Transition to Perioperative Practice Program

PARTICIPANT RESOURCE MANUAL

NSW GOVERNMENT

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The NSW Ministry for Health acknowledges the traditional custodians of the lands across NSW. We acknowledge that we live and work on Aboriginal lands. We pay our respects to Elders past and present and to all Aboriginal people.

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FOREWORD

Perioperative nursing is a fast paced nursing specialty, requiring a broad level of skill and ability to meet the care needs of patients and their families in the high acuity, technical environment of the Operating Suite. Perioperative nurses are an integral part of the multidisciplinary surgical and anaesthetic team.

For nurses starting out in the perioperative specialty, the environments and work flows may represent a very different way of nursing. The Transition to Perioperative Practice (T2PP) Program is a foundational education program designed to provide a consistent approach in the support of new perioperative nurses as they develop new knowledge and skills. The program strengthens critical thinking, guides the development of technical abilities, and reinforces the importance of communication and teamwork in providing safe, quality care for perioperative patients. It is intended to be used in perioperative services across NSW Health as an educational resource for all nurses new to perioperative practice.

This participant resource manual is the core theoretical component of the program and is complemented by a skills booklet and a facilitator manual. Participants will be supported to meet the learning objectives and master the basic skillsets by senior clinical staff.

The development of the T2PP has been a lengthy process which reflects the commitment of perioperative nurses to their area of practice. I acknowledge and thank all clinicians involved for their enthusiasm and work in enabling T2PP to be developed. I am sure this resource will significantly benefit nurses new to perioperative services, and most importantly, have a positive impact on the care of our patients.

I wish you a warm welcome to the perioperative team!

Jacqui Cross
Chief Nursing and Midwifery Officer, NSW Health

ACKNOWLEDGEMENTS

The T2PP has been developed by Project Officers and a perioperative reference group formed during 2016-17 including Clinical Nurse Consultants, Nurse Educators, Clinical Nurse Educators, Nurse Managers, and Nurse Unit Managers from across NSW Health. Consultation was provided by Health Education & Learning Partnerships (HE&LP) and the Health Education and Training Institute (HETI).

NSW Health thanks all contributors, whose knowledge and experience have been integral to the development and review of this document.

GLOSSARY

Term	Definition
Accountability	Registered and enrolled nurses are answerable to others, such as health care consumers, the relevant national nursing and midwifery regulatory authority, employers and the public for decisions, actions, behaviours and the responsibilities that are inherent in perioperative nursing. Accountability cannot be delegated, but if actions are delegated, the RN responsible for delegation remains accountable and responsible for monitoring and evaluating the performance.
Anaesthetic bay/ Anaesthetic room	Clinical area directly connected to the Operating Room (OR), used to hold the pre-operative patient until OR is available. Area where patients are prepared for anaesthesia and where anaesthesia may be induced prior to transfer into the OR.
ASA Score	American Society of Anesthesiologists Score: a global score that assesses the physical status of patients before surgery. The addition of 'E' to a score denotes Emergency surgery: an emergency is defined as existing when delay in treatment of the patient would lead to a significant increase in the threat to life or body part.
Asepsis	Absence of pathogenic microorganisms on living tissue.
Aseptic field	Area around the surgical site that has been prepared using an antimicrobial agent and draped ready for surgery. The aseptic field also includes all furniture covered with sterile drapes, such as the instrument table, and the surgical team who don sterile gown and gloves.
Aseptic technique	Specific actions taken to prevent contamination by microorganisms of aseptic fields, patients and equipment.
Bronchospasm	Acute narrowing and obstruction of the respiratory airway caused by irritation (e.g. secretions, airway equipment or pulmonary aspiration) or injury to the respiratory mucosa, infections, allergies, drug hypersensitivity or the rapid introduction of volatile anaesthetic agents. Characterised by expiratory wheeze.
Capnography	Graphical representation of expired carbon dioxide ($C0_2$), often termed end-tidal $C0_2$.
Central nerve block	Administration of local anaesthetic drugs into the subarachnoid or epidural space, blocking nerves as they exit the spinal cord and causing large areas of the lower body to lose sensation (hence, the term 'block'). Also known as central neuraxial block.
Confidentiality	Restricts the sharing of private information about an individual without their consent.
Consent	The patient's agreement with a healthcare professional to provide specific treatment and care. Must meet certain criteria to be considered valid.
Conscious sedation	Drug-induced depression of consciousness during which patients are able to respond purposefully to verbal commands or light tactile stimulation. May be used in procedures such as colonoscopy.
Core temperature	Temperature of the internal environment of the body. Measured non-invasively using temporal artery, oral, and nasal temperature probes.
Cricoid pressure	Also known as Sellick's manoeuvre. It is a technique to reduce the risk of the aspiration of gastric contents during the induction of general anaesthesia which may lead to a condition known as Mendelson's syndrome. Digital pressure is applied to the cricoid cartilage pressing it against the sixth cervical vertebrae, occluding the upper end of the oesophagus. It is applied immediately after the injection of anaesthetic drugs and before tracheal intubation, and as part of a *rapid sequence intubation*. Used for patients at risk of aspiration e.g. trauma, pregnancy.
Dead space	Empty space between layers of tissue or beneath wound edges. Elimination of dead space is important in preventing the accumulation of blood or fluid and possible haematoma.

Term	Definition
Diathermy/ Electrosurgery	Generation of high frequency electrical current which creates heat in body tissue, resulting in coagulation of blood vessels providing haemostasis and a bloodless field during a surgical procedure. There are two main types: monopolar and bipolar.
Endoscopy	Visualisation of the interior of organs and cavities of the body with a rigid or flexible endoscope. Used for diagnostic and therapeutic purposes e.g. gastroscopy.
Endotracheal tube (ETT)	Large-bore, disposable silicone or PVC tube inserted through the mouth or nose and into the trachea to the point above the bifurcation of the trachea. Used to deliver anaesthetic gases and oxygen directly into the trachea through the vocal cords. ETTs may have a single or double lumen (for lung surgery). Adult-sized ETTs have a cuff at their distal end, which, when inflated with air, seals off the trachea, permitting positive pressure ventilation and decreasing the risk of aspiration.
Epidural anaesthesia/ analgesia	Type of central nerve anaesthesia block in which a local anaesthetic drug is injected via a fine catheter into the epidural space surrounding the dural membrane, which contains cerebrospinal fluid and spinal nerves. The catheter lies between the dura mater and ligamentum flavum at the L3-4 or L5-6 level. An epidural injection can be used to facilitate surgery of the lower half of the body and/or provide prolonged postoperative analgesia.
Evidence based practice	Conscientious, explicit and judicious use of theory-derived, research-based information used in decision making when planning and implementing patient care.
5 Moments of hand hygiene	WHO program, 'Save Lives: Clean your Hands', launched in 2009. Identifies the 5 key moments in patient care when the application of effective hand hygiene can be reduce risks of transmission of infective agents.
General anaesthesia (GA)	Reversible, unconscious state characterised by amnesia, loss of sensation, analgesia and suppression of reflexes.
Haemodynamic monitoring	Measurement of a patient's circulation (blood pressure and ECG), respiration (pulse oximetry and capnography) and temperature.
Haemostasis	Termination of bleeding by mechanical, chemical means or by the coagulation processes of the body.
Healthcare associated or acquired infection (HAI)	Infection acquired during the course of receiving healthcare. Also known as a nosocomial infection.
Human factors (including non-technical skills)	Interrelationships of people to their environment and to each other, which need to be considered to optimise performance and assure safety e.g. teamwork, situational awareness, communication.
Inadvertent perioperative hypothermia (IPH)	Preventable complication of perioperative procedures, which is associated with poor outcomes for patients. Active warming measures are initiated prophylactically and when the patient's temperature is below 360C.
Ionising radiation	Type of energy released by atoms in the form of electromagnetic waves (gamma or x-rays) or particles (neutrons, beta or alpha): health sources include x-rays and medical devices.
Laparoscopy	Form of minimally invasive surgery (MIS). Examination of the abdominal cavity and viscera with a laparoscope inserted through one or more small incisions in the abdominal wall. Can be diagnostic or therapeutic.
Laryngeal mask airway (LMA)	Device for maintaining a patent airway during general anaesthesia when tracheal intubation is not indicated. LMA consists of a tube connected to an oval inflatable cuff that sits above the larynx, sealing the airway and through which anaesthetic gases are delivered.

Term	Definition
Laryngospasm	Anaesthetic airway emergency due to spasmodic closure of the larynx. Caused by local irritation, such as the presence of secretions, airway equipment or pulmonary aspiration in the back of the pharynx, resulting in partial or complete spasm of the vocal cords and the inability of the patient to breathe effectively. Partial laryngospasm may be characterised by a 'crowing' sound made on inspiration. In a total laryngospasm there is no sound made as no air moves into or out of the lungs; ineffective respiratory efforts will be noted in chest movement. Requires immediate action to restore patient's airway and respiratory function.
LASER	Acronym '*light amplification by stimulated emission of radiation*'. Can be used to destroy or refashion tissue. Strict safety procedures and protective attire (goggles) must be worn when using LASER.
Latex allergy	Hypersensitivity to the soluble proteins in latex, most often seen in patients sensitised by repeated exposure to latex. Reactions range from irritant dermatitis and eczema to anaphylactic collapse. Can also affect staff members e.g. gloves used in perioperative environment.
Local anaesthetic (LA)	Direct administration of an anaesthetic agent (e.g. lignocaine) to tissues to induce the absence of pain sensation in that part of the body. Used to facilitate many minor procedures, for example, excision of skin lesions.
Multidisciplinary team (MDT)	Describes the surgical, nursing and ancillary staff who care for surgical patients within the perioperative environment.
Malignant hyperthermia (MH)	Rare, life-threatening, genetic hypermetabolic condition characterised by severe hyperthermia and rigidity of the skeletal muscles triggered by inhalational anaesthetics and the muscle relaxant succinylcholine. Immediate specific treatment is required.
National Standards	National Safety and Quality Health Service (NSQHS) Standards developed by the Australian Commission on Safety and Quality in Healthcare (ACSQHC) to drive the implementation of safety and quality systems and improve the quality of health care in Australia.
Patient controlled anaesthesia (PCA)	Drug delivery system consisting of a computerised pump with a chamber holding a syringe of drug. Dispenses a prescribed dose of a narcotic analgesic for pain relief when the patient pushes a switch attached to the pump. A lockout interval automatically inactivates the system if a patient tries to increase the amount of narcotic within a pre-set period.
Perioperative	The period immediately before, during and immediately after surgery.
Personal protective equipment (PPE)	Range of equipment, such as gloves, eye protection, masks and plastic aprons used to protect healthcare staff and patients from transmission of infectious diseases.
Pre-admission Clinic (PAC)	Department where surgical patients undergo preoperative assessment, education and discharge planning. The process is undertaken either face to face or via a telephone conversation to ensure patients are prepared physically and mentally for their procedure.
Post anaesthetic care unit (PACU)/ Recovery Room	Unit within the operating suite where surgical patients are cared for and monitored in the immediate post-operative period by specially trained nurses.
Person/patient centred care	Healthcare that is respectful of and responsive to the preferences, needs and values of patients, families and consumers.
Pulse oximetry	Device attached to the patient's finger or earlobe that measures the amount of saturated haemoglobin in the tissue capillaries. A reading above 95% is considered within normal limits.
Rapid sequence induction	Also referred to as crash induction. Anaesthetic induction technique used in patients when there is a risk of aspiration of gastric contents. See also *cricoid pressure*.

