

PERI-SURGICAL PROCEDURES: A BOOK**Prof. Dr. Moumita Hazra***

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Preface

Surgery is one of the most important fields of modern medicine. It combines scientific knowledge, technical skill, patient care, safety, and continuous innovation. Over time, surgical practice has advanced from basic procedures to highly developed techniques supported by anesthesia, antisepsis, imaging, minimally invasive methods, and robotic technology. The purpose of this book “**Peri-Surgical Procedures**” is to provide a clear and structured understanding of how surgical procedures are planned, performed, monitored, and managed. It is aspired that this book will serve as a useful foundation for readers who wish to build their knowledge of peri-surgical procedures and patient care principles.

Prologue

Peri - Surgical Procedures is a structured academic book that introduces the main principles, techniques, and applications of contemporary surgery. The book is divided into two chapters. Chapter 1 explains the foundations of surgery, preoperative preparation, and surgical anesthesia. Chapter 2 combines intraoperative care, postoperative care, complications management, and surgical safety. Each chapter includes a chapter overview and focused subtopics. These features are included to help readers understand key concepts and apply knowledge in clinical situations.

1. Foundations, Preoperative Preparation, and Surgical Anesthesia**Chapter Overview**

Modern surgical practice depends on safe preparation, clear terminology, ethical decision-making, patient evaluation, infection prevention, and anesthesia. This chapter introduces the historical foundations of surgery, common procedure classifications, consent principles, diagnostic assessment, preoperative preparation, and basic anesthesia methods. It provides the foundation needed to safely understand later specialty-based surgical procedures.

1.1 Evolution and Foundations of Surgery

Surgery has developed from early manual procedures into a highly organized field supported by science, technology, anesthesia, infection control, and patient safety principles. These barriers to surgery were pain, bleeding, infection and basic anatomical knowledge in the earlier time period. Many procedures were only done when it was necessary to avoid death or were associated with a significant risk of death and complications. There were few diagnostic facilities and an inadequate knowledge of microorganisms that limited surgical care during the time.

The introduction of anesthesia was one of the most important developments in surgical history. Pre-

anesthetic surgery needed to be done rapidly as the patient suffered greatly from pain. Pain, consciousness, movement and physiological outputs can be managed throughout the procedure with modern anesthesia, so longer, safer and more complicated procedures are allowed. It is also useful for improving precision in surgical procedures as the patient does not move during the operation and maintains good comfort (Butterworth et al., 2013; Gropper et al., 2024).

Another major advancement was the development of antisepsis and aseptic technique. As understanding of the relationship between microorganisms and infection grew, aspects of surgical practice such as preparation of hands, the use of sterilized instruments, and skin antisepsis

became a part of surgery. These advances significantly decreased surgical site infections and outcomes (Berrios-Torres et al., 2017; World Health Organization, 2009).

Modern surgery is also shaped by imaging, minimally invasive techniques, robotic systems, and advanced surgical instruments. Imaging is important for an early diagnosis and for planning surgery; there are also less invasive and robotic-based surgeries for specific cases that will diminish trauma to the tissues (Townsend et al., 2021; O'Connell et al., 2023). However, the core foundations remain the same: correct diagnosis, appropriate indication, safe preparation, infection prevention, careful tissue handling, hemostasis, anesthesia support, and postoperative monitoring.

