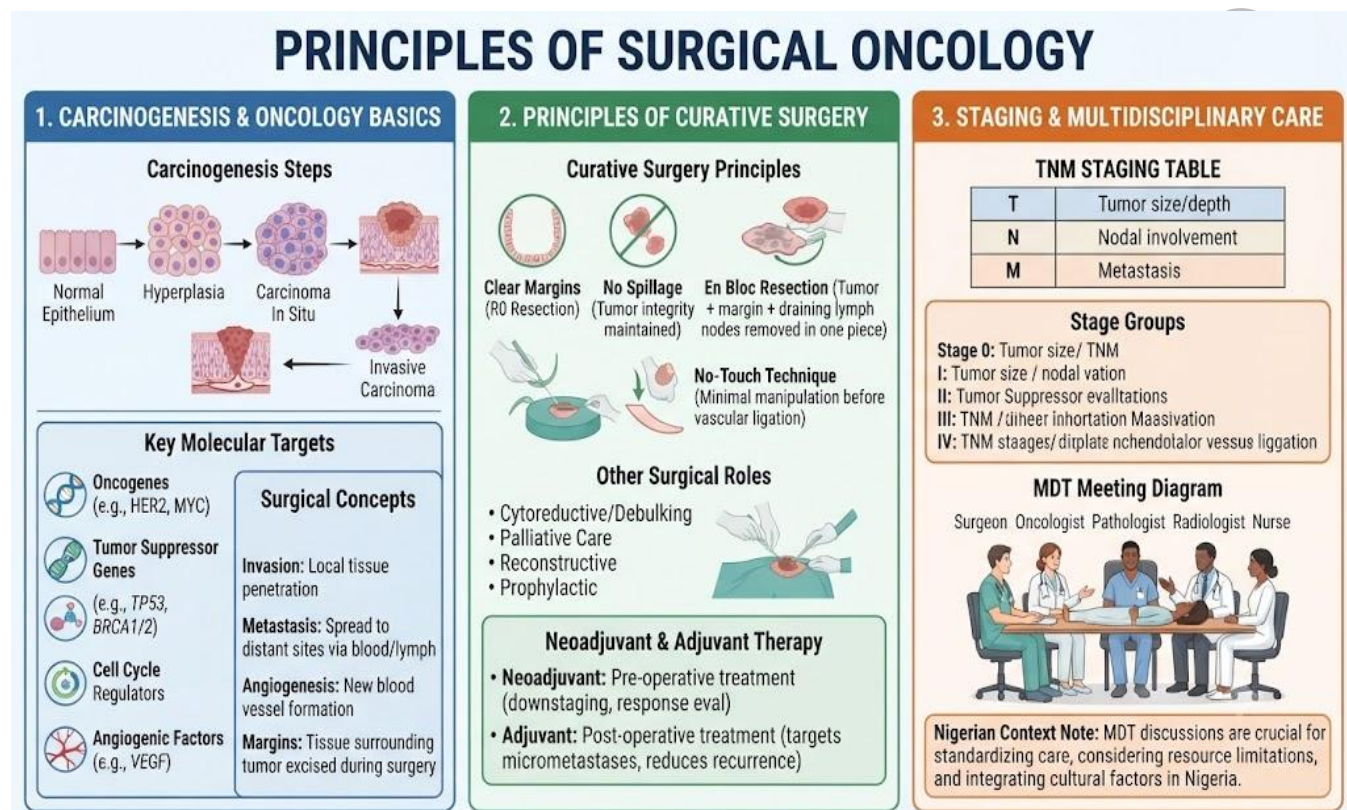


Figure 5.1: Biology of cancer, surgical principles in oncology, and TNM staging and MDT management

Pilot questions 5.1

- State the three types of genes involved in carcinogenesis and give an example of each. (Linked to SLO 5.1)
- Describe the four principles of curative cancer surgery. (Linked to SLO 5.1)
- Distinguish neoadjuvant from adjuvant therapy and state the purpose of each. (Linked to SLO 5.1)
- Describe the TNM staging system and state what stage IV indicates. (Linked to SLO 5.1)
- State the members of a cancer MDT and describe the purpose of the MDT meeting. (Linked to SLO 5.1)



5.2 Herniae

5.2.1 Classification and pathophysiology of herniae

A **hernia** is the protrusion of a viscus or part of a viscus through an abnormal opening in the wall of the cavity in which it normally lies. Every hernia has three components: the sac (a peritoneal pouch), the contents (omentum, bowel, or other viscera), and the coverings (layers of the abdominal wall overlying the sac). Herniae are classified as reducible (contents return to the abdominal cavity spontaneously or with gentle pressure), irreducible or incarcerated (contents cannot be reduced: no blood supply compromise yet), and strangulated (blood supply compromised: a surgical emergency).

Predisposing factors are divided into factors increasing intra-abdominal pressure (chronic cough, constipation, prostatism, ascites, obesity, heavy lifting, and pregnancy) and factors weakening the abdominal wall (congenital defects, previous surgery creating incisional weakness, malnutrition, ageing, and steroid use). Understanding these factors is essential for counselling patients preoperatively and for reducing recurrence after repair.

Fill in the blank: The three components of every hernia are the _____, the contents, and the coverings. A hernia in which the blood supply to the contents is compromised is called a _____ hernia, and is a surgical emergency.

5.2.2 Inguinal and femoral herniae

The inguinal hernia is the most common hernia in surgical practice and occurs predominantly in males. An indirect inguinal hernia passes through the deep inguinal ring, travels along the inguinal canal, and may descend into the scrotum; it follows the path of the descending testis and is the most common type in both sexes. A direct inguinal hernia pushes directly through the posterior wall of the inguinal canal (Hesselbach's triangle: medial to the inferior epigastric vessels); it is associated with abdominal wall weakness and is more common in older males. Both present as a groin swelling above and medial to the pubic tubercle.

A femoral hernia passes through the femoral canal, below and lateral to the pubic tubercle. It is more common in women (particularly multiparous women) and carries a higher risk of strangulation than inguinal herniae because the femoral ring is narrow and rigid. It should be distinguished from an inguinal hernia by the relationship to the pubic tubercle. Repair of all inguinal and femoral herniae is recommended to prevent strangulation; laparoscopic repair (TAPP or TEP) and open mesh repair (Lichtenstein) are the standard techniques.

Fill in the blank: An indirect inguinal hernia passes through the _____ inguinal ring and may descend into the scrotum. A femoral hernia lies _____ and lateral to the pubic tubercle and has a higher strangulation risk than an inguinal hernia.

5.2.3 Other abdominal wall herniae



An umbilical hernia in adults results from weakness at the umbilical ring and is particularly common in obese, multiparous women and in patients with ascites. Small asymptomatic umbilical herniae may be observed; symptomatic herniae are repaired with mesh. A paraumbilical hernia occurs just above or below the umbilicus through the linea alba; it is more common in obese middle-aged women and has a higher risk of strangulation than true umbilical herniae; repair with mesh is advised.

An incisional hernia develops through a previous surgical scar due to inadequate fascial healing (from wound infection, obesity, malnutrition, steroid use, or poor surgical technique). It presents as a diffuse bulge along the scar, enlarging on standing and coughing, and reducible on lying. Large incisional herniae may be difficult to repair because of loss of domain (insufficient abdominal wall muscle to close the defect without tension); mesh repair is used to bridge the defect. Epigastric herniae (through the linea alba between the xiphisternum and umbilicus) and Spigelian herniae (through the Spigelian fascia lateral to the rectus muscle) are less common but should be considered in any patient with a midline or lateral abdominal wall lump.

Fill in the blank: An _____ hernia develops through a previous surgical scar and is associated with wound infection, obesity, and steroid use. A _____ hernia occurs through the linea alba between the xiphisternum and the umbilicus.