Term	Definition
Regional anaesthesia	Local anaesthetic drug injected to block a group of sensory nerve fibres. for example, axillary, brachial plexus, caudal, epidural, pudendal, intercostal, paracervical and spinal anaesthesia.
Sentinel event	Subset of nationally agreed and reportable adverse events that result in death or serious harm to a patient and caused specifically by healthcare, rather than underlying patient condition.
Situation awareness	A human factor/non-technical skill requiring the ability of an individual to watch, listen, understand cues and anticipate actions of the surgical team. An awareness of the 'big picture' which can enhance good teamwork and communication.
Standard procedures	Infection prevention strategies aimed at reducing transmission of microorganisms through contact with blood and body fluids, for example, the use of personal protective equipment (PPE) and safe work practices.
Sterile	Free from all living microorganisms.
Sterilisation	Processes used to eliminate or destroy all microbial life from surgical instruments and equipment in preparation for use in surgical procedures.
Sterilising services department (SSD)	Centralised department within a hospital which manages the reprocessing of reusable medical devices (RMD).
Surgical conscience	Individual's professional honesty and inner morality system, which allows no compromise in practice whether a breach occurs within the team or when working alone.
Surgical site infection (SSI)	Infection caused by the introduction of pathogenic microorganisms during surgical procedure.
Surgical team	Multidisciplinary team (MDT) who have performed surgical hand antisepsis, are gowned and gloved and work cooperatively to perform the planned surgery.
SurgiNet	The electronic medical record (eMR) application used in NSW Health Operating Suites.
Therapeutic Goods Australia (TGA)	Australia's regulatory authority for therapeutic goods.
Transmission based precautions	Additional precautions to standard precautions applied when patients are known or suspected of being infected with transmissible pathogens. Three modes: airborne, droplet and contact – each require a range of strategies to prevent transmission.
Venous thromboembolism (VTE)	Development of venous thrombosis and possible subsequent pulmonary embolism (PE). Preventable surgical complication minimised by the use of mechanical and pharmacological measures during the perioperative period.

ABBREVIATIONS

ACI	Agency for Clinical Innovation
ACORN	Australian College of Perioperative Room Nurses
BiPAP	Bi-level positive airway pressure
BVM	Bag valve mask
CICO	Can't intubate can't oxygenate
CEC	Clinical Excellence Commission
CNC	Clinical Nurse Consultant
CNE	Clinical Nurse Educator
CNS	Clinical Nurse Specialist
CO_2	Carbon Dioxide
CPAP	Continuous positive airway pressure
CSSD	Central sterilising services department see also SSD
CVAD	Central venous access device
CVC	Central venous catheter
CVP	Central venous pressure
DSU	Day surgery unit
DOSA	Day of surgery admission
EDO	Extended day only surgery
eMR	Electronic medical record (e.g. Surginet)
ETT	Endotracheal tube
EVD	External ventricular drain
FBC	Full blood count
GCS	Glasgow Coma Scale
HAI	Healthcare associated infection
HEPA	High efficiency particulate air
ISBAR	Identification, Situation, Background, Assessment, Recommendation: structured handover
LMA	Laryngeal mask airway
LOS	Length of stay
OR	Operating room, also known as an operating theatre
OS	Operating Suite: pertains to the entire operating theatre complex
MDT	Multidisciplinary team
MH	Malignant hyperthermia
MO	Medical Officer
MOH	NSW Ministry of Health
MRO	Multi-resistant organism

NE	Nurse Educator
NIBP	Non-invasive blood pressure
PAC	Pre-admission Clinic
PACU	Post anaesthetic care unit (Recovery Room)
PaO_2	Partial Pressure of Oxygen in Arterial Blood
PCA	Patient controlled analgesia
PD	Policy directive: published through MOH or LHD
PEEP	Positive end-expiratory pressure
PPE	Personal protective equipment
SaO_2	Arterial oxygen saturation
SGA	Supraglottic airway
TGA	Therapeutic Goods Australia: Australia's regulatory authority for therapeutic goods
VRE	Vancomycin resistant enterococcus

RECOMMENDED TEXTS AND RESOURCES

RECOMMENDED TEXTS

Australian College of Perioperative Nurses (2018). *Standards for Perioperative Nursing in Australia*. ACORN, Australia.

Hamlin, L., Davies, M., Richardson-Tench, M., & Sutherland-Fraser, S. (2016). *Perioperative Nursing: An introduction*. Elsevier, Australia.

USEFUL TEXTS/RESOURCES

Agency for Clinical Innovation (2016). *The perioperative toolkit*. ACI, Sydney.

Odem-Forren, J. (Ed.) 2017. *Drain's Perianesthesia care: A critical care approach*. Elsevier, Sydney

Rothrock, J. (2018) *Alexander's care of the patient in surgery*. 16th edition. Elsevier, Sydney.

Staunton, P. & Chiarella, M. (2016). *Law for nurses and midwives*. 8th edition, Churchill Livingstone, Sydney

USEFUL WEB RESOURCES

AANSA Australian Association of Nurse Surgical Assistants

ACI Agency for Clinical Innovation

ACORN Australian College of Perioperative Nurses

ACPAN Australian College of Peri Anaesthesia Nurses

ACSQHC Australian Commission on Safety and Quality in Healthcare

ANZCA Australian and New Zealand College of Anaesthetists

Bureau of Health Information Independent reporting of NSW Health system performance

CEC Clinical Excellence Commission

CIAP Clinical Information Access Port

GENCA Gastroenterological Nurses College of Australia

My Health Learning Online learning for NSW Health staff

NSW Health Policy and Guidelines

NSW OTA NSW Operating Theatre Association

WHO World Health Organization

USEFUL SMARTPHONE APPS

ScrubUp, Butterfly Systems: information management of surgical preferences, setups, stock, procedures

AO Surgery Reference: procedures, anatomy and management of fractures

ShoulderDoc: diagnosis, treatment and operations for shoulder injuries

CRMD Finder: helps identify cardiac rhythm management devices from X-ray

Meducation: compilation of medical learning resources

Perioperative Care: care of special patient groups and management of emergencies

Nursewell: Self-care app for nurses developed by SESLHD nurses

JOURNALS

Journal of Perioperative Nursing in Australia (ACORN)

AORN Journal

Journal of Perioperative Practice (AfPP)

Journal of Peri Anaesthesia Nursing

Perioperative Care and Operating Room Management

Canadian Operating Room Nursing Journal (ORNAC)

Journal of Infection Prevention

Journal of Prevention and Infection Control

Anaesthesia

ADDITIONAL

My Health Learning modules, LHD libraries, LHD and NSW Health policy/procedure/guidelines

Contents

INTRODUCTION

The Transition to Perioperative Practice (T2PP) program provides a foundation level of knowledge and skills for nurses new to the perioperative environment. T2PP utilises a standardised yet flexible approach including resources, case studies, learning opportunities, peer support, and clinical skills assessments to be undertaken by the participant on the job.

The perioperative environment is a diverse place to work and can be challenging, especially when starting in a role that is significantly different to previous experiences. T2PP aims to support the new perioperative clinician with both theoretical resources and clinical guidance as they master the basic skillset and processes required to care for the perioperative patient.

T2PP is designed for RNs and ENs who are new to the perioperative environment, including but not limited to:

- recently graduated nurses with limited or no perioperative nursing experience
- nurses wishing to make a transition to perioperative nursing from other clinical areas
- nurses returning to perioperative nursing
- nurses transitioning to a new perioperative nursing role.

Perioperative nursing involves the four key roles of anaesthetic nurse, circulating nurse, instrument nurse, and post anaesthesia care unit (PACU) nurse. Depending on the clinical context, the transitional nurse may work in one role or across multiple roles. It is beneficial to gain insight into each role for consolidated learning and to understand the interconnectedness of the perioperative environment, however it is acknowledged that each Operating Suite will use the program according to local capacity.

The key objectives of the program are to:

- develop the confidence and competence of the perioperative nurse within a supportive clinical setting to provide quality patient care
- collaborate with all members of the healthcare team to develop an educationally supportive clinical culture
- provide the novice perioperative nurse with a comprehensive but flexible program, that supports transition to advanced beginner
- provide varied learning opportunities during which the participant can access, share, and validate knowledge
- develop communities of practice that are reflective, responsive, and that value critical thinking.