Historical Development of Modern Surgery

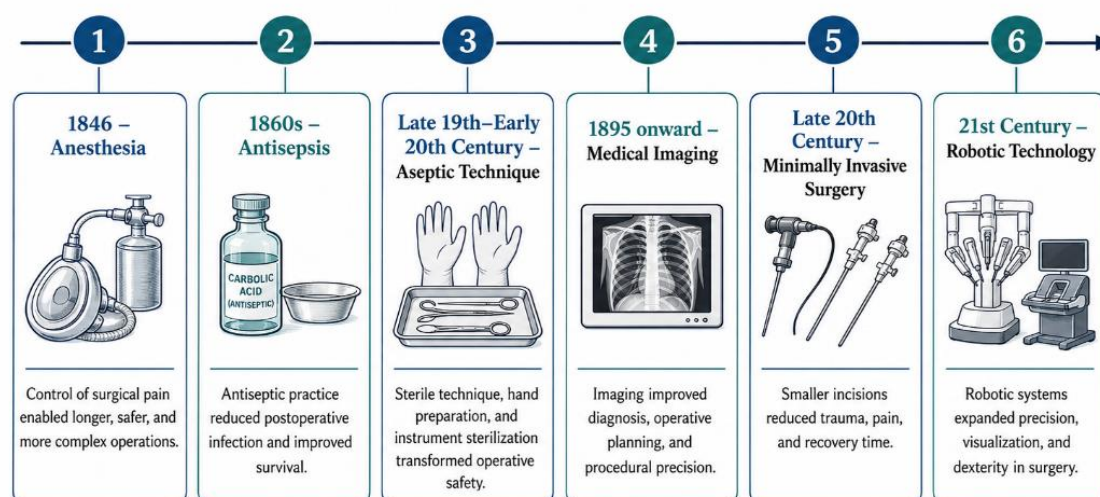


Figure 1.1: Historical Development of Modern Surgery.

1.2 Surgical Terminology and Classification

Surgical terminology provides a standard language for describing procedures, body sites, techniques, and treatment goals. This is critical to ensure effective communication between healthcare providers and between clinicians and patients during surgical care. Standard terms are also beneficial for the documentation of consent, documentation, procedure planning, and postoperative communication. The lack of terminology may allow mistakes to be made when assessing the type of surgery, the location of the surgical site, or the type of care the surgery was supposed to provide.

Many terms related to surgery have prefixes, roots and suffixes. For instance, “-ectomy” indicates the removal, such as the appendectomy (removal of the appendix). The word “-otomy” refers to a surgical procedure that involves cutting into a structure, and “-ostomy” refers to a procedure that involves making an opening. “Laparoscopy” is the term used to describe an examination or surgery of the abdomen from within,

using a camera and small cuts. These terms are useful to those who are not well acquainted with the particular organ that is involved, but know the procedure.

Surgical procedures may be classified in different ways. There are two types of surgery: elective surgery is scheduled in advance, and emergency surgery is performed urgently in the case of serious and life-threatening conditions. A diagnostic surgery is used to establish a diagnosis, e.g., a biopsy, whereas a therapeutic surgery is used to treat a disease, e.g., a cholecystectomy. Surgery can also be curative, intended to remove or fix disease, or palliative, to ease symptoms without curing the underlying illness. Procedures can also be minor, major, reconstructive or cosmetic, depending on their purpose and complexity (Haisley et al., 2019; Townsend et al., 2021). The classifications are useful to provide a clear explanation of treatment for the clinician and to help the patient understand the likely role of surgery in their treatment.

Table 1.1: Common Classifications of Surgical Procedures.

Classification	Meaning	Example
Elective surgery	Planned procedure	Hernia repair
Emergency surgery	Urgent procedure	Bowel perforation surgery
Diagnostic surgery	Confirms diagnosis	Biopsy
Therapeutic surgery	Treats disease	Cholecystectomy
Curative surgery	Aims to remove the disease	Tumor excision
Palliative surgery	Relieves symptoms	Obstruction relief surgery

As shown in Table 1.1, classification helps readers understand why a procedure is performed and how it contributes to patient care.

1.3 Ethical and Legal Considerations in Surgery

Ethical and legal principles are essential in surgery because operations may involve pain, anesthesia, tissue removal, permanent physical change, and risk of complications. Therefore, it is important to provide truth and honest treatment, respect and dignity, and fairness for patients starting from the surgical procedure. Providing ethical surgical care is the clinician's work to balance medical benefit against the patient's preference, patient safety and the informed patient's right to make decisions.

Informed consent is one of the most important requirements. Before surgery, the patient should be provided with clear information regarding the diagnosis, the reason for undergoing surgery, the known potential benefits of surgery, possible complications of surgery, alternative courses, as well as a description of what would happen if the surgery were not performed. Patients should be given a chance to ask questions and consent without being coerced into it, and consent should be voluntary (American College of Surgeons, 2016a). The explanation should be understandable and adapted in language to the patient's knowledge.

Patient autonomy means that patients have the right to make decisions about their own healthcare. Where surgery is clinically appropriate, then the patient's values, beliefs and preferences must be respected. Treatment may be accepted, deferred or refused following the provision of appropriate information. Respecting autonomy also implies time for decision-making in cases where pressures are not required by the clinical situation.

Another important role is to maintain confidentiality. Only disclosure to authorized professionals involved in the care should be made unless there is a legal obligation to make disclosures regarding diagnosis, investigations, consent, information about the procedure and treatment plans. Surgical practice supports professional standards and helps to maintain trust by protecting private information.