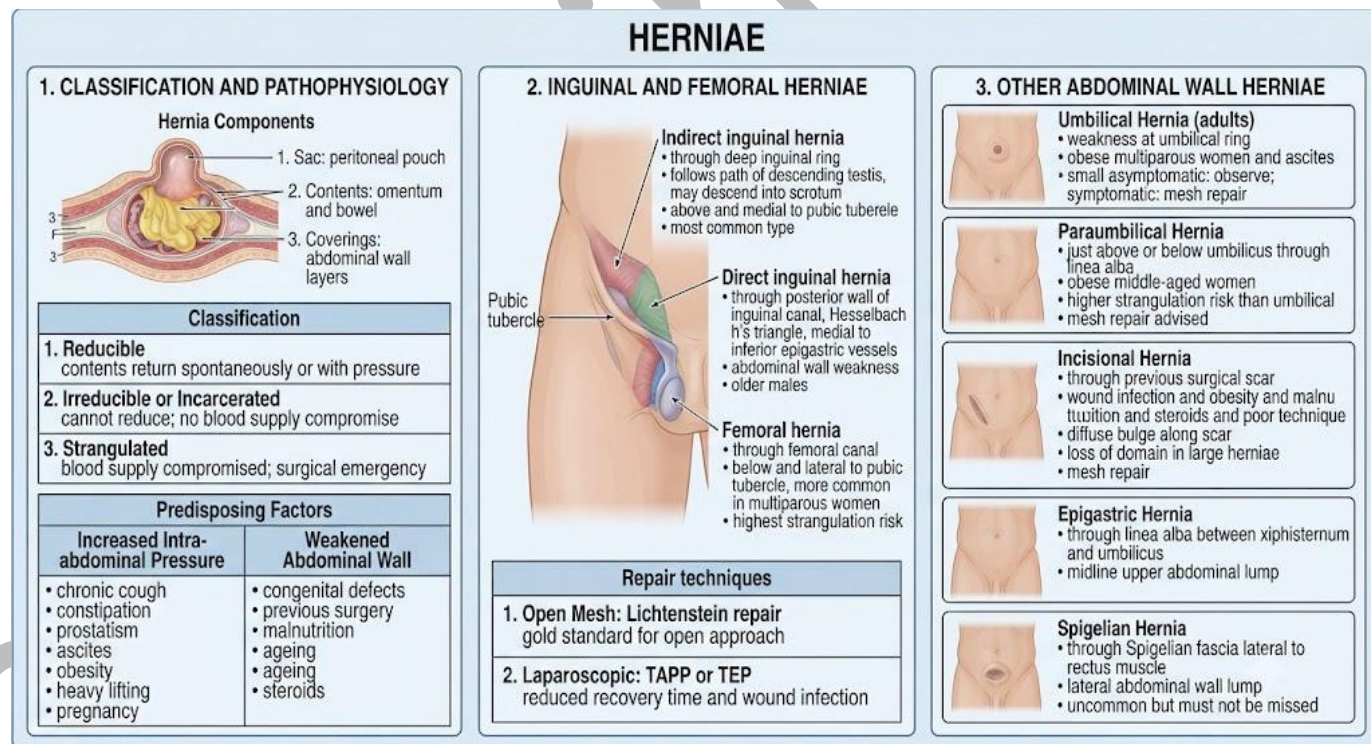


Figure 5.2: Classification of herniae, inguinal and femoral herniae, and other abdominal wall herniae.

Figure 5.2: Classification of herniae, inguinal and femoral herniae, and other abdominal wall herniae

Pilot questions 5.2



11. State the three components of a hernia and describe the difference between an irreducible and a strangulated hernia. (Linked to SLO 5.2)
12. Distinguish an indirect from a direct inguinal hernia in terms of anatomy and patient characteristics. (Linked to SLO 5.2)
13. Describe how to distinguish an inguinal from a femoral hernia clinically. (Linked to SLO 5.2)
14. Describe the risk factors for an incisional hernia. (Linked to SLO 5.2)
15. Describe the clinical features of a strangulated inguinal hernia. (Linked to SLO 5.2)

5.3 Lumps and Swellings

5.3.1 Skin and subcutaneous lumps

A sebaceous cyst (epidermoid cyst) is a benign cyst arising from a blocked sebaceous gland, presenting as a smooth, non-tender, mobile swelling in the dermis, attached to the skin with a visible central punctum. It is found predominantly on the scalp, face, neck, and trunk. Treatment: excision of the intact cyst with its wall to prevent recurrence; incision and drainage in the acute infected phase.

A lipoma is a benign tumour of mature adipose tissue, presenting as a soft, lobulated, non-tender, mobile subcutaneous swelling with a slip sign (the examining finger slips off the edge of the lump due to its smooth capsule). Lipomata are the most common soft tissue tumours. Treatment: observation if asymptomatic; excision for cosmetic reasons or if large or enlarging. A dermoid cyst is a benign cystic lesion containing skin appendages (hair, sebaceous glands); external angular dermoids occur at the lateral end of the eyebrow; they are treated by excision.

Fill in the blank: A sebaceous cyst has a visible central _____ and is attached to the _____. A lipoma demonstrates the slip sign because its _____ capsule allows the examining finger to slide off its edge.

5.3.2 Lumps in the neck

A neck lump requires a systematic approach. The anatomical triangle determines the likely diagnosis: anterior triangle (thyroid swellings: move on swallowing; thyroglossal cysts: move on swallowing and tongue protrusion; branchial cysts: lateral neck at the anterior border of sternocleidomastoid: transilluminable in young adults; lymph nodes: the most common cause of neck lump in all age groups), posterior triangle (lymph nodes, lipomata, subclavian artery aneurysm). A thyroid swelling moves on swallowing because the thyroid is attached to the pretracheal fascia. A thyroglossal cyst moves on both swallowing and tongue protrusion because it is attached to the hyoid bone via the thyroglossal tract.



The most important question in any neck lump is: could this be malignant? Red flags for malignancy include hard consistency, fixity to skin or deep structures, rapid growth, associated dysphagia or hoarseness, cervical lymphadenopathy, and constitutional symptoms (weight loss, night sweats, fever). Any neck lump in a patient over 40 years that has been present for more than 3 weeks must be investigated urgently to exclude malignancy. FNAC is the first-line investigation for most neck lumps; excision biopsy is reserved for lymphoma (where architecture is needed for diagnosis).

Fill in the blank: A thyroglossal cyst moves on both swallowing and _____ protrusion because it is attached to the hyoid bone. Any neck lump in a patient over 40 present for more than _____ weeks requires urgent investigation to exclude malignancy.

5.3.3 Breast lumps

Breast lumps are evaluated using triple assessment: clinical examination, imaging (ultrasound for women under 35 years; mammography for women over 35 years), and FNAC or core needle biopsy. This triple approach achieves a sensitivity of above 99 percent for breast cancer when all three components agree. Benign causes include fibroadenoma (the most common breast lump in young women under 30: smooth, mobile, firm, rubbery: the breast mouse), breast cyst (fluctuant, often tender: confirmed by ultrasound: treated by aspiration), and fibrocystic change (diffuse nodularity and tenderness related to the menstrual cycle).

Breast carcinoma is the most common cancer in women in Nigeria and presents as a hard, irregular, ill-defined lump that may be fixed to skin (causing skin tethering or peau d'orange from lymphatic involvement) or to the underlying pectoral muscle. Associated features include nipple discharge (blood-stained: suspicious), nipple retraction, and axillary lymphadenopathy. Investigations: triple assessment followed by staging CT of the chest, abdomen, and pelvis. Surgical treatment: wide local excision (breast-conserving surgery) with sentinel lymph node biopsy, or mastectomy with axillary lymph node dissection for larger tumours.

Fill in the blank: The three components of breast triple assessment are clinical examination, _____, and FNAC or core biopsy. The most common breast lump in young women under 30 is a _____, also known as the breast mouse.