It is expected that participants completing the program will build sound knowledge and practical skillsets, enabling them to achieve the following learning outcomes:

- demonstrate knowledge and skills across one or more of the roles of the anaesthetic nurse, instrument nurse, circulating nurse, and PACU nurse and understand how each role contributes to safe outcomes for the surgical patient
- assess and plan safe and effective nursing care for the patient and their parent/carer in the perioperative environment.

PROGRAM FRAMEWORK

T2PP is underpinned by the principles of adult learning to encourage the participant to be reflective, think critically, and respond appropriately.

Facilitators and clinical support

Participants in T2PP are assigned a facilitator and a clinical support person, who support and assist in the participant's professional adjustment and skill acquisition. These roles are undertaken by CNEs or senior registered nurses with the capability of mentoring and assessing the participant.

Program features

The features of the program include:

- **National standards for the registered nurse and enrolled nurse standards for practice:** T2PP aligns with the Nursing and Midwifery Board of Australia's standards and champions the RN domains of professional practice, critical thinking and analysis, provision and coordination of care, and collaborative and therapeutic practice, and the EN domains of professional and collaborative practice, provision of care, and reflective and analytical practice.
- **Team approach to clinical support**: Ensuring the learner has an effective support network is integral to achieving T2PP objectives. The participant is supported by a facilitator and clinical support person who are key in assisting in knowledge and skill acquisition, however the greater nursing team should assist to facilitate learning within the clinical environment.
- **Recognition of prior learning (RPL)**: RPL is a process for giving students credit for skills, knowledge and experience gained through working and learning. Any RPL enquiries should be discussed with the facilitator.
- **Professional development**: Continuing professional development is a requirement of RNs and ENs as part of registration.

PROGRAM DELIVERY

The facilitator has an initial meeting with participants as they commence in the perioperative environment to discuss the program as a whole, review expectations, and develop a learning plan.

The learning plan allows the facilitator and participant to keep a record of progress and key discussions, and to ensure the participant is meeting the requirements of the program. Regular meetings between the facilitator and participant should be scheduled to discuss progress, resolve issues, plan education for any knowledge gaps, and review participant learning and development.

Duration

The program is self-paced. The duration will vary between facilities and depends on the number and extent of experiences that are able to be offered in each nursing role. A minimum program time of six months is recommended.

Learning resources

There are three resources associated with T2PP: the participant's resource manual, the clinical skills and performance assessment booklet (CSPA), and the facilitator's manual. Participants are expected to work in partnership with their facilitators to affect their rotations and complete the resource manual in order to achieve the clinical skills.

Resource manual

T2PP is divided into five components of study:

1. Introduction to perioperative nursing
2. Safety and quality of care
3. Anaesthetic nursing
4. Intraoperative nursing – circulating and instrument nurse roles
5. Post anaesthetic care unit (PACU) nursing

Each of the five components contains guided reading and suggested activities, with opportunities for additional self-directed consolidation via videos and websites.

Participants are recommended to commence T2PP with the *Introduction to Perioperative Nursing* and *Safety and Quality of Care* (Components 1 and 2), which provide general information common to all perioperative roles.

The topics covered in Components 3, 4, and 5 are presented in the format of a 'virtual operating suite'. Participants are provided with an operating list of the patients and their procedures. The readings and activities relate to aspects of patient care as the patients progress through their procedures.

Learning actions and opportunities for self-directed consolidation are referenced in-text throughout each component as follows:

ACTIVITY	Opportunities and exercises to consolidate the program content are referred to in-text and found in the back of each component
READ	Suggested related chapters, articles, and readings
VIEW	Links to online learning and video resources

Recommended texts

The recommended texts may be held by your Operating Suite or accessed via your facility or LHD/SN library.

- Australian College of Perioperative Nurses (2018). **Standards for perioperative nursing in Australia**. ACORN, Australia.
- Hamlin, L., Davies, M., Richardson-Tench, M., & Sutherland-Fraser, S. (2016). **Perioperative nursing: an introduction**. Elsevier, Australia.

Activities

Throughout each component are learning activities related to the patient scenarios. These can be completed in the Activity sections at the end of each Component. Answers to some activities are facility specific and will require completion based on local policies and practices.

Clinical skills and performance assessment (CSPA)

Perioperative nursing skills will be developed by participants by building on their theoretical knowledge whilst working as part of the multidisciplinary team, supported by the facilitator and colleagues as necessary. As part of the T2PP, key clinical skills will be assessed. These are in addition to the clinical assessments required locally by the facility and/or department.

Performance assessments are available for each perioperative nursing role. They take a holistic approach to clinical performance requiring observation of the participant's practice over approximately a four hour period (or one theatre session) by your facilitator or clinical support person. This provides the opportunity to observe the participant across a number and variety of procedures and related nursing care.

Participants are encouraged to self-assess their performance for discussion and comparison of ratings following the assessment.

In addition to the holistic performance assessments, a number of **stand-alone clinical skills assessments** are available to assess development whilst undertaking specific skills e.g. scrubbing, gowning and gloving, or checking an anaesthetic machine. These skills may be assessed under simulation conditions if clinical opportunities are unavailable or are considered unsuitable.

The ongoing assessment of clinical performance should be viewed as another tool to guide learning and development. The participant will be assessed as a foundation level clinician. The CSPAs are included in a separate workbook and include:

Role	Clinical skills and performance assessments (CSPAs)
Anaesthetic nurse	Performance assessment
	Clinical skills: • checking anaesthetic machine • basic airway management (anaesthetics) • intubation (adult) • rapid sequence induction • counting (for anaesthetic procedures and relief)
Circulating nurse	Performance assessment
	Clinical skill: • counting
Instrument nurse	Performance assessment
	Clinical skill: • surgical hand antisepsis, gowning and gloving
PACU nurse	Performance assessment
	Clinical skills: • pain management • airway management • intubation (adult)

Expectations and commitment to T2PP

Gaining experience in each perioperative role is beneficial for consolidated learning and to understand the interconnectedness of the perioperative environment. However, this may not be possible in every Operating Suite. Acknowledging that, it is recommended participants complete the program in approximately six months with variances for fewer or more role rotations. The participant is considered to have completed the program once the CSPAs have been successfully completed for the nursing roles undertaken.

At the commencement of the program, the required level of commitment is to be discussed between the participant, facilitator, and clinical support person. As with many professional development opportunities, T2PP may require some commitment of time outside rostered shifts.

The facilitator's role is to guide the participant through the program, assist in creating learning opportunities, and assess the participant's learning as required.

Clinical support persons also commit to facilitating informal learning and assessing competency within the clinical environment.

In addition to the structured learning activities in this document, participants are required to complete other training programs mandated by either NSW Health, the Local Health District/Specialty Network (LHD/SN) or facility (e.g. DETECT).

Facilitator manual

The facilitator's manual provides a resource for facilitators and clinical support people. It contains answers to the activities within the resource manual and the CSPA booklet.

Ongoing professional development

Perioperative career development pathway

The NSW Operating Theatre Association's *Career Development Pathway for the Registered Nurse in the perioperative environment* and *Career Development Pathway for the Enrolled Nurse in the perioperative environment* are useful timeframe guides for the development of perioperative skills. Blair's table (Figure 1-1) also provides a guide for clinical development.

Figure 1-1. Clinical development for perioperative nurses

Stage	Practice level	Time frame
Stage one	Induction requirements for the NOVICE or NEW nurse to the perioperative environment	0 – 3 months
Stage two	Advanced beginner	3 – 12 months
Stage three	Intermediate practice	12 – 24 months
Stage four	Advanced practice	2 years and above
Stage five	Specialisation/extended practice	5 years and above

Adapted from Blair 2013

Additional learning opportunities

Continuing professional development (CPD) activities can be undertaken in a variety of ways, and may include:

- attending local study days and inservices, conferences or professional education sessions
- undertaking supervised practice for skills development
- reflecting on clinical practice with a support person
- participating in clinical supervision/action learning sets
- undertaking simulation exercises.

Program evaluation

As each LHD/SN will use the T2PP resources differently, participants and clinical support people are encouraged to provide program feedback directly to their facilitators. Evaluation of the program as adapted locally may be undertaken within LHD/SNs.

Recognising that perioperative nursing is a contemporary and evolving specialty, the program content will be subject to periodic review by the Nursing and Midwifery Office, NSW Health.

Perioperative orientation

Orientation to the perioperative environment is critical for safety and efficiency. Information on the following topics is essential for perioperative nurses and should be included in local orientation programs:

- accessing the OS
- key locations: ORs, PACU
- staff areas including change rooms, lockers, tea rooms, bathrooms etc.
- emergency procedures and equipment
- evacuation routes, evacuation aids, and assembly points
- equipment and sterile stock storage
- scrub bays and clean up areas
- specimen and pathology dispatch area
- WHS information and considerations
- computer access
- duty board, rosters, and allocation board
- check in area
- stores delivery and dispatch.

The participant is required to attend and complete the local mandatory requirements of corporate, nursing, and perioperative department orientation in addition to undertaking the transition program.

COMPONENT 1

INTRODUCTION TO PERIOPERATIVE NURSING

Aim

The aim of this component is to provide new perioperative nursing staff with an introduction to the operating suite environment and an overview of the multidisciplinary team approach in caring for the pre-, peri- and post-operative patient.

Learning outcomes

On completion of Component 1, participants will be able to:

- describe the principles of Operating Suite (OS) design and the impact of the environment on the care of the patient
- identify the various roles within the multidisciplinary perioperative team and explain the team approach to patient care
- describe the relationship of allied health care workers and other units/departments within the OS
- define the term human factors and describe how human factors impact patient safety in the perioperative context
- provide strategies for clear and effective communication to patients, families, and members of the multidisciplinary team.

Overview of the operating suite and nursing roles

The Operating Suite (OS) is the area within a hospital where patients are provided pre-, intra-, and immediate post-operative (perioperative) care whilst they undergo surgery. It is a unique, specialised environment accessed on a needs basis by patients of all ages and in all states of health or illness. It is a dynamic, challenging environment where effective teamwork is vital for the safe outcome of the surgical patient.