Documentation is also important. All findings, diagnoses, investigations, consent discussions, operative plan, anaesthetic plan, procedure notes, postoperative instructions and complications should be documented in

the surgical records. Good documentation supports continuity of care and protects both the patient and healthcare team (American College of Surgeons, 2016b). It also provides a clear decision-making process record, should a later review be desired.

1.4 Patient Evaluation and Diagnostic Testing

Patient evaluation helps determine whether surgery is necessary and whether the patient is prepared for the planned procedure. This starts with a medical history (which involves current symptoms, earlier illnesses, past operations, medications, allergies, family history and lifestyle factors like smoking or drinking alcohol). History may indicate a condition that could influence anesthesia, bleeding, healing of wounds, predisposition to infection, or recovery after an operation.

Physical examination gives an overview of the surgical state and overall health of the patient. For instance, tenderness may point to a possible diagnosis of appendicitis, and swelling/deformity may indicate a fracture. General examination may also show dehydration, infection, breathing difficulties, circulation or nutritional issues. These findings help to decide the urgency of surgery and further investigations to be carried out.

The surgical indication must be clear before an operation is performed. Surgical options are used to remove diseased tissue, repair injury, treat cancer, alleviate obstruction, improve function, or be used for diagnosis. If the indication is not clear, more assessment should be done first. A clear indication is vital to avoid unnecessary surgery and inform safer decision-making.

Diagnostic testing is used to aid in safe decision-making. Laboratory investigations can consist of complete blood count, blood glucose, kidney function, liver function, blood grouping, coagulation profile and infection markers. Depending on the condition, imaging could be performed through X-ray, ultrasound, computed tomography or magnetic resonance imaging. These tests aid in the diagnosis, detection of complications, and the operating plan.

Further tests may be required depending on the type of specialty. In some patients, for instance, cardiac or pulmonary evaluation may be warranted preoperatively prior to major surgery. Preanesthetic evaluation is also useful in order to identify factors that may impact the selection of anesthetic techniques and the type of

monitoring required during the anesthetic (Apfelbaum et al., 2012). The general goal is to completely comprehend the patient prior to the beginning of the procedure.

1.5 Preoperative Preparation

Preoperative preparation includes the steps taken before surgery to reduce complications and improve patient safety. It verifies that the patient, procedure, investigations, consent, surgical site, medication plan and anesthesia plan are prepared prior to the start of the operation. Avoidable delays are minimized, and communication is enhanced with good preparation, and problems can be fixed before the patient goes into the OR.

Fasting is commonly required before anesthesia to reduce the risk of aspiration. Aspiration refers to when stomach contents go into the lungs, leading to severe lung problems. Patients should be given clear guidelines on when eating and drinking should cease prior to surgery. These instructions should be explained in simple language so that the patient understands their importance.

It is also essential to have medication administration procedures. Certain medications can be continued, others may need to be adjusted or will need to be temporarily stopped. For instance, medications used to modify bleeding, diabetes, blood pressure, and heart medication should be evaluated before the operation. It is important to remember that medication decisions must be personalized and that omitting or continuing medications without a proper evaluation can pose a risk.

Prevention of infection starts prior to an operation. May involve skin cleansing, treatment of current infection, proper hair removal and antibiotics if necessary. Preventing surgical site infection (SSI) is a significant aspect of safe peri-operative care (Berríos-Torres et al., 2017). It is particularly crucial in diabetic or obese patients with immune suppression or dirty wounds.

Skin preparation reduces microorganisms at the incision site. The area is usually cleaned with an antiseptic solution before incision. Avoid causing skin damage if hair removal is required; this must be done carefully. Psychological preparation is also necessary since there are patients who have anxiety before the surgery. Explanation, reassurance, and discussion about what they are likely to recover from can facilitate cooperation and decrease fear. In the event of avoidable errors that could happen, final checks such as patient identification, surgical site, consent, allergies, and anesthesia plan can help reduce such errors (World Health Organization, 2009).

1.6 Fundamentals of Surgical Anesthesia

Anesthesia prevents pain and discomfort during surgery. It helps to facilitate safe operative care by controlling pain, awareness, motion, muscle tone and physiological

responses. Some type of anesthesia is given during the surgery based on the type of procedure, location, patient status, length of the operation, and clinical judgment.

General anaesthesia is a controlled state of unconsciousness. No pain is experienced by the patient, and they are not aware of surgery. It is widely applied to the major, long, abdominal, thoracic and neurosurgical surgeries. In general anesthesia, breathing, oxygenation, blood pressure, heart rate and temperature are carefully monitored (Butterworth et al., 2013; Gropper et al., 2024).