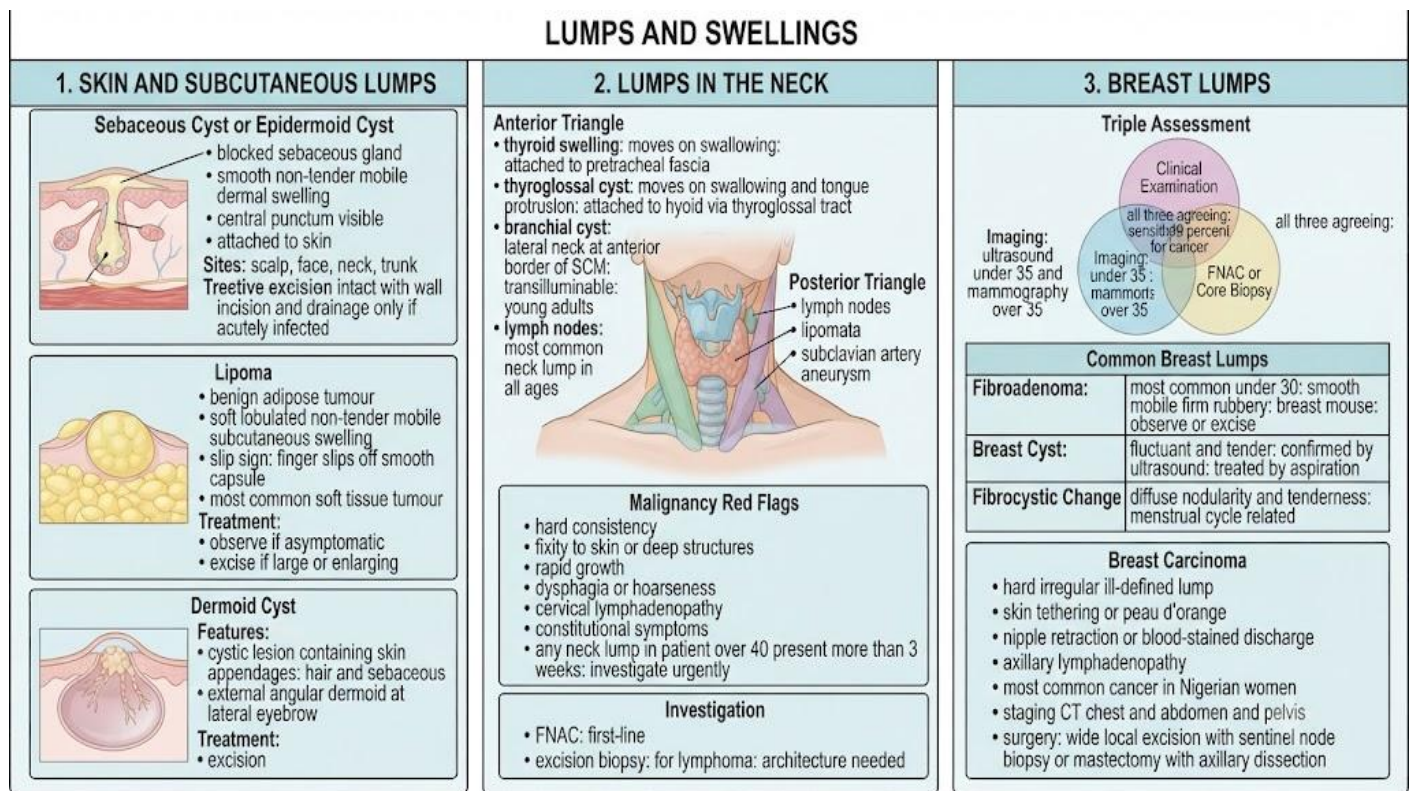


Figure 5.3: Skin and subcutaneous lumps, neck lumps, and breast lumps.

Figure 5.3: Skin and subcutaneous lumps, neck lumps, and breast lumps

Pilot questions 5.3

1. Distinguish a sebaceous cyst from a lipoma in terms of clinical features and treatment. (Linked to SLO 5.3)
2. Explain why a thyroglossal cyst moves on tongue protrusion. (Linked to SLO 5.3)
3. State five red flags for malignancy in a neck lump. (Linked to SLO 5.3)
4. Describe the triple assessment of a breast lump and state its significance. (Linked to SLO 5.3)
5. Describe the clinical features of breast carcinoma. (Linked to SLO 5.3)

5.4 The Acute Abdomen Revisited

5.4.1 Acute appendicitis

Acute appendicitis is the most common surgical emergency in young adults. It begins with obstruction of the appendiceal lumen (by a faecolith, lymphoid hyperplasia, or rarely a tumour),



causing distension, bacterial overgrowth, and inflammation. The classic presentation is central colicky abdominal pain that migrates to the right iliac fossa (McBurney's point) over 4 to 24 hours, accompanied by anorexia, nausea, low-grade fever (above 37.5 degrees C), and localised right iliac fossa guarding. Rovsing's sign may be positive.

Investigations: raised WBC and CRP, urinalysis (to exclude urinary tract infection and renal colic), ultrasound (identifies an inflamed non-compressible appendix above 6 mm in diameter: first-line in children and women), CT abdomen and pelvis (most accurate: reserved for diagnostic uncertainty or suspected perforation). The Alvarado score uses clinical and laboratory findings to estimate the probability of acute appendicitis. Treatment: emergency appendicectomy (laparoscopic or open); IV antibiotics (cefuroxime plus metronidazole). Perforated appendicitis with peritonitis requires peritoneal lavage and prolonged antibiotic therapy.

Fill in the blank: Acute appendicitis classically begins as central colicky pain that migrates to the _____ fossa. An inflamed appendix on ultrasound appears non-compressible and measures more than _____ mm in diameter.

5.4.2 Biliary emergencies

Biliary colic is severe right hypochondrial pain lasting 1 to 6 hours, caused by a gallstone temporarily obstructing the cystic duct. It is triggered by fatty meals and associated with nausea and vomiting. Acute cholecystitis is caused by persistent obstruction of the cystic duct by a gallstone, leading to inflammation of the gallbladder wall. Features: right hypochondrial pain lasting more than 6 hours, fever, leucocytosis, and a positive Murphy's sign. Ultrasound shows gallstones, a thickened gallbladder wall, and pericholecystic fluid. Treatment: IV antibiotics, analgesia, and laparoscopic cholecystectomy (ideally within 72 hours of presentation: early surgery is superior to delayed surgery in reducing complications).

Ascending cholangitis is a bacterial infection of the bile duct, typically caused by a common bile duct stone. It presents with Charcot's triad: fever and rigors, right hypochondrial pain, and jaundice. Reynold's pentad adds hypotension and confusion in severe septic cholangitis. Treatment: IV antibiotics, IV fluids, and urgent endoscopic retrograde cholangiopancreatography (ERCP) with stone extraction and bile duct decompression. Acute pancreatitis (raised serum amylase or lipase above three times normal, with epigastric pain radiating to the back) is managed conservatively: IV fluids, analgesia, nil by mouth, and treatment of the underlying cause (gallstones by cholecystectomy after recovery; alcohol by abstinence).

Fill in the blank: Charcot's triad of ascending cholangitis consists of fever, right hypochondrial pain, and _____. Acute cholecystitis is treated with IV antibiotics and laparoscopic _____, ideally within 72 hours of presentation.

5.4.3 Bowel obstruction and volvulus

Small bowel obstruction (SBO) presents with central colicky abdominal pain, vomiting (early and profuse: bilious or faeculent), central abdominal distension, and high-pitched tinkling bowel sounds. The most common causes in Nigeria are adhesions from previous surgery and



strangulated inguinal hernia. Large bowel obstruction (LBO) presents with peripheral abdominal distension, late or absent vomiting, and absolute constipation; the most common causes are colorectal carcinoma and sigmoid volvulus. Management: nasogastric tube for decompression, IV fluids, urinary catheter; surgery for complete obstruction or strangulation.

Sigmoid volvulus is a particularly common cause of LBO in Nigeria, caused by twisting of the sigmoid colon on its mesenteric pedicle. It presents with rapid onset massive abdominal distension, absolute constipation, and the classic coffee-bean sign on plain AXR. Initial management: rigid sigmoidoscopy or flexible endoscopy for deflation and passage of a flatus tube. Elective sigmoid colectomy is performed during the same admission to prevent recurrence. Emergency sigmoid colectomy (and Hartmann's procedure if the bowel is non-viable) is required for strangulation.

Fill in the blank: The most common cause of small bowel obstruction in Nigeria is _____ from previous surgery. Sigmoid volvulus produces the classic _____ sign on plain AXR and is initially managed by endoscopic _____.