The goals of nursing care within the OS focus on patient-centred clinical care, safety, advocacy, and teamwork. Specialised technical and non-technical skills are integral to the effective and safe delivery of perioperative care and as such, perioperative nursing is a recognised nursing speciality.

The following video was made by the staff at Concord Hospital, Sydney, highlighting the role perioperative nurses play in the care of the perioperative patient.

VIEW

ACORN and **Sydney LHD video** Day in the life of a Perioperative Nurse
http://www.acorn.org.au/acorn/perioperative-careers/

READ

Scroll down on the above **ACORN** webpage and read the summary of perioperative nursing roles which will be described in detail in the following section.

Nursing roles

Perioperative nursing includes a range of specific roles in the pre-admission, pre-operative, intra-operative, and post-operative care areas. In some facilities, nurses will be skilled in multiple roles. Each position has a central role in ensuring the patient has an optimal outcome in a safe environment.

Pre-admission nurse

The pre-admission nurse role, whilst not based in the OS, includes clinical and risk assessment, and education of patients as part of a pre-admission team within a Pre Admission Clinic (PAC). The pre-admission process occurs via telephone or directly with patients presenting to the general or multidisciplinary PAC for pre-admission assessment, education and pre-operative tests. Planning for the patient's discharge also commences in the PAC, with pre-admission nurses well positioned to reassure patients, reduce anxiety, and increase compliance with pre- and post-operative instructions.

Anaesthetic nurse

The role of the anaesthetic nurse is twofold: as a nurse responsible for ensuring the patient receives safe, person-centred, high quality care immediately prior to and during the intraoperative period, and as an assistant to the anaesthetist. Anaesthetic nurses require knowledge of anatomy, physiology, pharmacology, and to be technically competent with anaesthetic equipment. The ability to communicate effectively and provide psychological support to the patient is important during a time of great vulnerability for the patient.

Practically, the anaesthetic nurse is responsible for:

- preparing the anaesthetic bay and OR for anaesthesia
- receiving the patient into OS and carrying out the required pre-operative patient checks e.g. identification, allergies etc.
- providing nursing care throughout the pre- and intra-operative period
- delivering skilled assistance to the anaesthetist for the duration of anaesthesia.

In some facilities, the role of anaesthetic assistant is undertaken by an anaesthetic technician: there are differences in their scope of practice.

Figure 1-2. Anaesthetic nurse at induction

Source: SCHN 2016

Circulating nurse (alternatively, Scout nurse)

The role of the circulating nurse is critical to a safe patient outcome. The circulating nurse works closely with the instrument nurse and they may alternate roles during the course of an operating list.

Key responsibilities of the circulating nurse include to:

- establish and monitor the aseptic field
- open sterile items and equipment
- ensure and maintain patient safety and dignity
- assist the surgical team as a mobile resource within the OR to ensure all supplies and equipment are available during the surgical procedure
- collaborate with the surgical team to ensure that all instruments, accountable items, and other items used during surgery/procedures are retrieved, accounted for, and appropriately documented.

Instrument nurse (alternatively, Scrub nurse)

The instrument nurse works closely with the circulating nurse and with the surgeon/s as part of the surgical team. The instrument nurse works to ensure the safety of the patient at all times, and in some facilities is responsible for the nursing handover to PACU staff.

Figure 1-3. Intraoperative nurses

Source: NSW Health 2017

Figure 1-4. Instrument nurse and the perioperative team

Source: NSW Health 2017

Key responsibilities of the instrument nurse include to:

- establish and monitor the aseptic field
- manage the instruments and associated sterile items
- assist the surgeon with access to instruments and supplies required to undertake the surgical procedure
- recognise intraoperative complications or changes in the patient's condition and responding promptly
- manage accountable items (as described above in circulating nurse role).

Post anaesthesia care unit (PACU) nurse (alternatively, Recovery Room nurse)

The PACU nurse provides patient care in the immediate post-operative period in a separate area within the OS, but with easy access to the surgical team should complications arise. Whilst the majority of patients experience a smooth recovery from anaesthesia, the PACU nurse is vigilant in monitoring the patient to ensure any complications that may occur are recognised and managed immediately.

Key responsibilities of the PACU nurse include to:

- receive, assess and monitor the patient during emergence from anaesthesia
- maintain safety, provide pain relief and other comfort measures during the immediate post-operative period
- recognise post-operative complications e.g. respiratory and/or cardiac complications, rapid deterioration and manage them effectively in collaboration with members of the surgical team
- provide a comprehensive handover when transferring the patient from PACU to another ward/department.

Figure 1-5. PACU nurses

Source: NSW Health 2017

Perioperative Nurse Surgeon's Assistant (PNSA)

The PNSA role is an expanded practice role that requires additional education and training. PNSAs may act as first assistant to the surgeon, with their scope of practice extended to include skin retraction, diathermy, deep retraction and tissue handling, assisting with haemostasis, and suturing. There are a small number PNSAs practicing in NSW Health facilities.

Other perioperative nursing roles include educators, consultants, managers, and researchers.

READ

Hamlin et al. (2016) Chapter 1 pp 4–8, Nursing Roles

ACORN (2016) Nursing Roles, from pp 7.
Select one or two of the roles and explore in detail.

Australian College of PeriOperative Nursing (ACORN)

ACORN is the national professional body for perioperative nurses in Australia. Formed in 1975, its vision is for *'Australian patients to receive the safest and highest quality perioperative care in the world'.* ACORN pursues their vision by publishing evidence based standards, guidelines and role statements, representing the accepted standard for professional nursing practice in the Operating Suite. Knowledge of the standards is central to ensuring safe patient outcomes.

ACTIVITY

1-1 Nursing roles
Select one of the nursing roles and note three key responsibilities of the role selected in relation to patient safety. Write your answer in the Activity section (located at rear of component).

Operating Suite design

The OS is a unique, environmentally controlled unit with restricted access due to infection prevention requirements and the nature of the work carried out. The number and configuration of ORs and the functional relationships with other parts of the hospital varies, and reflects the model of perioperative care in use (see Table 1-6). The range of services provided and the number and complexity of surgical procedures undertaken varies between facilities. One unique design seen increasingly is the hybrid OR, which combines features of a standard OR with those of a radiology suite in which minimally invasive angioplasty procedures can be undertaken.

Each OS differs in its layout, however the design must meet the Australasian Health Facility Guidelines (AHFG). The AHFG are based on the clinical management requirements of the surgical patient, the requirements of staff working in the area, visitors to the unit including family and carers, and to ensure room for future surgical trends.

Size

The number of ORs and PACU beds/spaces in an OS are determined by a range of factors: the anticipated volume of surgical procedures, the mix and complexity of surgical cases supported, the model of care, planned operating hours, management of emergencies, and the changeover time between procedures. Large and tertiary hospitals have correspondingly larger OS services.

Figure 1-6. Models of perioperative care

INTEGRATED UNIT	Provides all facilities for preoperative, surgical and postoperative management of all patients including Day of Surgery Admissions (DOSA) and day only patients within a single envelope +/- Extended Day Only Unit
SINGLE SPECIALTY OPERATING UNIT	A unit catering to a single specialty such as burns, obstetrics, plastic surgery, or ophthalmology. Patients are frequently day-only admissions
PERIOPERATIVE MODEL	Patients undergoing planned surgery as day-only or DOSA are admitted to a dedicated Perioperative Unit facility prior to surgery. Surgery and 1st stage recovery are undertaken in the Operating Suite. DOSA patients are transferred to inpatient units. Day-only cases are transferred to the Perioperative Unit for pre-discharge care
EXTENDED DAY ONLY UNIT (23 HOUR)	This model is based on the premise that the majority of surgical and procedural care can be provided within a 24 hour period in a non-inpatient unit environment. Patients are admitted, prepared, then recovered post-op before protocol-based discharge. Some patients may only need a few hours of care post procedure, others may stay in the Unit for up to 23 hours
SHORT STAY UNIT/ HIGH VOLUME SHORT STAY SURGICAL	Patients undergoing planned surgery as a day only or overnight admission are admitted to a dedicated short stay unit, transferred to the OS for surgery and 1st stage recovery, and then returned to the short stay unit. Postoperative stay is usually 48 hours or less
CO-LOCATED UNITS	Where operating rooms and interventional angiography or other procedure rooms are co-located, allowing for access to anaesthetic support and shared use of perioperative facilities, reducing unnecessary duplication

Adapted from: Australasian Health Facility Guidelines Part B – Health Facility Briefing and Planning 0520 – Operating Unit 2016.

Physical layout

Each OS is comprised of several purpose-built rooms or areas where specific actions occur, including reception, holding bay, the anaesthetic bay or room, the operating room, scrub bay, post-anaesthetic care unit bays, sterile stock room, utility room, sterilising services department, stores, and change rooms (see Figure 1-7).