Regional anesthesia is used to numb a larger area of the body. These include spinal anaesthetic, epidural anaesthetic and nerve blocks. It is utilized in the limbs, lower stomach, pregnancy and orthopedic procedures. It might also be used to treat pain after surgery.

Local anesthesia blocks sensation in a small area. It is commonly used for minor procedures such as skin biopsy, wound repair, and small lesion excision. The whole procedure is performed without causing any sedation, and only the area being treated is made numb.

Sedation reduces anxiety and may cause drowsiness. It is administered alone or in combination with local or regional anesthesia. The depth of sedation depends on the procedure and the patient's needs.

Anesthetic risks may include nausea, vomiting, breathing difficulty, allergic reaction, aspiration, blood pressure changes, nerve injury, or drug-related complications. Monitoring can identify issues early on and enables issues to be resolved quickly. Hence, anesthesia is not just pain relief but a managed medical procedure that keeps the patient safe during the medical intervention.

2. INTRAOPERATIVE, POST-OPERATIVE AND COMPLICATIONS MANAGEMENT AND SURGICAL SAFETY

Chapter Overview

Safety of surgical operation depends on a well-coordinated process both during surgery, recovery from anaesthesia and post-operative treatment. This chapter covers topics such as equipment used in the operating theatre, sterilization, physiological monitoring, positioning, emergency situations management, post-surgery recovery, complication management and quality improvement. The key idea of this chapter is the fact that safety is obtained through proper planning, teamwork and timely detection and escalation of any worsening of the condition of the patient. Modern technologies can help in achieving this, but should always be supported by clinical reasoning and responsibility.

2.1 Surgical Instruments and Equipment

The choice of surgical instruments depends on the type of tissue, the nature of the procedure, and the desire to minimize tissue damage. Cutting instruments include

scalpels, scissors, osteotomes and powered cutters. Instruments used to grasp or hold/occlude structures; atraumatic forceps preferred when crushing may compromise blood supply; clamps may temporarily control vessels or ducts. While retractors provide exposure, hand-held or self-retaining retractors can cause damage to skin, nerves, muscles or organs due to prolonged pressure. Handling sharp items should be protected during the transfer process and neutral-zone passing could minimize accidental injury.

Energy devices are those that divide tissues and effect haemostasis with electrical, ultrasonic or laser energy.

Safe use relies on appropriate settings, undamaged insulation, proper return-electrode positioning (where applicable) and an understanding of fire risks. It is important to capture surgical smoke near its source as this can impair visibility and increase the risk of airborne contaminants to surgical staff (Williams, 2022). Specialized equipment includes laparoscopic towers, microscopes, navigation systems, and robotic platforms, cell salvage, and intraoperative imaging. Familiarization of function checks, compatible accessories and back-up plan confirmed prior to use. Rental items are swabbed, counted with a needle and instrument at known times to minimize the risk of retained items.

Table 2.1 Main Surgical Instrument Groups and Safety Considerations.

Instrument group	Main purpose	Key safety consideration
Cutting and dissecting	Incision, division, or tissue dissection	Protect sharp edges; select the correct blade or scissors for the tissue.
Grasping and clamping	Hold tissue or temporarily control vessels and ducts	Avoid unnecessary crushing and confirm secure but atraumatic application.
Retractors	Maintain exposure of the operative site	Pad contact points and avoid excessive or prolonged pressure.
Energy devices	Cut tissue and achieve haemostasis	Check insulation, settings, return electrode, fire risk, and smoke evacuation.
Specialised equipment	Visualisation, navigation, imaging, robotics, or organ support	Complete function checks and ensure an immediately available contingency plan.

2.2 Sterile Technique and Infection Control

Aseptic practice takes steps to keep the wound, implants, sterile instruments and critical tissues free of microorganisms. Environmental preparation, surgical hand antisepsis, sterile gowning and gloving, patient skin preparation, and controlled opening of supplies are all methods used to create a sterile field. The field is kept in view and sterile personnel do not come into contact with non-sterile surfaces and report any break immediately. Sterility may be compromised by moisture, damaged packaging, unnecessary opening of doors, and moving about in the field. If the status of an item is unknown, it is replaced and never assumed to be safe. Hand preparation is carried out for the recommended time and careful drying; gowning and gloving is done after hand preparation. Gloves are changed after contact with a non-sterile surface, after visible perforation, or when there is a high risk of exposure to the procedure (double gloving may be used).