THE ACUTE ABDOMEN REVISITED

1. ACUTE APPENDICITIS

Pathophysiology

- appendiceal lumen obstruction by faecolith or lymphoid hyperplasia
- distension and bacterial overgrowth and inflammation

Clinical Features

- central colicky pain migrating to right iliac fossa
- McBurney's point tenderness and guarding
- anorexia
- low-grade fever above 37.5 degrees C
- positive Rovsing's sign

Investigations

- raised WBC and CRP
- urine dipstick
- ultrasound: non-compressible appendix above 6 mm: first-line in children and women
- CT: most accurate: diagnostic uncertainty or suspected perforation
- Alvarado score

Treatment

- emergency appendectomy: laparoscopic or open
- IV cefuroxime plus metronidazole
- peritoneal lavage for perforated appendicitis

2. BILIARY EMERGENCIES

Biliary Colic	Acute Cholecystitis	Ascending Cholangitis
• gallstone transiently obstructing cystic duct • right hypochondrial pain 1 to 6 hours • triggered by fatty meal • nausea and vomiting • no fever • ultrasound shows gallstones • treatment: analgesia and elective laparoscopic cholecystectomy	• persistent cystic duct obstruction • right hypochondrial pain above 6 hours • fever and leucocytosis • positive Murphy's sign • thickened gallbladder wall and pericholecystic fluid on ultrasound • IV antibiotics and analgesia and laparoscopic cholecystectomy within 72 hours	• common bile duct stone • Charcot's triad: fever and rigors and right hypochondrial pain and jaundice • Reynold's pentad adds hypotension and confusion • IV antibiotics and fluids and urgent ERCP with stone extraction • urgent ERCP extraction

Acute Pancreatitis

- amylase or lipase above three times normal
- epigastric pain to back
- conservative management: IV fluids and analgesia and nil by mouth
- treat underlying cause

3. BOWEL OBSTRUCTION AND VOLVULUS

	SBO	LBO
Pain	central colicky	peripheral colicky
Vomiting	early and profuse bilious or faeculent	late or absent
Distension	central	peripheral and massive
Bowel Sounds	high-pitched tinkling	reduced or absent
Constipation	incomplete initially	absolute
Causes in Nigeria	adhesions and strangulated inguinal hernia	colorectal carcinoma and sigmoid volvulus

Sigmoid Volvulus

- twisting of sigmoid colon on mesenteric pedicle
- rapid onset massive distension and absolute constipation
- coffee-bean sign on plain AXR
- initial management: rigid sigmoidoscopy or flexible endoscopy and flatus tube deflation
- elective sigmoid colectomy same admission
- emergency colectomy and Hartmann's procedure for strangulation

Figure 5.4: Acute appendicitis, biliary emergencies, and bowel obstruction and volvulus.

Figure 5.4: Acute appendicitis, biliary emergencies, and bowel obstruction and volvulus

Pilot questions 5.4

1. Describe the classic clinical presentation of acute appendicitis. (Linked to SLO 5.4)
2. Describe Charcot's triad and state the condition it indicates. (Linked to SLO 5.4)



3. State the treatment of acute cholecystitis and explain why early surgery is preferred. (Linked to SLO 5.4)
4. Compare the clinical features of small bowel and large bowel obstruction. (Linked to SLO 5.4)
5. Describe the initial management of sigmoid volvulus. (Linked to SLO 5.4)

5.5 Upper Gastrointestinal Surgery

5.5.1 Peptic ulcer disease and its complications

Peptic ulcer disease (PUD) results from an imbalance between aggressive factors (gastric acid, pepsin, and *Helicobacter pylori*) and mucosal defence. *H. pylori* infection (a Gram-negative spiral bacterium colonising the gastric antrum) is present in approximately 95 percent of duodenal ulcers and 70 percent of gastric ulcers. Other risk factors include NSAID use, smoking, and alcohol. Medical treatment: *H. pylori* eradication (triple therapy: amoxicillin plus clarithromycin plus a proton pump inhibitor for 7 to 14 days) and proton pump inhibitors (omeprazole, pantoprazole) for acid suppression.

Surgical complications of PUD: perforation (sudden peritonitis from gastric acid leaking into the peritoneal cavity: emergency surgery: Graham patch closure of the perforation and peritoneal lavage), haemorrhage (haematemesis or melaena: resuscitate with IV fluids and blood transfusion: urgent endoscopy for diagnosis and haemostasis: over-sewing of the bleeding vessel at surgery if endoscopy fails), and pyloric stenosis or gastric outlet obstruction (from scarring at the pylorus: persistent vomiting: projectile, non-bilious: treated by endoscopic dilatation or surgical drainage procedure: gastrojejunostomy).

Fill in the blank: *H. pylori* infection is present in approximately _____ percent of duodenal ulcers and is treated with triple therapy including a _____ pump inhibitor. Perforation of a peptic ulcer is managed by Graham _____ closure and peritoneal lavage.

5.5.2 Gastric carcinoma

Gastric carcinoma is a common malignancy in Nigeria with a poor prognosis because most patients present with advanced disease. Risk factors include *H. pylori* infection (the most important modifiable risk factor), chronic atrophic gastritis, dietary factors (smoked, salted, and pickled foods), smoking, and a family history. The majority are adenocarcinomas arising from the mucosa. Early gastric cancer (confined to the mucosa and submucosa) has a 5-year survival above 90 percent; advanced gastric cancer (beyond the submucosa) has a much poorer prognosis.

Clinical features: insidious onset of epigastric pain, anorexia, weight loss, early satiety, and dysphagia (if the cardia or oesophagogastric junction is involved). Signs suggesting advanced or metastatic disease: a palpable epigastric mass (Borrmann type IV linitis plastica: a diffusely



infiltrating tumour causing a rigid leather-bottle stomach), left supraclavicular lymphadenopathy (Virchow's node: Troisier's sign), palpable periumbilical lymphadenopathy (Sister Mary Joseph's nodule from peritoneal metastasis), and ascites. Staging CT, OGD with biopsy, and laparoscopy are used for staging. Curative treatment: radical gastrectomy (subtotal or total) with D2 lymph node dissection.

Fill in the blank: The most important modifiable risk factor for gastric carcinoma is _____ infection. Left supraclavicular lymphadenopathy in gastric carcinoma is called _____ node (Troisier's sign).

5.5.3 Oesophageal disease

Dysphagia (difficulty swallowing) is the cardinal symptom of oesophageal disease. Progressive dysphagia for solids first, then liquids, in an adult over 50 years is a red-flag symptom requiring urgent upper GI endoscopy (OGD) to exclude oesophageal carcinoma. Oesophageal carcinoma is classified as squamous cell carcinoma (most common in the upper and middle thirds: associated with smoking and alcohol) or adenocarcinoma (most common in the lower third and at the oesophagogastric junction: arising from Barrett's oesophagus from chronic gastro-oesophageal reflux). Treatment: curative oesophagectomy for resectable disease; palliative stenting for unresectable disease to restore swallowing.

Gastro-oesophageal reflux disease (GORD) is caused by incompetence of the lower oesophageal sphincter, allowing reflux of acid into the oesophagus. It presents with heartburn, regurgitation, and waterbrash. Complications include oesophagitis, Barrett's oesophagus (replacement of squamous epithelium by columnar epithelium: a pre-malignant condition), and peptic stricture (causing dysphagia). A hiatus hernia (protrusion of the stomach through the oesophageal hiatus into the mediastinum) facilitates GORD. Medical treatment: proton pump inhibitors; surgical treatment: laparoscopic fundoplication (Nissen: 360 degrees wrap) for refractory cases.

Fill in the blank: Progressive dysphagia for solids then liquids in a patient over 50 is a red flag requiring urgent _____ (OGD). Barrett's oesophagus is a pre-malignant condition caused by replacement of squamous epithelium by _____ epithelium from chronic acid reflux.



UPPER GASTROINTESTINAL SURGERY																	
1. PEPTIC ULCER DISEASE	2. GASTRIC CARCINOMA	3. OESOPHAGEAL DISEASE															
Pathophysiology • <i>H. pylori</i> infection: 95% of duodenal ulcers and 70% of gastric ulcers • NSAID use • smoking • alcohol • imbalance of aggressive factors versus mucosal defence	Risk Factors • <i>H. pylori</i>: most important modifiable risk • chronic atrophic gastritis • smoked, salted, pickled foods • smoking • family history • most are adenocarcinomas	Dysphagia Red Flag • progressive solid then liquid dysphagia in adult > 50: urgent OGD to exclude carcinoma															
Medical Treatment • <i>H. pylori</i> eradication: triple therapy: amoxicillin + clarithromycin + PPI for 7-14 days • PPI for acid suppression	Clinical Features • insidious epigastric pain, anorexia, weight loss, early satiety • dysphagia if cardia involved	Oesophageal Carcinoma • squamous cell carcinoma: upper and middle third: smoking and alcohol • adenocarcinoma: lower third and OGJ: Barrett's oesophagus from GORD • treatment: curative oesophagectomy or palliative stenting															
Complications <table border="1"> <thead> <tr> <th>Condition</th><th>Features</th><th>Management</th></tr> </thead> <tbody> <tr> <td>Perforation</td><td>sudden peritonitis: emergency surgery: Graham patch closure and peritoneal lavage</td><td></td></tr> <tr> <td>Haemorrhage</td><td>haematemesis or melaena resuscitate and urgent endoscopy for haemostasis: over-sewing at surgery if endoscopy fails</td><td></td></tr> <tr> <td>Pyloric Stenosis</td><td>persistent projectile non-bilious vomiting from scarring</td><td></td></tr> <tr> <td>Gastric Outlet Obstruction</td><td>endoscopic dilatation or gastrojejunostomy</td><td></td></tr> </tbody> </table>	Condition	Features	Management	Perforation	sudden peritonitis: emergency surgery: Graham patch closure and peritoneal lavage		Haemorrhage	haematemesis or melaena resuscitate and urgent endoscopy for haemostasis: over-sewing at surgery if endoscopy fails		Pyloric Stenosis	persistent projectile non-bilious vomiting from scarring		Gastric Outlet Obstruction	endoscopic dilatation or gastrojejunostomy		Signs of Advanced Disease • palpable epigastric mass: linitis plastica leather-bottle stomach • Virchow's node: left supraclavicular lymphadenopathy: Troisier's sign • Sister Mary Joseph's nodule: periumbilical metastasis • ascites	GORD and Complications • incompetent lower oesophageal sphincter • heartburn and regurgitation • complications: oesophagitis, Barrett's oesophagus: pre-malignant columnar metaplasia, peptic stricture causing dysphagia • hiatus hernia facilitates GORD • medical treatment: PPI • surgery: laparoscopic Nissen fundoplication for refractory cases
Condition	Features	Management															
Perforation	sudden peritonitis: emergency surgery: Graham patch closure and peritoneal lavage																
Haemorrhage	haematemesis or melaena resuscitate and urgent endoscopy for haemostasis: over-sewing at surgery if endoscopy fails																
Pyloric Stenosis	persistent projectile non-bilious vomiting from scarring																
Gastric Outlet Obstruction	endoscopic dilatation or gastrojejunostomy																
	Investigation and Treatment • staging CT • OGD with biopsy • laparoscopy • curative: radical gastrectomy subtotal or total with D2 lymph node dissection • 5-year survival early cancer > 90%																