The OS should have close or direct links with other units for convenience, patient safety, and practicality including:

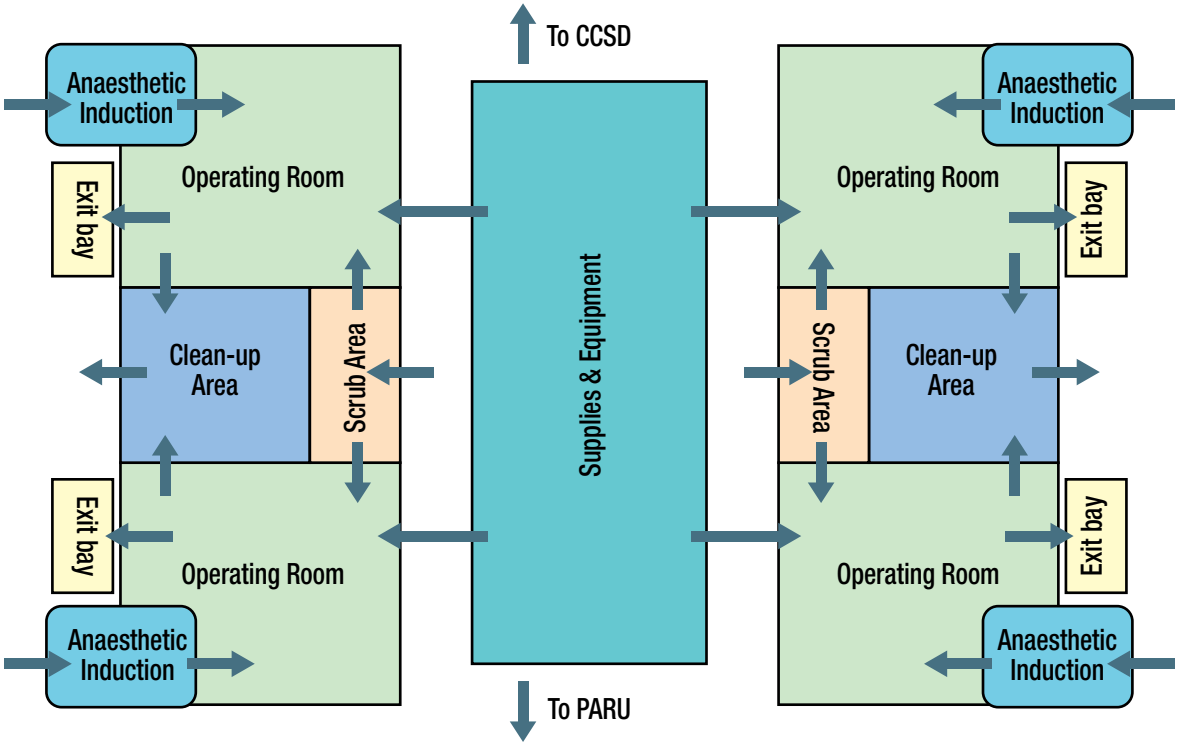
- sterilising supply department (SSD)
- PACU
- emergency department
- intensive care unit (ICU)
- surgical wards
- delivery suite
- pathology
- blood bank
- medical imaging departments (Hamlin et al., 2016).

Commonly used designs of OS are:

- single corridor – a central corridor dividing the ORs with sterile stock located at one end
- racetrack – a central grouping of ORs with a corridor around the outside that manages the flow of clean and contaminated equipment
- small clusters – ORs in groups of two or four that share a sterile stock room.

Figure 1-7 shows an example of a cluster design, including the relationship with other departments e.g. sterilising department (CSSD) and PACU (noted in diagram as PARU), and entry/exit routes that avoid clean and contaminated items coming into contact with each other.

Figure 1-7. Cluster design



Source: Phillips 2013

READ

Hamlin et al. (2016) Chapter 5, pp 98-105 Operating Suite Design.
This reading provides a description of various OR designs with diagrams, their advantages and disadvantages. Note the photograph of the hybrid OR on pp 105 with the radiology equipment and viewing screens.

ACORN (2016) Planning and design of the perioperative environment, pp 231-239.

ACTIVITY

1-2 Interdepartmental relationships
Select four departments with relationships to the OS and complete the table in the Activity section stating how they contribute to the efficient function of the OS and to patient care.

Operating suite zones

The OS consists of zones that relate largely to infection prevention measures required in each specific area. The zones will vary in their location and extent, depending on the design of the OS (see Figure 1-8). They are generally described as:

- unrestricted zone – visitors are permitted and staff may wear street clothes e.g. reception areas, change rooms
- semi-restricted zone – perioperative attire is worn by staff but street clothes are also permitted (i.e. visitors) e.g. holding bays, some PACUs
- restricted zone – those areas accessible only to authorised personnel in full perioperative attire e.g. the anaesthetic bay and OR. Food/drinks are not to be consumed in this area. Visitors must don perioperative attire (ACORN, 2016).

Figure 1-8. Zones and traffic flow

	Patient	Staff	Supplies
Unrestricted	Emergency/ICU/Wards/Admissions send patients to operating suite Operating room reception greet visitors and staff	Change rooms Tea rooms	Supplies received from stores Loan set delivery instrumentation for CSSD
Semi-restricted	Patients enter holding bay Induction rooms may be used	Staff gather necessary equipment and supplies for surgery	Cleaning → Sterilisation undertaken in CSSD Sterile items enter sterile stockroom Sterile supplies are gathered in preparation for operation
Restricted	Patient enters operating room	Check operating room prior to list Prepare sterile set-up Scrubbing, gowning & gloving Surgery performed	Supplies received from stores Loan set delivery inustrumentation for CSSD
Semi-restricted	Patients enter PARU after surgery Discharged to ward or home	Terminal cleaning of operating room at end of list Environmental cleaning	Leftover supplies returned to sterile stock room Instruments taken into clean-up room for transportation to CSSD Linen/waste/sharps disposal

Source: Hamlin et al 2016

Figure 1-9. Signage demonstrating entry requirements

Source: NSW Health 2017

Traffic flows

The flow of staff, patients and equipment within the OS is dictated by the design. Each OS is designed to allow for the movement of patients, staff, and equipment in to and out of the ORs safely and directly and through the various zones (Figure 1-8). Dirty/soiled equipment or waste is moved by covered transportation directly to clean up areas, taking a route different to that of the clean equipment and sterile supplies. However, some facilities may have a single corridor, and risk minimisation strategies are required to prevent cross contamination (ACORN, 2016).

ACTIVITY

1-3 Operating suite design

Walk around your operating suite and identify areas within the three different zones. Identify the signage that informs personnel the requirements for entering each zone. In the Activity section, detail the following routes (use a floor plan of the OS if available):

- The path instruments (both sterile and dirty) travel in and out of the OS
- The path the patient takes on their perioperative journey.

VIEW

My Health Learning. *Operating Suite: Beyond the Red Line.*

Environmental Controls

Environment controls in OS are unique and must comply with the AHFG, together with contemporary, evidence based infection prevention and control practices.

Key environmental features are:

Temperature and humidity

Each OS is fitted with an HVAC (heating, ventilation, air conditioning) system to satisfy the internal environmental requirements for infection control, safety, and comfort. Optimal ventilation rates, airflow patterns, and humidity help to minimise microorganisms in the air which may lead to surgical site infections.

ORs have a recommended temperature range of 18–24°C, however, a narrower range of 20–22°C is commonly used as this has the effect of inhibiting growth of potentially harmful bacteria, whilst maintaining a comfortable temperature for staff. Similarly, humidity is kept at 50%-60% to inhibit bacterial growth and also to reduce risks associated with static electricity (ACORN, 2016).

Air pressures and flow

The OR and sterile stock rooms have a higher air pressure (positive pressure) than the surrounding corridors of the OS to prevent air with potentially high levels of microbial contamination from entering the OR and compromising aseptic fields. The air pressure in the greater OS is also higher than the external corridors of the hospital for the same reason.

The doors to each OR and the OS should remain closed where possible to assist in maintaining the positive pressures and air flow, thus assisting in preventing airborne contaminants entering the OR. Positive pressure systems become overwhelmed when doors are excessively opened or held open. Excessive door opening/ closing can cause air turbulence which can also compromise aseptic fields.

Laminar flow, where High Efficiency Particulate Air (HEPA) filtered air is blown into the OR at a set rate in one direction was once considered essential for orthopaedic theatres, but studies have since shown it is difficult to achieve and therefore is of questionable efficacy (NSW Health, 2016). The current air flow recommendation from NSW Health is the 'supply air ceiling', whereby airflow into the OR is by a distribution system providing flow of HEPA-filtered air downwards over the operating table area first, then away. The air in an OR changes 20 times per hour and must not be recirculated (ACORN, 2016).

READ

Hamlin et al. (2016) Chapter 5, pp 105-108.
Read about a range of other environmental features of OS and become familiar with the unique environment in which you work.

ACTIVITY

1-4 Environmental features
Select three (3) environmental features described in the above reading and consider how each contributes to patient and staff safety nd comfort. Complete the table in the Activity section.

Surgical specialties

The surgical specialties supported in each OS are determined largely by the capability and capacity to manage specific patient groups, access to specialist surgeons, the hospital's location, size, and focus: for example, if the facility is a designated burns centre or children's hospital. Figure 1-10 lists the surgical specialties across a range of operating suites in NSW. Perioperative nurses may work across a number of these surgical specialties or specialise in one or two depending on the size and complexity of surgery undertaken within the OS.

OS staff may also provide anaesthesia and post-anaesthesia care for patients requiring an anaesthetic in procedure suites outside of the OS, for example gastroenterological, interventional radiology, and cardiac catheterisation procedures, where no hybrid OR is present.

Figure 1-10. Surgical specialties

Surgical specialties

- cardiothoracic
- general surgery (includes colorectal, upper gastrointestinal, endocrine, hepato-biliary, and surgical oncology)
- neurosurgery
- orthopaedics
- ear nose & throat (ENT)
- head and neck
- paediatric surgery
- plastic and reconstructive surgery
- urology
- vascular
- obstetrics and gynaecology
- transplant surgery
- ophthalmology

Human Factors and the Multidisciplinary Team (MDT)

Human factors and non-technical skills

Quality perioperative care relies on the multidisciplinary team (MDT) working together towards the common goal. The construction of the team varies depending on the circumstances, and nursing staff may form part of many different teams throughout any one day. All teams require excellent communication skills, mutual respect, and professionalism to effectively work together (Rosenstein et al., 2016). These are termed non-technical skills, components of *human factors,* a term used to describe the relationship between the perioperative environment and the people who work within the multidisciplinary teams. They are as important as technical expertise in ensuring patient safety.

Activities within the OR can be classified as predominantly technical in nature. However, technical skills demonstrated by the surgeon and the team do not ensure patient safety. Investigations into adverse events and poor patient outcomes during surgery have showed that major contributing factors were poor communication between health professionals and dysfunctional team dynamics (Hamlin et al, 2016).