For reusable devices, cleaning prior to disinfection or sterilisation is essential as organic material remaining in the devices will diminish the effectiveness of the processing. Many heat-stable instruments can be cleaned using steam, and validated low-temperature instruments are needed for sensitive instruments. Safe processing encompasses compatibility tests, packaging, loading, cycle monitoring, traceability, transport and storage (Fischer, 2024). In addition to the above, infection prevention involves appropriate and timely use of prophylactic antibiotics when required, skin antisepsis, maintenance of normal temperature, glycaemic control,

gentle handling of tissues, haemostasis and evidence-based wound care. When bundled measures are consistently implemented and audited, they are most likely to be effective (Calderwood et al., 2023).

2.3 Patient Monitoring During Surgery

Intraoperative monitoring provides information on patient's response to anaesthesia, positioning, surgical stimulation, loss of blood, fluids, and changes in temperature. Typical observations would be electrocardiography, blood pressure, pulse oximetry, respiratory rate or airway pressure, capnography during general anaesthetic and temperature if applicable. Values are compared to trends and baseline. Pulse oximetry measures oxygenation, and capnography can be used to detect hypoventilation, obstruction, circuit disconnection, embolic events and changes in pulmonary blood flow. Monitoring and clinical observation need to be continued beyond wound closure (Klein et al., 2021). Alarm set points should be tailored to the specific patient and make sound to the responsible team. Upon alarm, clinicians will first evaluate the patient, then check the sensor and equipment, and confirm if the intervention has returned the patient to a safe trend.

Arterial pressure, blood gases, central access, cardiac-output evaluation, urine output and repeated laboratory testing may be necessary during higher-risk surgery. Anaesthetic monitoring also includes drug delivery, inspired and expired gases, neuromuscular function and depth of anaesthetic (as required). Postoperative residual neuromuscular weakness may affect airway protection

and ventilation, and can be detected with quantitative monitoring (Thilen et al., 2023). The team verifies access to the following before incision: emergency airway equipment, defibrillation, drugs, blood products if applicable, and protocols for difficult airway, malignant hyperthermia, cardiac arrest and anaphylaxis, as well as major haemorrhage.

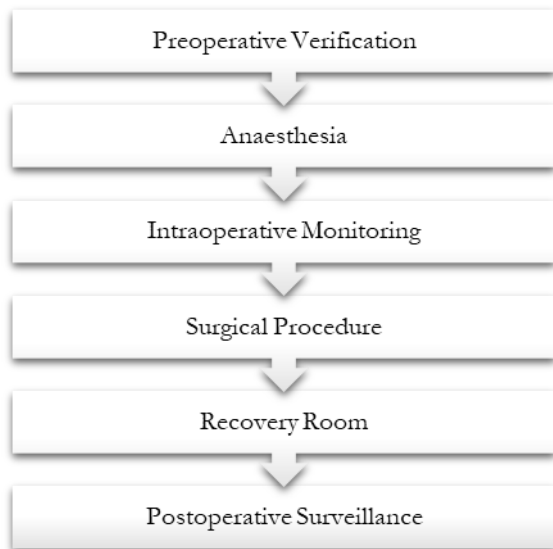


Figure 2.1 Integrated Perioperative Patient Monitoring and Safety Pathway.

2.4 Surgical Positioning and Intraoperative Safety

Positioning should allow for surgical access without compromising ventilation, circulation, skin integrity,

nerve function and joint alignment. When lying on their back, the head and spine are aligned, the arms are not allowed to spread too wide, and the heels and elbows are padded. Prone positioning requires a protected airway, eye and face protection and prevention of harmful chest or abdominal compression. When the baby is lying on their side, the axillary support, padding and alignment will prevent dependent-pressure and brachial-plexus injury. Both legs must be moved simultaneously during lithotomy and protected from excessive flexion, nerve compression, poor perfusion and compartment syndrome.

The surgical, anaesthetic, and nursing team inspect all lines, tubes, eyes, limbs and pressure points after moving and when the tables tilt. It is more likely to occur in obese patients, patients who are frail, patients with neuropathy, vascular disease, joint restriction, or long procedures. However, the preparation and reassessment of the surgery are essential since extreme tilt during minimally invasive pelvic surgery can impact the eyes, nerves, breathing and the skin (Silva-Filho et al., 2024). Temperature safety is also related to exposure and positioning, and active monitoring, warming and minimising cold exposure are recommended to prevent perioperative hypothermia (Munday et al., 2023).