Figure 5.5: Peptic ulcer disease, gastric carcinoma, and oesophageal disease.

Figure 5.5: Peptic ulcer disease, gastric carcinoma, and oesophageal disease

Pilot questions 5.5

1. State the role of *H. pylori* in peptic ulcer disease and describe its eradication treatment. (Linked to SLO 5.5)
2. Describe the surgical management of a perforated peptic ulcer. (Linked to SLO 5.5)
3. State four clinical signs of advanced gastric carcinoma. (Linked to SLO 5.5)
4. Distinguish squamous cell carcinoma from adenocarcinoma of the oesophagus. (Linked to SLO 5.5)
5. Describe Barrett's oesophagus and explain its clinical significance. (Linked to SLO 5.5)

5.6 Colorectal Surgery

5.6.1 Colorectal carcinoma

Colorectal carcinoma (CRC) is the most common gastrointestinal malignancy in high-income countries and is increasingly common in Nigeria. Risk factors include age (above 50 years), dietary factors (low fibre, high red meat), inflammatory bowel disease, familial adenomatous polyposis (FAP: autosomal dominant: APC gene mutation: hundreds of colonic polyps: 100



percent risk of malignant transformation if untreated), and Lynch syndrome (hereditary non-polyposis colorectal cancer: HNPCC: mismatch repair gene mutations: increased risk of CRC and other malignancies).

Right-sided CRC: insidious presentation with iron deficiency anaemia (from occult bleeding), vague right iliac fossa discomfort, and weight loss. Left-sided CRC: change in bowel habit, bright rectal bleeding, and progressive bowel obstruction. Rectal CRC: tenesmus (sensation of incomplete evacuation), passage of blood and mucus per rectum, and alteration in stool calibre. Staging: CT of chest, abdomen, and pelvis for TNM staging; MRI rectum for rectal cancer. Treatment: right hemicolectomy (right-sided CRC), sigmoid colectomy or anterior resection (sigmoid and upper rectal CRC), and low anterior resection or abdominoperineal resection (lower rectal CRC).

Fill in the blank: FAP is caused by a mutation in the _____ gene and carries a 100 percent risk of malignant transformation if untreated. Right-sided colorectal carcinoma classically presents with iron deficiency _____ from occult blood loss.

5.6.2 Diverticular disease

Diverticula are outpouchings of mucosa and submucosa through weaknesses in the colonic wall at points where blood vessels penetrate. They are most common in the sigmoid colon and are caused by a low-fibre diet (increasing intraluminal pressure). Uncomplicated diverticular disease is managed with a high-fibre diet. Diverticulitis (inflammation of a diverticulum) presents with left iliac fossa pain, fever, and leucocytosis; it is treated with antibiotics (amoxicillin plus metronidazole or co-amoxiclav) and bowel rest for uncomplicated cases.

Complications of diverticular disease: pericolic abscess (CT-guided drainage), perforation with generalised faecal peritonitis (emergency Hartmann's procedure: sigmoid resection with end colostomy and closure of the rectal stump), fistula formation (colovesical fistula presenting with pneumaturia: air in the urine from faecal-urinary fistula), and haemorrhage (the most common cause of massive lower GI bleeding in adults: usually self-limiting; colonoscopy or CT angiography for diagnosis; embolisation or surgery for persistent bleeding). Elective sigmoid colectomy is offered after two episodes of uncomplicated diverticulitis or after one episode of complicated diverticulitis.

Fill in the blank: Diverticula are most common in the _____ colon and are caused by a low-_____ diet. A colovesical fistula from diverticular disease presents with _____ (air in the urine).

5.6.3 Anorectal conditions

Haemorrhoids are dilated submucosal vascular cushions in the anal canal. They are classified by degree: first degree (bleed but do not prolapse), second degree (prolapse on defaecation but reduce spontaneously), third degree (prolapse and require manual reduction), and fourth degree (permanently prolapsed and irreducible). Symptoms include bright red rectal bleeding (classically on the surface of the stool or on the toilet paper), perianal discomfort, and prolapse.



Treatment: lifestyle advice (high-fibre diet, adequate fluid intake) for first and second degree; rubber band ligation or injection sclerotherapy for second and third degree; haemorrhoidectomy for third and fourth degree or failed conservative treatment.

An anal fissure is a tear in the anoderm distal to the dentate line, most commonly in the posterior midline, presenting with severe pain on defaecation and bright red bleeding. Acute fissures (less than 6 weeks) are treated with topical lubricants, stool softeners, and increased dietary fibre. Chronic fissures are treated with topical glyceryl trinitrate (GTN) or diltiazem (relax the internal anal sphincter), or botulinum toxin injection; lateral internal sphincterotomy is the surgical option for refractory cases. A perianal abscess is a collection of pus in the perianal or ischiorectal space; it presents with throbbing perianal pain and a tender fluctuant swelling; treatment is incision and drainage under general anaesthesia.

Fill in the blank: Third-degree haemorrhoids prolapse on defaecation and require _____ reduction. An anal fissure is most commonly located in the _____ midline and causes severe pain on _____.

COLORECTAL SURGERY

1. COLORECTAL CARCINOMA

Risk Factors

- age > 50
- low fibre and high red meat diet
- IBD
- FAP: APC gene mutation and hundreds of polyps and 100% malignant transformation
- Lynch syndrome: HNPCC: mismatch repair gene mutations

Clinical Presentation by Site

Site	Right-sided CRC	Left-sided CRC	Rectal CRC
Right-sided CRC	insidious iron deficiency anaemia, weight loss, vague RIF discomfort		
Left-sided CRC	change in bowel habit, bright rectal bleeding, obstruction		
Rectal CRC	tenesmus, blood and mucus per rectum, stool calibre change		

Staging and Treatment

- CT chest, abdomen, pelvis for TNM staging
- MRI rectum for rectal cancer
- Right hemicolectomy for right-sided CRC
- sigmoid colectomy or anterior resection for sigmoid and upper rectal CRC
- low anterior resection or APR for lower rectal CRC

2. DIVERTICULAR DISEASE

Pathophysiology

- outpouchings of mucosa and submucosa through vessel entry points in sigmoid colon wall
- low-fibre diet increases intraluminal pressure

Management

Condition	Features	Treatment
Uncomplicated diverticular disease	high-fibre diet	
Diverticulitis:	left iliac fossa pain, fever, leucocytosis: amoxicillin + metronidazole, bowel rest	
Pericolic Abscess:	CT-guided drainage	
Perforation with Faecal Peritonitis	emergency Hartmann's procedure: sigmoid resection, end colostomy	
Colovesical Fistula	pneumaturia: elective resection	
Haemorrhage:	most common cause of massive lower GI bleed in adults: colonoscopy or CT angiography, embolisation or surgery	

Elective Surgery

- sigmoid colectomy after two uncomplicated or one complicated diverticulitis episode

3. ANORECTAL CONDITIONS

Haemorrhoids Classification

Grade	Features
First Degree:	bleed only
Second Degree:	prolapse and reduce spontaneously
Third Degree:	prolapse and require manual reduction
Fourth Degree:	permanently prolapsed

Haemorrhoids Treatment

First and Second:	lifestyle and diet
Second and Third:	rubber band ligation or injection sclerotherapy
Third and Fourth or failed conservative:	

Anal Fissure

- tear in anoderm distal to dentate line: posterior midline most common
- severe pain on defaecation and bright red bleeding
- acute < 6 weeks: lubricants and stool softeners
- chronic: topical GTN or diltiazem or botulinum toxin
- surgical: lateral internal sphincterotomy

Perianal Abscess

- pus in perianal or ischiorectal space
- throbbing perianal pain, tender fluctuant swelling
- treatment: incision and drainage under GA

Figure 5.6: Colorectal carcinoma, diverticular disease, and anorectal conditions.