Communication in the perioperative team

Communication in a multidisciplinary setting like the OS can be complex, but essential to providing safe, quality healthcare (Glymph, Olenick, Barbera, Brown, Prestianni, and Miller, 2015). Good communication may be influenced by the organisational and unit culture, differing levels of training, varying communication styles, personalities, and perceptions. It is important that nurses feel empowered in communicating with the team, to 'speak up', particularly when advocating for the patient or when standards are breached and patient safety compromised (Reid, 2013). 'Speaking up' can be challenging for some nurses, particularly those new to the OS. Graded assertiveness is a communication technique that can assist in an individual's ability to 'speak up' in situations that demand action, whilst remaining respectful to the other people in the interaction.

Figure 1-11. Multidisciplinary team

Source: NSW Health 2017

As health care evolves and the focus on patient centred care becomes sharper, the traditional hierarchical medical-led model is shifting to one which identifies all team members as being equally responsible for ensuring a safe surgical journey for the patient. Part of the preparation for each list is the team (nursing, surgical, anaesthetics) communicating with each other about the patients and procedures on the operating list in relation to any potential critical issues, equipment or possible complications. This 'shared mental model', is an important non-technical skill ensuring that all team members possess the information required to effectively collaborate in their care of the patient.

The following reading identifies these techniques and their role in patient safety.

READ

Hamlin et al. (2016) Chapter 2 pp 30-43 on human factors.
This chapter provides detailed description and perioperative examples of human factors and their role in patient safety. Note the models of graded assertiveness on pp 41-42.

Clear, respectful communication with the patient and/or carer/support person is also essential. Patients have the right to be treated with respect and dignity throughout their surgical journey.

The importance of effective communication is especially true for children, older people, or those with a disability. These patients may need or prefer to have a person accompany them throughout their OS experience. Clear communication can assist in allaying fears by conveying clear instructions, explaining processes, and providing reassurance. Using therapeutic touch when appropriate and employing active listening techniques may assist.

Other non-technical skills identified for perioperative nurses are:

- Situation awareness: developing and maintaining overall awareness of relevant aspects of the theatre environment by watching, listening, understanding cues and anticipating what might happen next (Fioratu, Flin, Glavin, & Patey, 2010)
- Task management: planning and preparing, prioritising, providing and maintaining standards, identifying and utilising resources (Fioratu et al., 2010)
- Teamwork: coordinating activities with the team, exchanging information, using assertiveness, assessing capabilities, supporting others (Fioratu et al., 2010).

Situation awareness

Situation awareness is a non-technical skill that can be difficult for new staff members new to master as it relies on the ability to watch, listen and understand cues from the many activities that occur simultaneously within the OR during a procedure. It is taking in the 'big picture' and being able to anticipate the needs of the team. The following reading explains situation awareness and provides an interesting example from clinical practice.

READ

Hamlin et al. (2016) Chapter 2, pp 37-38, situation awareness.
Note the Feature Box 2-3 on p 38 and an example of lack of situation awareness.

Task management

Task management is a non-technical skill that refers to the organisation of supplies and equipment required for surgical procedures. Also important is the adherence to standards of practice regardless of the demands and work pressures that might be present. The use of surgeons' preference cards, checklist, tray lists, and algorithms are all resources available to assist staff organise their work and contribute to patient safety.

Figure 1-12. Perioperative team

Source: NSW Health 2017

Teamwork

Perioperative MDTs consist of varying levels of expertise and training. The role that each member performs within the team is essential to ensure a holistic care approach to the surgical patient. To optimise patient care, teams must work cohesively, understand each other's roles and be respectful of each other's skills and knowledge (Hamlin et al., 2016). This is of particular importance in teaching hospitals where staff regularly rotate through different teams, resulting in a constant need to adapt to new members. Patience and effective communication is required to achieve a safe and cohesive team (Gillespie et al, 2013).

Figure 1-13. Perioperative team members

External product specialists may occasionally support the team during surgical cases, although are not permitted to provide direct patient care.

Depending on the age and health status of the patient and the complexity of the planned procedure, the MDT may extend beyond the OS and to include an oncologist, additional surgeons/physicians, specialist nurses, social worker, physiotherapist, pharmacist, and various allied health professionals however their presence in the OS is minimal (see Figure 1-13).

READ

Spruce, L. (2016) Back to basics: Speak up. *ACORN Journal of Perioperative Practice 29*(1), 20-22. [If you are not a member of ACORN, ask your facilitator to access this article].

Garrett, J. (2015) Effective perioperative communication to enhance patient care. *AORN Journal* 104, 112-117. https://www.aorn.org/websitedata/cearticle/pdf_file/CEM16526-0001.pdf
The above readings provide further information about the importance for effective communication within the perioperative team.

ACTIVITY

1-5 Human factors
Whilst working in the OR during a procedure, take a moment to watch the activities that are taking place around you. Categorise the activities you observe into what you consider technical and non-technical skills. Complete the table in the Activity section.

VIEW

Clinical Human Factors Group: *Just a Routine Operation*.
https://chfg.org/learning-resources/just-a-routine-operation-teaching-video/
'Just a Routine Operation' details the British case of Elaine Bromiley and highlights how the inadequate application of non-technical skills contributed adversely to Elaine's tragic outcome. You may like to also watch 'Gina's Story', which further highlights the importance of non-technical skills.

ACTIVITY

1-6 Non-technical skills
Which non-technical skills contributed adversely to Elaine Bromiley's tragic outcome? Explain your answer when completing the table in the Activity section.

Conclusion

Component 1 has provided an introduction to the individuals who make up the perioperative team, the physical setting of the OS, and how the two interact to provide a safe environment in which patients undergo anaesthesia and surgery. Subsequent topic areas will reflect the integration of non-technical skills, emphasising their role in patient safety.

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COMPONENT 1 – ACTIVITIES

ACTIVITY 1-1: NURSING ROLES

From ACORN Standards (2016) select one of the nursing roles. Write down three key responsibilities of the role in relation to patient safety.

Role	Key responsibilities in relation to patient safety
	1.
	2.
	3.

ACTIVITY 1-2: INTERDEPARTMENTAL RELATIONSHIPS

Select four departments with relationships to the OS and complete the table to state how they contribute to the efficient function of the OS and to patient care.

Department	Contribution to efficiency and patient safety in the OS
1.	
2.	
3.	
4.	

ACTIVITY 1-3: OPERATING SUITE DESIGN

Walk around your OS and identify areas within the three different zones. Identify the signage that informs personnel the requirements for entering each zone. Plot the following routes (you may use a floor plan of the OS if available):

- The path instruments (both sterile and dirty) travel in and out of the OS
- The path the patient takes on their perioperative journey.

ACTIVITY 1-4: ENVIRONMENTAL FEATURES

Select three (3) environmental features described in the reading, noting how each contributes to patient and staff safety and comfort. Complete the table:

Environmental feature	Patient comfort & safety	Staff comfort & safety

ACTIVITY 1-5: HUMAN FACTORS

Whilst working in the OR during a procedure, take a moment to watch the activities that are taking place around you. Of the activities observed, identify whether technical or non-technical skills are displayed. Complete the table below.

Activity	Technical or non-technical skill?	Rationale

ACTIVITY 1–6: NON-TECHNICAL SKILLS

Which four (4) non-technical skills contributed adversely to Elaine Bromiley's tragic outcome? Explain their contribution to the tragic outcome and what could the team have done differently to effect a positive outcome?

Non-technical skill	Contribution to Elaine Bromiley's death and what could have been done differently?

— End of Component 1 —

COMPONENT 2

SAFETY AND QUALITY OF CARE

Aim

The aim of this module is to explain the importance of maintaining an environment that optimises the delivery of safe, effective, quality care to patients during their operating suite (OS) journey.

Learning outcomes

On completion of this module the participant should be able to:

- relate the National Safety and Quality Health Service Standards to perioperative care
- apply legal and ethical principles and practices relevant to the perioperative context
- explain components of a safe work environment and outline the key perioperative-specific patient and staff safety issues
- apply evidence based principles when positioning the patient for surgery
- outline the contingency measures and evacuation procedures in the event of utility failure or other internal or external emergency
- explain the practical application of the NSW Health Clinical Procedure Safety policy PD2017_032
- apply knowledge of microbiology and the infective process to potential sources of infection in the perioperative environment.
- apply the principles and practices of infection prevention and control in the OS context
- apply the principles and practices of aseptic technique and surgical conscience to the care of the surgical patient
- describe physical and chemical sterilisation processes to instruments and equipment used in surgical procedures.
- implement a systematic approach to clinical handover and identify documentation requirements in the OS.

National Safety and Quality Health Service (NSQHS) Standards

The National Safety and Quality Health Service (NSQHS) Standards were first developed and published in 2012 by the Australian Commission on Safety and Quality in Healthcare (ACSQHC) with the primary aim of protecting the public from harm and improving the quality of healthcare. The Standards, now in their second edition, provide a nationally consistent statement of the level of care consumers can expect from health service organisations, and include quality assurance and improvement mechanisms for providers of healthcare (ACSQHC, 2017). There are many overlaps between NSQHS Standards and the Australian College of Perioperative Nurses (ACORN) Standards: together they provide the perioperative team with a comprehensive framework in which to provide high quality, safe patient care.

The eight (8) Standards address the following areas:

1. Clinical Governance
2. Partnering with Consumers
3. Preventing and Controlling Healthcare Associated Infections
4. Medication Safety
5. Comprehensive care
6. Communicating for safety
7. Blood management
8. Recognising and Responding to Clinical Deterioration in Acute Health Care

Perioperative nurses require awareness of the Standards and how they relate to standards of patient care in the perioperative context.

READ

Hamlin et al. (2016) Chapter 3, pp 55-60.
The reading provides a summary of each Standard (2013 version) and their application to the perioperative context.

ACTIVITY

2-1 NSQHS Standards
Locate a copy of the updated Standards in your workplace or via www.safetyandquality.gov.au. Select two of the Standards and explain, in the Activity section at rear of Component 2, how each guides your perioperative practice.