Table 2.2: Common Surgical Positions, Risks, and Preventive Measures

Position	Common use	Main risks	Preventive measures.
Supine	Abdominal, vascular, breast, and limb surgery	Heel, elbow, ulnar nerve, and back pressure	Neutral alignment, arm control, and heel/elbow padding.
Prone	Spine and posterior procedures	Airway difficulty, eye injury, facial pressure, chest/abdominal compression	Secure airway, protect eyes and face, free abdomen, and reassess pressure points.
Lateral	Thoracic, renal, and hip surgery	Brachial plexus injury, dependent pressure, reduced ventilation	Axillary support, padding, alignment, and secure fixation.
Lithotomy	Pelvic, perineal, and gynaecological surgery	Nerve injury, compartment syndrome, joint strain, hemodynamic change	Symmetrical leg movement, limited flexion, padding, and duration review.

2.5 Intraoperative Complications and Safety Protocols

Any intra-operative complications must be quickly recognised, the problem clearly stated and coordinated action taken. For significant bleeding, the team determines the loss on the field, from suction, swabs, hemodynamic changes and lab results. Surgical haemostasis, oxygenation, circulation, warming, coagulation assessment and activation of a major-haemorrhage pathway, if necessary. Continuous loss, physiological status and test results are used to direct blood products. If there are any unexpected changes in

the operative activity, a new swab count, needle count, and instrument count should be performed.

Airway and anaesthetic emergencies are those where there is difficulty in breathing or intubation, aspiration, bronchospasm, anaphylaxis, severe hypotension, arrhythmia, residual paralysis, and malignant hyperthermia. Reversible causes are looked for, while oxygen delivery or circulation takes priority. Difficult-airway guidance facilitates early declaration, limiting repeated failed attempts, alternative use of devices, skilled airway help and progression to an emergency

airway pathway if oxygenation fails (Law et al., 2021). Unsafe progress should also be stopped by equipment failure: patient is checked; faulty equipment is isolated and a validated alternate/conversion plan is followed. Fire risk is determined whenever an ignition source, an

oxygen-rich atmosphere and combustible material may all be present. In the event of a failure of the laparoscope or robot, the team will discuss whether the surgery can be continued safely, converted, or abandoned, but not at the expense of the patient's condition.