Figure 5.6: Colorectal carcinoma, diverticular disease, and anorectal conditions

Pilot questions 5.6



1. Describe the clinical presentation of right-sided versus left-sided colorectal carcinoma. (Linked to SLO 5.6)
2. Describe the complications of diverticular disease and the management of each. (Linked to SLO 5.6)
3. Classify haemorrhoids by degree and state the treatment for each degree. (Linked to SLO 5.6)
4. Describe the clinical features and treatment of an anal fissure. (Linked to SLO 5.6)
5. Describe the management of a perianal abscess. (Linked to SLO 5.6)

Series Summary

This Series covered the common surgical conditions in Nigerian practice. We examined surgical oncology principles (carcinogenesis, curative surgery, TNM staging, and MDT management), herniae (classification, inguinal and femoral herniae, and other abdominal wall herniae), and lumps (sebaceous cysts and lipomata, neck lumps and malignancy red flags, and breast triple assessment). We then revisited the acute abdomen (appendicitis, biliary emergencies including Charcot's triad, and bowel obstruction with sigmoid volvulus), upper GI surgery (PUD complications, gastric carcinoma signs, and oesophageal disease), and colorectal surgery (CRC presentation by site, diverticular complications, and anorectal conditions).

You should now be able to describe surgical oncology principles and TNM staging (SLO 5.1), classify and manage herniae (SLO 5.2), evaluate skin, neck, and breast lumps (SLO 5.3), manage appendicitis, biliary emergencies, and bowel obstruction (SLO 5.4), describe PUD complications, gastric carcinoma, and oesophageal disease (SLO 5.5), and describe colorectal carcinoma, diverticular disease, and anorectal conditions (SLO 5.6). These skills complete the foundations of General Surgery I.

Glossary of Terms

- **Adjuvant therapy:** treatment (chemotherapy or radiotherapy) given after curative surgery to eradicate micrometastases and reduce the risk of recurrence.
- **Anal fissure:** a linear tear in the anoderm distal to the dentate line, typically in the posterior midline, causing severe pain on defaecation and bright red bleeding.
- **Barrett's oesophagus:** replacement of the normal squamous epithelium of the lower oesophagus by columnar epithelium as a result of chronic acid reflux; a pre-malignant condition predisposing to oesophageal adenocarcinoma.
- **Charcot's triad:** the clinical triad of ascending cholangitis: fever and rigors, right hypochondrial pain, and jaundice.



- **En bloc resection:** surgical removal of the primary tumour and its regional lymph nodes as a single intact specimen, a core principle of curative cancer surgery.
- **Fibroadenoma:** the most common breast lump in women under 30 years: a benign tumour of fibrous and glandular tissue presenting as a smooth, mobile, firm, rubbery swelling (the breast mouse).
- **Hartmann's procedure:** emergency sigmoid resection with formation of an end colostomy and closure of the rectal stump; performed for perforated sigmoid diverticulitis or obstructing sigmoid carcinoma when primary anastomosis is not safe.
- **Linitis plastica:** diffuse infiltrating gastric carcinoma causing a rigid, thickened, leather-bottle stomach; presents as epigastric mass with early satiety; poor prognosis.
- **Neoadjuvant therapy:** treatment (chemotherapy or radiotherapy) given before surgery to downstage the tumour and improve resectability.
- **Sigmoid volvulus:** twisting of the sigmoid colon on its mesenteric pedicle causing closed-loop large bowel obstruction; presents with massive distension and coffee-bean sign on AXR; initially managed by endoscopic deflation.
- **Triple assessment:** the three-component evaluation of a breast lump: clinical examination, imaging (ultrasound or mammography), and FNAC or core needle biopsy; sensitivity above 99 percent when all three components agree.
- **Virchow's node:** enlargement of the left supraclavicular lymph node from metastatic upper GI (especially gastric) carcinoma; also called Troisier's sign.

Concept Check Questions [Series 5]

Objective questions

- Removal of the primary tumour and its regional lymph nodes as a single specimen is called _____ resection. (Linked to SLO 5.1)
- A hernia in which the blood supply to the contents is compromised is called a _____ hernia and is a surgical emergency. (Linked to SLO 5.2)
- The triple assessment of a breast lump includes clinical examination, imaging, and FNAC or _____ needle biopsy. (Linked to SLO 5.3)
- Charcot's triad of ascending cholangitis consists of fever, right hypochondrial pain, and _____. (Linked to SLO 5.4)



- FAP is caused by a mutation in the _____ gene and carries a 100 percent risk of malignant transformation if untreated. (Linked to SLO 5.6)

Short-answer questions

6. Describe the four principles of curative cancer surgery. (Linked to SLO 5.1)
7. Distinguish an inguinal from a femoral hernia clinically. (Linked to SLO 5.2)
8. State five red flags for malignancy in a neck lump. (Linked to SLO 5.3)
9. Describe the initial management of acute cholecystitis. (Linked to SLO 5.4)
10. Describe the surgical complications of peptic ulcer disease. (Linked to SLO 5.5)

Long-answer questions

11. Describe the TNM staging system and explain how staging guides surgical decision-making in cancer. (Linked to SLO 5.1)
12. Describe the clinical features and management of a strangulated inguinal hernia. (Linked to SLO 5.2)
13. Describe the investigation and surgical management of colorectal carcinoma. (Linked to SLO 5.6)
14. Describe the clinical features and management of sigmoid volvulus in Nigerian practice. (Linked to SLO 5.4)
15. Describe the complications of diverticular disease and state the management of each. (Linked to SLO 5.6)

Answers to Concept Check Questions [Series 5]

Objective questions

1. En bloc.
2. Strangulated.
3. Core.



4. Jaundice.
5. APC.

Short-answer questions

6. Achieve clear margins (resect with a cuff of normal tissue), avoid tumour spillage (do not breach the capsule), perform en bloc resection (remove primary tumour and regional lymph nodes as one specimen), and use the no-touch technique (ligate venous drainage early to prevent haematogenous dissemination).
7. An inguinal hernia lies above and medial to the pubic tubercle and may descend into the scrotum. A femoral hernia lies below and lateral to the pubic tubercle, is more common in women, and has a higher strangulation risk because the femoral ring is narrow and rigid.
8. Hard consistency, fixity to skin or deep structures, rapid growth, associated dysphagia or hoarseness, cervical lymphadenopathy, and constitutional symptoms (weight loss, night sweats, fever).
9. IV antibiotics (cefuroxime plus metronidazole or co-amoxiclav), adequate IV fluid resuscitation, analgesia, and laparoscopic cholecystectomy ideally within 72 hours of presentation. Early surgery reduces the risk of complications compared with delayed surgery.
10. Perforation (sudden peritonitis: emergency Graham patch closure and peritoneal lavage), haemorrhage (haematemesis or melaena: endoscopic haemostasis and over-sewing at surgery if endoscopy fails), and pyloric stenosis or gastric outlet obstruction (persistent projectile non-bilious vomiting: endoscopic dilatation or gastrojejunostomy).

Long-answer questions

11. **Basic response:** The TNM system describes: T (primary tumour: T1 small and confined to mucosa; T4 invading adjacent structures), N (regional lymph nodes: N0 no nodal involvement; N1 to N3 increasing numbers of involved nodes), and M (distant metastasis: M0 absent; M1 present). These combine to define stages I to IV, with stage IV (M1) indicating incurable disease in most cancers. Staging guides surgery by determining resectability: stage I to III may be resectable with curative intent; stage IV indicates palliative intent. Neoadjuvant therapy is used to downstage tumours (for example rectal cancer: preoperative chemoradiotherapy to reduce the stage before surgery). Staging also guides the extent of lymph node dissection required.