Value based care

The *Leading Better Value Care* program is NSW Health's framework for the continuous movement toward higher levels of quality, safety, and cost-effectiveness in healthcare. Under this program, the system is adopting the Institute for Healthcare Improvement's internationally endorsed framework known as the Triple Aim. This is a singular concept outlining the simultaneous pursuit of three objectives:

- Improving the patient's experience of care
- Improving the health of populations, and
- Reducing the per capita cost of health care.

For perioperative nurses, this means providing care that is safe, effective, patient-centred, timely, efficient, and equitable: being the patient's advocate and speaking up for safety. As routine decision-makers for resource utilisation like consumable and equipment use, perioperative nurses are positioned to reduce inefficiencies along the surgical journey, and to influence a culture of efficiency.

Quality management in the perioperative environment

Quality management programs are implemented in OS to ensure standards (National and ACORN), local policies, and legislative requirements are being met by perioperative staff. The aim of quality management programs is to ensure the patient receives the highest quality of care and staff are complying with the required practice standards.

Quality improvement (QI) is defined as: *the evaluation of services provided with results achieved compared to accepted standards* (Hamlin et al, 2016). Quality activities (QA) is *an organised process designed to ensure the maintenance of a desired level of safety and quality in a service or product* (ANZCA, 2018).

In practical terms, quality management programs include:

- appointing a staff member to coordinate and document quality activities within the perioperative environment
- developing strategies to measure workplace compliance with National and ACORN Standards using a variety of strategies including:
  - review policy and procedure documents
  - carry out observational audits of clinical practice
  - ensure products used met regulatory requirements
- providing feedback and developing education strategies to address variances identified within data collected during observational audits (ACORN, 2018).

Audit and feedback is recognised as an efficient way to review clinical performance and is used in many small-scale QI projects. Auditing staff by observing clinical practice and measuring compliance against evidence based standards i.e. ACORN Standards, provides a 'snapshot' of current clinical practices. This allows non-compliant practices to be identified, rapid feedback provided, and education strategies developed to address deficits (Gomez, 2017).

During T2PP you will undertake a series of competency assessments to assess your individual clinical practice, however, you may also be involved in periodic audits of practice, carried out as part of your unit's quality management programs (see Figure 2-1).

Figure 2-1. Competency assessments and clinical audits

COMPETENCY ASSESSMENT **CAN** you do it?	CLINICAL AUDIT **DID** you do it?
• Assesses an *individual's practice* using a combination of strategies e.g. observation of clinical practice, theoretical assessment. • Used in education programs to evaluate if participant is meeting course outcomes. Can also be used as part of individual performance appraisal process.	• Measures clinical performance of *healthcare teams* in the workplace, using direct observation and/or review of documentation. • Used as part of QI programs to measure workplace compliance against recognised, evidence based standards of practice e.g. ACORN Standards.

Source: ACORN (2018)

ACORN's Practice Audit Tools (PATs) cover 12 key areas of patient safety aligned to the relevant ACORN Standards. These are developed from *Asepsis and Clinical Care* and *Staff and Patient Care* sections of the ACORN Standards. The PATs can be used for periodic measurement of workplace compliance against the ACORN Standards. The data collected either confirms that staff are meeting the ACORN Standards or identifies areas of non-compliance which require addressing through education.

Legal issues in perioperative nursing

Nurses have a legal and moral responsibility to keep patients safe from harm: this responsibility is known as the 'duty of care'. By engaging with a patient as they present to the OS and subsequently along the patient's perioperative journey, the nurse enters into a health professional-to-patient relationship, where a duty of care applies. The nurse has an obligation to protect the patient from any foreseeable harm or injury and to ensure a reasonable standard of care. This reasonable standard of care is informed by policies based on the ACORN Standards for Perioperative Nursing in Australia, NSQHS Standards and other documents such as the Nursing and Midwifery Board of Australia's (NMBA) Code of Professional Conduct and Standards for Practice.

As per the NMBA's Standards for Practice, in order to fulfil the duty of care the nurse should:

- Perform nursing interventions in accordance with recognised standards of practice
- Clarify responsibility for aspects of care with other members of the health team
- Recognise the responsibility to prevent harm, and perform nursing interventions following comprehensive and accurate assessments.

A breach in the duty of care owed, by a nurse or other health professional, to the patient is an element of the civil wrong of negligence. The following reading provides an overview of aspects of negligence.

READ

Hamlin et al. (2016) Chapter 4, pp 74-79 (to Consent to Treatment)
Note the Feature Box 4-2. We will return to this incident in Component 4: Instrument and Circulating Nurses.

VIEW

My Health Learning, Nursing, Midwifery and the Law.
You will need to access your My Health Learning account to view this program.

Accountability

Whilst undergoing surgery, the majority of patients are sedated or under a general anaesthetic and therefore unable to care for themselves or question actions that are occurring. Patients are amongst their most vulnerable during the perioperative period of their hospitalisation, and rely on the perioperative team to take reasonable care in all activities to protect them from any possible injury. The team is accountable for their actions and must demonstrate adherence to standards of practice. If an adverse event occurs and the patient suffers an injury whilst in the perioperative environment, they may wish to make a complaint against those who they believe are responsible for their injury. This may have both legal and professional consequences for the members of the perioperative team. The following reading from the ACORN Standards provides an overview on accountability in the perioperative nursing context. Examples of perioperative-specific risks are summarised in Figure 2-2 and are expanded later in Component 2.

READ

ACORN (2018) Position statement on accountability for practice (Professional Practice section).

Vicarious liability

The law has evolved a doctrine of vicarious liability, which makes the employers of nurses (and others) responsible for any negligence committed by workers in the course of their employment (Staunton & Chiarella, 2016). The doctrine only applies if the employee is acting within the boundaries of their role and experience, and not acting outside of the recognised policies and procedures.

READ

Hamlin et al. (2016) Chapter 4, pp 76-77.
This reading discusses vicarious liability and aspects of the legislative framework within which nurses work.

There may also be professional consequences for the members of the surgical team. This may result from the patient/relatives making a notification (complaint) to the relevant regulatory body against the health professionals involved in the care of the patient.

Regulatory environment

Whilst suing nurses for negligence directly is a rare occurrence, concerns about a nurse's performance can be investigated within the regulatory framework which governs nurses in NSW. The Nursing and Midwifery Council of NSW (NMC) manages notifications (complaints) made against nurses. Notifications can be made by other health professionals or patients if they believe that the nurse's practice has fallen below expected standards (NMBA or ACORN). The nurse may find their practice investigated by the NMC using the non-disciplinary Performance Pathway. The following readings explain the regulatory framework and how notifications are managed.

READ

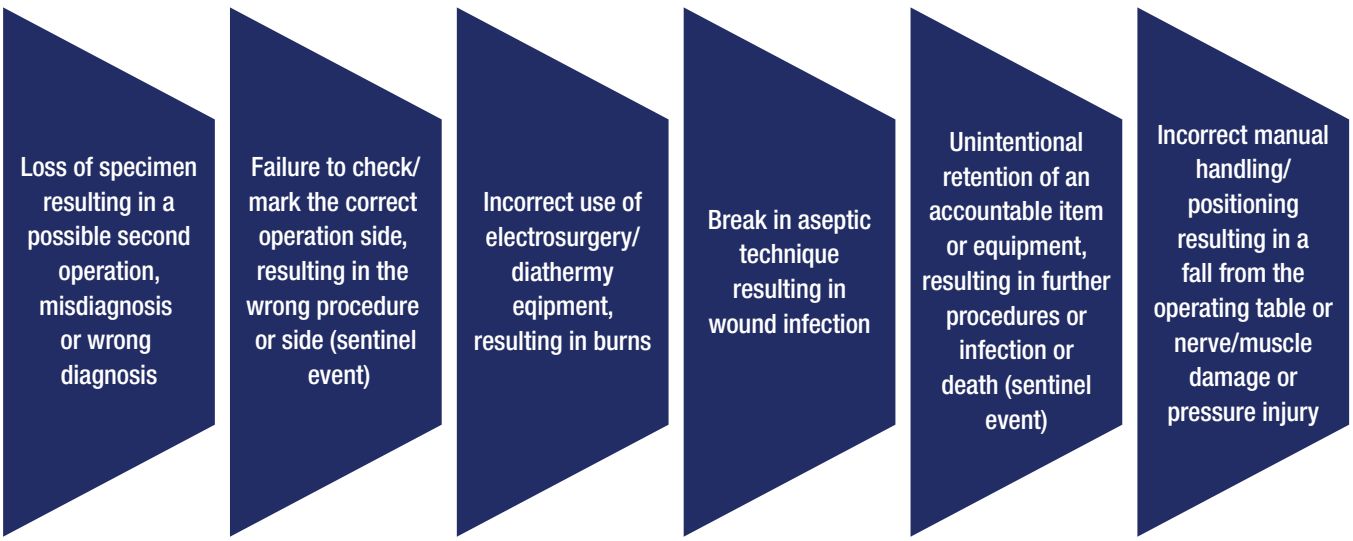
Hamlin et al. (2016) Chapter 4, pp 85-89.
Note in particular the section on Performance on p 86.

Nursing and Midwifery Council NSW (2016), NMC NSW Factsheet https://www.nursingandmidwiferycouncil.nsw.gov.au/sites/default/files/fact_sheet_-_about_the_nursing_and_midwifery_council_-_nov_2016.pdf
You may wish to explore the website for other aspects of the NMC's work.

Adverse and sentinel events

An adverse event is an incident that results in harm occurring to a patient during their hospitalisation and may require additional significant treatment. Figure 2-2 identifies incidents that can lead to an adverse event.

Figure 2-2. Perioperative patient risks



A sentinel event is a specific, rare adverse event defined as 'unexpected occurrences involving death or serious physical or psychological injury or risk thereof' and are caused by healthcare rather than any underlying patient condition (ACSQHC, 2011). Eight specific types of clinical incidents are identified nationally as sentinel events. Those relevant to the perioperative environment are:

- procedures involving the wrong patient or body part resulting in death or major permanent loss of function
- retained instruments or other material after surgery requiring re-operation or further surgical procedure
- medication error leading to the death of a patient reasonably believed to be due to incorrect administration of drugs (ACSQHC, 2011).