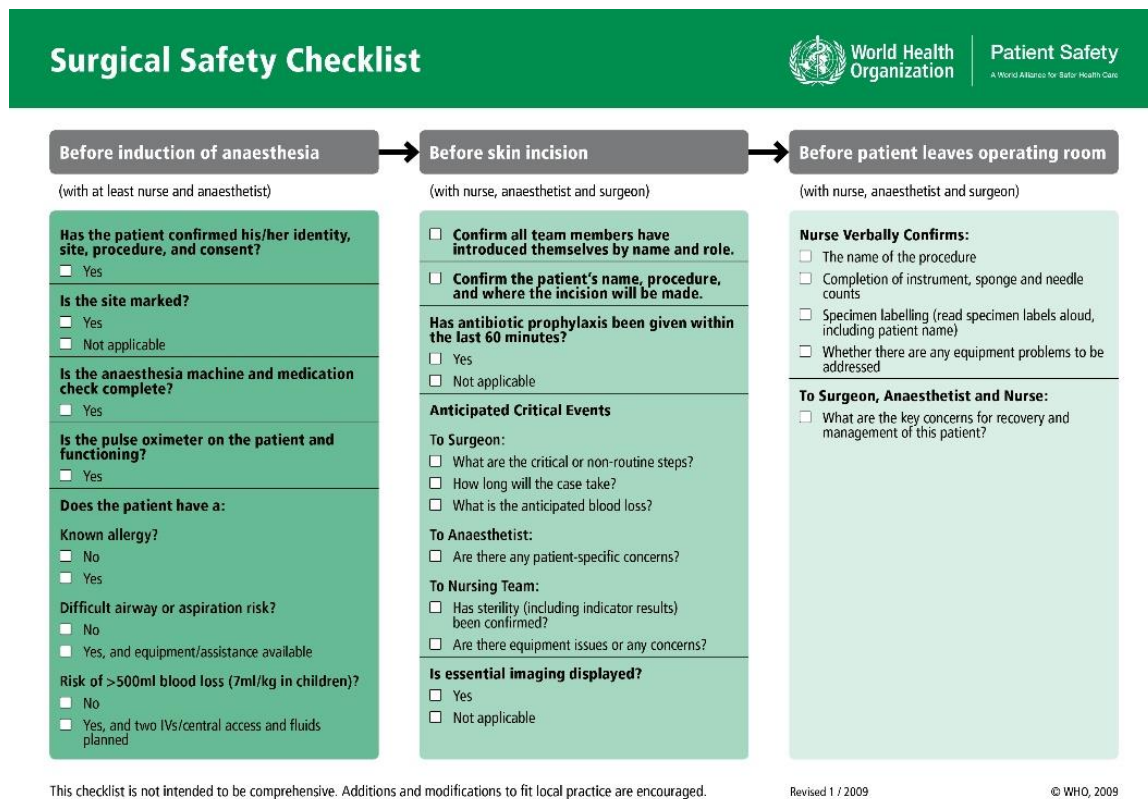


Figure 2.2: WHO Surgical Safety Checklist Framework and Prevention of Operative Errors (Source: WHO, 2009).

The surgical safety checklist establishes three structured pauses: before the induction of anaesthesia, before incision and before leaving the operating room. It confirms identity, procedure, site, consent, allergies, antibiotics, expected blood loss, imaging, equipment, counts, specimens and recovery issues. Its value is not only in terms of mechanical completion, but also on the level of active participation and implementation at the local level (Alsadoun et al., 2024). Closed-loop communication is used during emergencies to give tasks to be carried out with names, to read back important instructions and to check for completion. Documentation and de-briefing follow to facilitate learning and prevention.

2.6 Immediate Postoperative Care

It starts with a structured handover that includes a description of the procedure, anaesthetic technique, airway, blood loss, fluids and blood products, medications, allergies, drains, catheters, specimens, complications, analgesia and specific risks. Assessment is done after airway, breathing, circulation, neurological status, exposure and comfort in recovery. Respiratory rate, oxygen saturation, heart rate, blood pressure, temperature, consciousness and pain are assessed at

intervals corresponding to the level of risk. Airway obstruction, hypoventilation, aspiration, residual weakness and bleeding may occur during emergence and must be observed until a few recovery criteria are fulfilled (Klein et al., 2021). There should be no unnecessary distraction at handover, and it should identify the issues that are likely to arise, unusual findings and who to contact. The receiving practitioner restates key instructions to ensure clarity of responsibilities, monitoring frequency and escalation thresholds.

Access to breathing, coughing, mobilisation and rest should be maintained in pain management without excessive sedation and respiratory depression. Multimodal plans can include non-opioid medications, regional or local methods, and opioids that are carefully dosed. Early review also covers dressing, wound, drain output, urine output, perfusion, nausea, glucose (if applicable), and procedure-specific neurological and/or abdominal issues. Escalation required for hypoxia, hypotension, hypothermia, increase in pain, fresh bleeding, confusion, or low urine output. Post-operative ward safety is enhanced through explicit handover, staffing, rapid response criteria, and higher level care for

unstable and/or high risk patients (Snarskis et al., 2023). Transfer from recovery only if adequate control of airway, ventilation, circulation, consciousness, temperature, pain, nausea and bleeding. The receiving ward or the critical-care area should be able to meet the monitoring and treatment requirements outlined in the handover.

2.7 Postoperative Complications

Surgical-site infection may manifest itself as an increase in pain, redness, warmth, swelling, purulent drainage, fever, wound disruption or deep collection. Treatment varies with severity of the infection and can include cultures, opening, drainage, antibiotics, imaging, physiological support, and either operative or radiological source control. Sepsis and organ failure may proceed if source control is not achieved in time in cases of intra-abdominal infection (Huston et al., 2024). Prevention involves regular performing of perioperative bundles, hand hygiene, wound and lines, and surveillance (Calderwood et al., 2023). Bleeding may be obvious or hidden; signs of bleeding include tachycardia and hypotension, pallor, worsening pain or swelling, decreasing urinary output, confusion and decreasing haemoglobin which all need prompt evaluation and potentially return to the theatre or interventional radiology unit.

Deep-vein thrombosis and pulmonary embolus fall under the term venous thromboembolism. Major surgery, cancer, immobility, previous thrombosis, age, obesity and comorbidity are all risk factors. Prevention is after individual thrombosis and bleeding assessment and can involve mobilisation, mechanical and pharmacological thrombosis prophylaxis. It is imperative to have correct timing, use of the device, reassessment and patient education (Speth, 2023). Any new onset breathlessness, chest pain, hypoxia, tachycardia or unilateral limb swelling should be urgently investigated.