Value-added response: Staging laparoscopy is an underused but important tool in Nigerian practice for gastric and oesophageal cancers: it detects peritoneal metastases and small liver surface metastases not visible on CT, preventing unnecessary laparotomy in patients with incurable disease.

- 12. Basic response:** A strangulated inguinal hernia presents with a painful, tense, irreducible groin swelling with overlying erythema and oedema, associated with features of bowel obstruction (colicky abdominal pain, vomiting, distension, and absolute constipation) and systemic deterioration (fever, tachycardia, and hypotension in advanced cases). Management: IV fluid resuscitation, IV broad-spectrum antibiotics (cefuroxime plus metronidazole), urinary catheter, nasogastric tube, and urgent emergency surgery. At operation: reduce the hernia, assess bowel viability (viable bowel: pink, peristaltic, and pulsatile: return to abdomen; non-viable bowel: black or necrotic: resect and anastomose or create a stoma). Repair the hernia with mesh if the field is clean, or use suture repair in a contaminated field.

Value-added response: A key clinical rule: all painful irreducible herniae must be treated as strangulated until proven otherwise, and operated on urgently without waiting for systemic features to develop, as bowel necrosis can be present even without overt signs of sepsis in the early hours.

- 13. Basic response:** Investigations: colonoscopy with biopsy (confirms diagnosis and histological type), CT of chest, abdomen, and pelvis (TNM staging: assesses liver and lung metastases and lymph node involvement), MRI rectum (local staging for rectal cancer: T and N stage and relationship to mesorectal fascia: the circumferential resection margin), and tumour markers (CEA: baseline and postoperative surveillance). Surgical management by site: right-sided CRC: right hemicolectomy (resection of the right colon with ileocolic and right colic vessels); left-sided CRC: sigmoid colectomy or left hemicolectomy; upper rectal CRC: anterior resection (restore continuity with colorectal anastomosis); lower rectal CRC: low anterior resection or abdominoperineal resection (APR: permanent end colostomy if the sphincter cannot be preserved). Total mesorectal excision (TME) is the standard technique for rectal cancer, achieving a sharp dissection plane around the intact mesorectal envelope to reduce local recurrence.

Value-added response: In Nigerian practice, most CRC presents at an advanced stage (stage III or IV) because of lack of screening and late healthcare-seeking behaviour. Palliative resection, defunctioning colostomy, and symptom management are therefore the most common surgical interventions for CRC in many Nigerian centres.

- 14. Basic response:** Sigmoid volvulus is twisting of the sigmoid colon on its mesenteric pedicle, causing a closed-loop LBO. It presents with rapid onset massive abdominal distension, absolute constipation, late or absent vomiting, and the classic coffee-bean sign



on plain AXR (a massively dilated sigmoid loop with its apex pointing to the right upper quadrant). Initial management (if not strangulated): passage of a rigid sigmoidoscope or flexible colonoscope per rectum to decompress the volvulus, followed by insertion of a flatus tube to maintain decompression. Once deflated, elective sigmoid colectomy is performed during the same admission to prevent recurrence (recurrence rate without surgery is above 50 percent). Emergency surgery (emergency sigmoid colectomy and Hartmann's procedure): required when the colon is gangrenous or has perforated, when endoscopic deflation fails, or when signs of strangulation are present.

Value-added response: In Nigerian practice, sigmoid volvulus carries a significantly higher mortality when the patient presents late with gangrenous bowel. The ability to perform rigid sigmoidoscopy for deflation at the bedside is a simple, life-saving skill that all surgical trainees in Nigeria must master.

15. Basic response: Pericolic abscess (contained diverticular perforation): CT-guided percutaneous drainage plus IV antibiotics; may resolve without surgery. Generalised faecal peritonitis (free perforation): emergency Hartmann's procedure (sigmoid resection with end colostomy and Hartmann's stump); reversal of colostomy after recovery in fit patients. Colovesical fistula (diverticular disease tracking into the bladder: presents with pneumaturia and faecuria): elective sigmoid resection with repair of the bladder; IV antibiotics for urinary sepsis before surgery. Diverticular haemorrhage (most common cause of massive lower GI bleeding in adults: usually from a diverticulum in the right colon): resuscitate; colonoscopy or CT angiography for diagnosis; selective embolisation for active bleeding; elective colectomy for recurrent haemorrhage. Elective sigmoid colectomy is offered to fit patients after two episodes of uncomplicated diverticulitis or after any episode of complicated diverticulitis (abscess, fistula, or perforation).

Value-added response: Hartmann's procedure reversal (reconnecting the colon to the Hartmann's stump to restore bowel continuity) is a major operation with significant morbidity; many patients with a Hartmann's colostomy in Nigeria never undergo reversal due to limited access to re-do surgery, making the decision to perform Hartmann's procedure rather than primary anastomosis a significant and long-lasting one.

Answers to Pilot Questions [Series 5]

Part 5.1

1. Proto-oncogenes (promote cell growth: when mutated become oncogenes: example RAS), tumour suppressor genes (inhibit growth: example TP53), and DNA repair genes (fix DNA errors: example BRCA1/BRCA2: loss leads to genomic instability).



2. Achieve clear margins (resect a cuff of normal tissue around the tumour), avoid tumour spillage (do not breach the capsule), perform en bloc resection (remove the tumour and regional lymph nodes as one specimen), and use the no-touch technique (ligate the venous drainage early).
3. Neoadjuvant therapy is given before surgery to downstage the tumour and improve resectability (example: chemoradiotherapy before rectal cancer surgery). Adjuvant therapy is given after surgery to eradicate micrometastases and reduce recurrence (example: chemotherapy after colorectal resection in stage III disease).
4. TNM: T describes the primary tumour (T1 to T4: size and local invasion), N describes regional lymph node involvement (N0: no nodes; N1 to N3: increasing involvement), M describes distant metastasis (M0: absent; M1: present). Stage IV indicates M1: distant metastasis.
5. MDT members: surgeon, medical oncologist, radiation oncologist, radiologist, histopathologist, and specialist nurse. Purpose: collectively review the patient's clinical stage, fitness, and preferences and agree on the optimal treatment plan.

Part 5.2

1. Sac (peritoneal pouch), contents (omentum or bowel), and coverings (abdominal wall layers). An irreducible hernia cannot be returned to the abdominal cavity but the blood supply is intact. A strangulated hernia has its blood supply compromised, causing ischaemia and necrosis; it is a surgical emergency.
2. Indirect inguinal hernia: passes through the deep inguinal ring, travels along the inguinal canal, and may descend into the scrotum; the most common type in both sexes; more common in young males; follows the path of the descending testis. Direct inguinal hernia: pushes directly through the posterior wall of the inguinal canal (Hesselbach's triangle); associated with abdominal wall weakness; more common in older males; does not descend into the scrotum.
3. An inguinal hernia lies above and medial to the pubic tubercle and may descend into the scrotum. A femoral hernia lies below and lateral to the pubic tubercle, passes through the femoral canal, is more common in women, and has a higher strangulation risk because the femoral ring is narrow.
4. Wound infection (the most important factor), obesity, malnutrition, steroid use, poor surgical technique (mass closure with inadequate bites), advanced age, and conditions causing raised intra-abdominal pressure (COPD, ascites, straining).



5. A painful, tense, irreducible groin swelling with overlying skin erythema; associated colicky abdominal pain, vomiting, abdominal distension, and absolute constipation from bowel obstruction; systemic deterioration (fever, tachycardia, and hypotension in advanced cases). It is a surgical emergency.

Part 5.3

1. Sebaceous cyst: attached to the overlying skin with a visible central punctum; arises from a blocked sebaceous gland; treated by excision of the intact cyst with its wall. Lipoma: soft, lobulated, mobile subcutaneous swelling with a slip sign; not attached to skin; no punctum; arises from adipose tissue; treated by observation or excision.
2. A thyroglossal cyst arises from remnants of the thyroglossal tract (the path taken by the thyroid gland as it descends from the foramen caecum of the tongue to the neck during development). The tract is attached to the hyoid bone; when the tongue is protruded, the hyoid moves upward, pulling the cyst upward with it.
3. Hard consistency, fixity to skin or deep structures, rapid growth, associated dysphagia or hoarseness, cervical lymphadenopathy, and constitutional symptoms (weight loss, night sweats, fever). In a patient over 40 with a neck lump present for more than 3 weeks, malignancy must be excluded urgently.
4. Triple assessment: clinical examination, imaging (ultrasound for women under 35 years; mammography for women over 35 years), and FNAC or core needle biopsy. All three components together achieve a sensitivity above 99 percent for breast cancer when they all agree, allowing confident benign or malignant diagnosis without open biopsy.
5. Hard, irregular, ill-defined breast lump; skin tethering or peau d'orange (from lymphatic involvement); nipple retraction; blood-stained nipple discharge; axillary lymphadenopathy. Advanced features: a fixed mass adherent to pectoral muscle, peau d'orange, skin ulceration, and supraclavicular lymphadenopathy.