Organ dysfunction can manifest in the lungs, kidneys, heart, brain or gastrointestinal tract. Pulmonary complications are atelectasis, pneumonia, aspiration and respiratory failure. Risk models can help with planning, but with external validation, performance has been found to differ across populations and must be integrated with clinical judgement (STARSurg Collaborative & TASMAN Collaborative, 2022). Urine output, serum creatinine, perfusion, fluid balance, drugs, obstruction, and infection are the items used to assess acute kidney injury. Pressure injury, urinary retention, myocardial injury, ileus, and delirium are also conditions that should not be left untreated. Important preventive measures include adequate analgesia, breathing support, nutrition, line removal where possible and realistic early mobilisation (Tazreean et al., 2022). In addition, careful fluid and drug review, prevention of pressure areas, delirium reduction, and removal of unnecessary urinary and vascular devices are all part of prevention. Advice for the patient and family regarding indications for

wound change, fever, breathlessness, chest pain, persistent vomiting, decreased urinary output, etc., is clearly documented in writing before discharge.

Common Postoperative Complications: Warning Signs and Immediate Responses

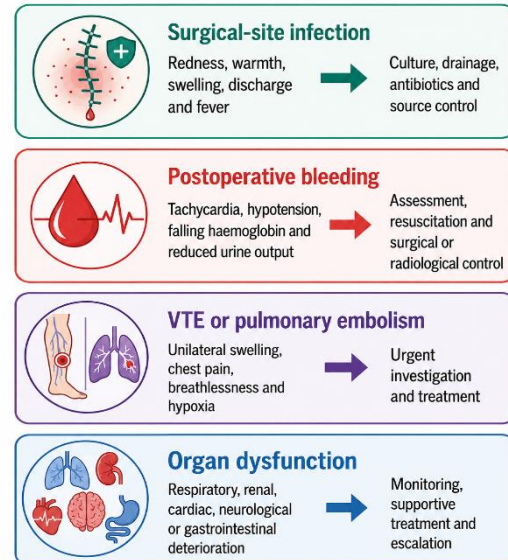


Figure 2.3: Common Postoperative Complications: Warning Signs and Immediate Responses.

2.8 Quality Improvement, Patient Safety, and Future Directions

Quality improvement is a mechanism for improving the reliability of care based on data that provide information on outcomes as well as process. Form completion is not a measure of meaningful practice – checklists, standardised handovers, count policies, antibiotic-timing measures, and escalation pathways reduce dependence on memory. Review should focus on participation, hazards identified, actions taken and local barriers (Alsadoun et al., 2024). Useful outcomes are mortality, complications, return to theatre, unexpected critical-care admission, infection, readmission, length of stay, and recovery (from patient's perspective). Audit, incident review, simulation, morbidity and mortality meetings and patient feedback should not only look at individual blame, but take into account other factors that may have contributed to an incident, such as workload, equipment, staffing, supervision and communication. The measures are considered, interpreted over time and adjusted for case complexity, where possible, so that any apparently differences are not misinterpreted as avoidable harm. Small-scale testing can also provide an opportunity for a change on a small scale, see how it's performing, and tweak it before rolling it out more broadly. Training, feedback, leadership support and repeat auditing should be used to support improvements and not used as one-off projects.

AI can be used for risk prediction, image interpretation, instrument recognition, workflow analysis, training, and

postoperative deterioration alerts. It needs to be used with representative data, an external validation, explainability, privacy protection, monitoring of its bias, and accountable clinical oversight. Morris et al. (2024) outline significant opportunities for decision support and education, and caution about the potential harms of false or opaque predictions. Thus, AI needs to be used to support an open, clear clinical decision making and not to supplant judgment.

Advanced robotics could enhance visualisation, ergonomics, motion scaling, navigation and select minimally invasive procedures. The possibility of future systems including augmented reality, force sensing and partially automated subtasks exists, but training, credentialing and maintenance must be taken into consideration along with cybersecurity and an emergency conversion plan. Personalised surgery utilizes knowledge of anatomy, comorbid conditions, frailty, molecular information and patient preferences to choose the surgery and recovery pathway. When considering the adoption of wearable monitoring, remotely viewable wound review, smart implants, three-dimensional (3D) planning and connected recovery systems, they should only be considered if they enhance outcomes, usability, cost-effectiveness and equity. Even for a technology-rich care, reliable escalation and postoperative system design remains fundamental (Snarskis et al., 2023). Precision approaches include integrating molecular pathology, imaging, anatomy, frailty and predicted response to treatment to individualize cancer margins, peri-operative therapy, implant selection or monitoring. They should be discussed via shared decision-making as a more detailed prediction does not remove uncertainty, competing risks or the patient's preference.

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