Part 5.4

1. Central colicky abdominal pain migrating to the right iliac fossa over 4 to 24 hours; anorexia; nausea and low-grade vomiting; low-grade fever (above 37.5 degrees C); localised right iliac fossa guarding and tenderness at McBurney's point. Rovsing's sign may be positive.



2. Charcot's triad: fever and rigors, right hypochondrial pain, and jaundice. It indicates ascending cholangitis (bacterial infection of the bile duct, usually from a common bile duct stone). Reynold's pentad adds hypotension and confusion in severe septic cholangitis.
3. IV antibiotics, adequate analgesia, and laparoscopic cholecystectomy ideally within 72 hours of presentation. Early surgery (within 72 hours) is superior to delayed surgery because it reduces the risk of complications such as empyema of the gallbladder, perforation, and gangrenous cholecystitis.
4. SBO: central colicky pain; early and profuse bilious or faeculent vomiting; central distension; high-pitched tinkling bowel sounds; incomplete constipation initially. LBO: peripheral colicky pain; late or absent vomiting; massive peripheral distension; reduced or absent bowel sounds; absolute constipation (no flatus or stool).
5. Rigid sigmoidoscopy or flexible colonoscopy passed per rectum to decompress the volvulus, followed by passage of a flatus tube to maintain decompression. This is performed without general anaesthesia in the initial management. Elective sigmoid colectomy is then planned during the same admission to prevent recurrence.

Part 5.5

- *H. pylori* is a Gram-negative bacterium colonising the gastric antrum, present in 95 percent of duodenal ulcers. It disrupts mucosal defence and promotes acid secretion. Eradication: triple therapy (amoxicillin 1 g plus clarithromycin 500 mg plus a PPI: omeprazole 20 mg, all twice daily for 7 to 14 days). Confirmation of eradication: urea breath test or stool antigen test 4 weeks after completing treatment.
- Emergency laparotomy after adequate resuscitation. The perforation is identified and closed with interrupted absorbable sutures reinforced by an omental patch (Graham patch closure). The peritoneal cavity is lavaged thoroughly with warm saline. Postoperative IV antibiotics are continued. *H. pylori* eradication and PPI therapy are given after recovery.
- Palpable epigastric mass, Virchow's node (left supraclavicular lymphadenopathy: Troisier's sign), Sister Mary Joseph's nodule (periumbilical metastatic nodule), and ascites.
- Squamous cell carcinoma: upper and middle third of the oesophagus; associated with smoking and alcohol; more common in developing countries. Adenocarcinoma: lower third and oesophagogastric junction; arises from Barrett's oesophagus from chronic GORD; more common in Western countries and in obese patients.



- Barrett's oesophagus is the replacement of the normal squamous epithelium of the lower oesophagus by columnar (intestinal-type) epithelium as a result of chronic acid reflux. It is a pre-malignant condition that predisposes to oesophageal adenocarcinoma: the risk of progression to adenocarcinoma is approximately 0.5 percent per year. It is diagnosed by OGD with biopsy and managed by PPI therapy, endoscopic surveillance, and endoscopic or surgical ablation for high-grade dysplasia.

Part 5.6

- Right-sided CRC: insidious presentation with iron deficiency anaemia (from occult blood loss into the large right colon lumen), vague right iliac fossa discomfort or a palpable mass, and weight loss. Left-sided CRC: change in bowel habit (alternating constipation and diarrhoea), bright red or mixed rectal bleeding, and progressive large bowel obstruction (the left colon has a narrower lumen).
- Pericolic abscess: CT-guided drainage and IV antibiotics. Generalised faecal peritonitis: emergency Hartmann's procedure (sigmoid resection and end colostomy). Colovesical fistula (pneumaturia): elective sigmoid resection and bladder repair. Diverticular haemorrhage: resuscitation; colonoscopy or CT angiography for localisation; embolisation or segmental colectomy for persistent or recurrent bleeding.
- First degree: bleed only; treatment: lifestyle advice and dietary fibre. Second degree: prolapse and reduce spontaneously; treatment: rubber band ligation or injection sclerotherapy. Third degree: prolapse and require manual reduction; treatment: rubber band ligation or haemorrhoidectomy. Fourth degree: permanently prolapsed and irreducible; treatment: haemorrhoidectomy.
- A linear tear in the anoderm distal to the dentate line, most commonly in the posterior midline; causes severe anal pain on defaecation and bright red rectal bleeding. Acute fissure (less than 6 weeks): topical lubricants, stool softeners, and dietary fibre. Chronic fissure: topical GTN or diltiazem to relax the internal anal sphincter; botulinum toxin injection; lateral internal sphincterotomy for refractory cases.
- A perianal abscess is incised and drained under general anaesthesia in the operating theatre. The skin over the abscess is incised with a cruciate or elliptical incision, pus is drained, loculations are broken down, and the cavity is packed. The wound is left open to heal by secondary intention. A proportion of patients will develop an anal fistula (a track between the anorectal lumen and the perianal skin) after an abscess, requiring further assessment and treatment.



References and Attributions [Series 5]

Textual References

- Bailey, H. and Love, R. J. M. (2018). Bailey and Love's Short Practice of Surgery (27th ed.). Boca Raton: CRC Press.
- Townsend, C. M., Beauchamp, R. D., Evers, B. M. and Mattox, K. L. (2017). Sabiston Textbook of Surgery (20th ed.). Philadelphia: Elsevier.
- Browse, N. L., Black, J., Burnand, K. G. and Thomas, W. E. G. (2005). Browse's Introduction to the Symptoms and Signs of Surgical Disease (4th ed.). London: Hodder Arnold.
- National Comprehensive Cancer Network. (2023). NCCN Clinical Practice Guidelines in Oncology: Colon Cancer. Fort Washington: NCCN.

Figures, Plates, Tables, and Boxes

- Figure 5.1: Principles of surgical oncology. AI-generated using the prompt: "Three-panel diagram: carcinogenesis steps and cancer biology box and surgical concepts; curative surgery principles and other surgical roles and neoadjuvant and adjuvant boxes; TNM staging table and stage groups box and MDT diagram." Suggested OER search string: "surgical oncology cancer biology TNM staging multidisciplinary team surgical margins OER."
- Figure 5.2: Herniae. AI-generated using the prompt: "Three-panel diagram: hernia components diagram and classification box and predisposing factors table; groin anatomy diagram with indirect, direct, and femoral herniae and repair techniques box; five abdominal wall hernia condition boxes." Suggested OER search string: "hernia classification inguinal femoral incisional umbilical repair surgical diagram OER."
- Figure 5.3: Lumps and swellings. AI-generated using the prompt: "Three-panel diagram: sebaceous cyst, lipoma, and dermoid cyst boxes; neck anatomy diagram with anterior and posterior triangle lumps and malignancy red flags; triple assessment diagram and breast lumps table and carcinoma box." Suggested OER search string: "sebaceous cyst lipoma neck lump thyroid thyroglossal breast triple assessment OER."
- Figure 5.4: The acute abdomen revisited. AI-generated using the prompt: "Three-panel diagram: acute appendicitis pathophysiology and features and investigation and treatment; three biliary conditions comparison table and pancreatitis box; SBO versus



LBO comparison table and sigmoid volvulus box." Suggested OER search string: "acute appendicitis biliary emergencies bowel obstruction sigmoid volvulus OER."

- Figure 5.5: Upper GI surgery. AI-generated using the prompt: "Three-panel diagram: PUD pathophysiology and treatment and complications table; gastric carcinoma risk factors and features and advanced signs and staging; dysphagia red flag box and oesophageal carcinoma box and GORD complications." Suggested OER search string: "peptic ulcer disease gastric carcinoma oesophageal carcinoma GORD Barrett's oesophagus OER."
- Figure 5.6: Colorectal surgery. AI-generated using the prompt: "Three-panel diagram: CRC risk factors and site presentation table and staging; diverticular disease pathophysiology and management table; haemorrhoid classification and treatment, anal fissure, and perianal abscess boxes." Suggested OER search string: "colorectal carcinoma diverticular disease haemorrhoids anal fissure perianal abscess OER."