The number of sentinel events that occur in the perioperative environment each year is generally low relative to the volume of surgical procedures. Perioperative related sentinel events that occurred in NSW in 2016 included:

- nine surgical patients required further surgery following the retention of instruments during their surgical procedures. This was a reduction from 20 incidents in 2015
- three incidents of wrong site surgery, an increase from zero in 2015
- medication errors resulted in deaths of four patients in 2016 and whilst it is not specified if they occurred in the OS, it is an area requiring vigilance in the perioperative period (NSW Auditor General, 2017).

Following a sentinel or adverse event, hospitals are required to follow a process to report the event, investigate how the adverse event occurred, and implement strategies to prevent patient harm in the future. This might require further education, changes to systems within the hospital or a change to policies.

Investigations are aimed at uncovering the reasons why an adverse event occurred rather than finding fault with the individuals involved.

Under the policy of open disclosure, the patient or their relatives must be:

- informed of the incident
- provided with the facts of the incident
- informed of the potential consequences for the patient
- informed of the steps taken to manage the event and prevent it from occurring in the future.

Patients or their relatives have the right to pursue legal action in negligence against the individuals and the hospital and seek financial compensation for the injury they have suffered. This is a complex area of law and it is rare for nurses to be sued directly for negligence. They may, however, still find themselves involved in legal proceedings as a member of the perioperative team involved in the incident for which the patient is suing for negligence. It is important, therefore to understand the doctrine of vicarious liability.

Consent

Before any surgical procedure can be undertaken, each patient must provide a valid and informed consent for treatment. Responsibility for obtaining the patient's informed consent lies with the surgeon or proceduralist. Obtaining consent is a process of providing sufficient information to allow a genuine understanding of the nature of the surgery or procedure.

A valid consent must satisfy the following elements:
- **the patient (guardian) must be informed**
- **the patient (guardian) must be legally competent**
- **the consent must cover the act (the procedure to be performed)**
- **the consent must be given voluntarily**

(Staunton & Chiarella, 2016)

In addition, known risks should be disclosed, and alternate options discussed. See Figure 2-3 for consent considerations in a variety of situations.

Whilst it is not the perioperative nurse's responsibility to provide information to the patient or to gain their consent to surgery, they do have a role to ensure that the patient understands and agrees to the planned procedure as part of the 'check in' procedure carried out on admission to the OS. This is achieved by asking the patient to verify the procedure they have signed for on the consent form, in accordance with NSW Health's Clinical Procedure Safety policy (PD2017_032). If the patient does not understand the procedure they are about to undergo or the consent does not match the patient's understanding, the nurse has a duty of care to inform the surgeon. The surgeon has a duty of care to ensure the issue is resolved before the patient progresses past the OS check-in area.

Figure 2-3. Patient consent considerations

PATIENT CONSENT CONSIDERATIONS	
Adult consent for treatment • No operation, procedure or treatment may be undertaken without the consent of the patient, if the patient is a competent adult. • Adequately informing patients and obtaining consent for treatment is both a specific legal requirement and an accepted part of good medical practice (NSW Health policy PD2005_406, 2005). • If a patient lacks capacity, consent will be sought from their person or authority responsible, except in situations where the treatment is urgent and necessary to save a person's life or prevent serious health damage. • An interpreter is required when consenting patients from culturally/linguistically diverse backgrounds.	**Consent for minors** • In NSW, a person who is over the age of 14 may give consent to medical treatment *provided they adequately understand and appreciate the nature and consequences of the operation, procedure or treatment* (NSW Health policy PD2005_406, 2005). • Ideally there should be a consensus between the consenting minor, the parents/guardian, and the treating practitioner, but this is not always possible.
Consent for blood transfusion • In NSW, written consent for the transfusion of all blood products must be obtained. • Adults may refuse a blood transfusion: they must be given a full explanation of the risks and consequences of refusal and any alternatives available, by their medical team. • When a patient elects to decline a transfusion, this must be communicated to the perioperative team prior to the surgery and documented in the medical record: this ensures the patient receives counselling and their wishes are followed intra-operatively. • A patient's decision to decline blood products may raise moral/ethical dilemmas for staff, particularly if significant blood loss is anticipated. Staff are encouraged to discuss such issues with senior colleagues.	**Consent for patients under the Mental Health Act** • If a voluntary patient lacks the capacity to consent due to mental illness, the substitute consent provisions of the Guardianship Act apply. • If an involuntary patient is incapable of giving consent or is capable but refuses, a medical superintendent can consent to emergency surgery on the patient's behalf. For non-emergency surgery, an application is made to the Mental Health Review Tribunal for consent (NSW Health policy PD2005_406, 2005). • ECT (electro-convulsive therapy) for involuntary patients must have the consent of the Mental Health Review Tribunal (NSW Health policy PD2005_406, 2005).
Disability Services and Guardianship Act • The Guardianship Act (1987) allows a 'responsible person' or a Guardian to be appointed in the event that a person loses mental capacity to make care decisions. • A 'responsible person' may be a family member/carer and is (in most cases) able to consent to treatment for a disabled or otherwise mentally incapable person. • A Guardian is a legally responsible person appointed by the Supreme Court, the Guardianship Tribunal, or the individual (enduring guardian) (NSW Health policy PD2005_406, 2005). • For treatment which is urgent and lifesaving, the medical officer in charge can give consent (NSW Government, 1987).	**Advance care directive** • An advance care directive allows a person to make their treatment wishes known as a guide to significant others and health care staff in the event they lose capacity to make health care decisions. • Health professionals and responsible persons have no authority to override a valid advance care directive (NSW Health, 2017).

READ

Hamlin et al. (2016) Chapter 4, pp 79-82 on Consent.
Note the discussion on patients who are unable to give consent. Also note Feature Box 4-3 which describes the famous civil case of Rogers v Whitaker which changed medico-legal understanding in relation to informed consent.

McPhee, J. (2002) Perceptions of risk: a legal perspective. Australian Prescriber 2002, 25:114-51. https://www.nps.org.au/australian-prescriber/articles/perceptions-of-risk-a-legal-perspective

This reading provides further information about informed consent and the outcome of the Rogers v Whitaker case.

NSW Health (2017) Clinical procedure safety policy directive (PD2017_032)
This policy directive addresses patient safety risks associated with clinical procedures.

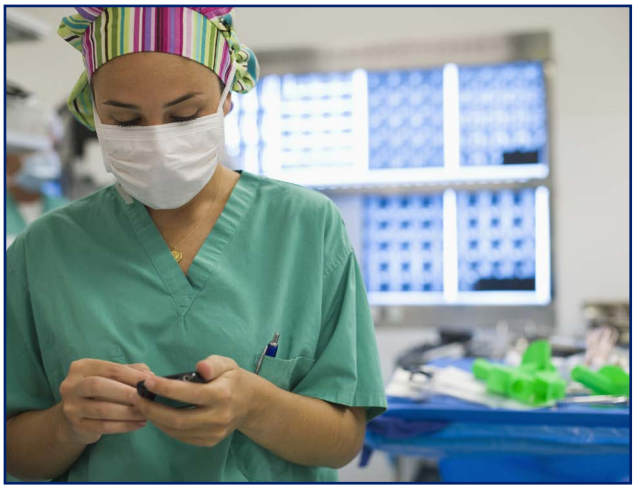
ACTIVITY

2-2 Consent to treatment
Scenario: You are admitting Mrs Frost to the operating suite. She is booked for a laparoscopic cholecystectomy. As part of the pre-operative checklist, you ask Mrs Frost to confirm the procedure she is about to undergo. She tells you 'It's something to do with my gallbladder, but I don't really know'.
How will you respond to Mrs Frost's answer? Write your answer and rationales in the Activity section.

Privacy and social media

Social media has become a powerful global communication tool that requires caution in its use, particularly within a healthcare setting. Misuse by divulging patient information via social media or other means can result in legal and professional repercussions.

Figure 2-4. Use of devices



Source: Getty Images

The surgical team has access to patients' medical and personal information. Patients have a right to this information being shared by only those involved in their care and only for the purposes of providing appropriate treatment during their hospitalisation. Nurses are bound by both legislative and professional requirements to maintain patient privacy and confidentiality.

Within the OR, taking photographs of aspects of surgery for teaching purposes by specially trained medical photographers has been common practice for many years. With the proliferation of smart phones, such photographs are often taken by members of the surgical team. This poses a risk to both patient and staff.

Firstly, the patient may not have given consent and secondly, the staff member has personal patient information (image) on their smart phone. The image of the patient has the potential to be accidentally or deliberately shared with others. This is a breach of patient privacy and confidentiality which may result in legal action.

The following reading discusses how perioperative nurses should react if requested by the surgeon to take a photograph of a patient during surgery.

READ

Hamlin et al. (2016) Chapter 4, pp 91-93 on Social Media.
Note the Feature Box 4-8 top of page 91.

ACORN (2018) Guideline on management of clinical images in the perioperative environment

NSW Health (2017), NSW Health Public Communication Procedures PD2017_012
http://www1.health.nsw.gov.au/pds/ActivePDSDocuments/PD2017_012.pdf

AHPRA (2014), Social Media policy.
http://www.nursingmidwiferyboard.gov.au/Codes-Guidelines-Statements/Policies/Social-media-policy.aspx

Safe work environment

It is incumbent on all staff members to maintain a safe working environment for all patients and workers under the Work Health and Safety Act (NSW Government, 2011). In addition to the standard clinical and environmental risks encountered in hospital settings, perioperative nurses are faced with hazards unique to the OS including risks posed by lasers, ionising radiation, surgical fires, surgical plume, an array of electrical equipment, hazardous substances, training/expertise related risks, and the emotional/psychological demands of a complex clinical setting. Perioperative nurses are required to be active in safe work practices, identifying hazards, adhering to risk mitigation strategies, and meeting the related reporting requirements.

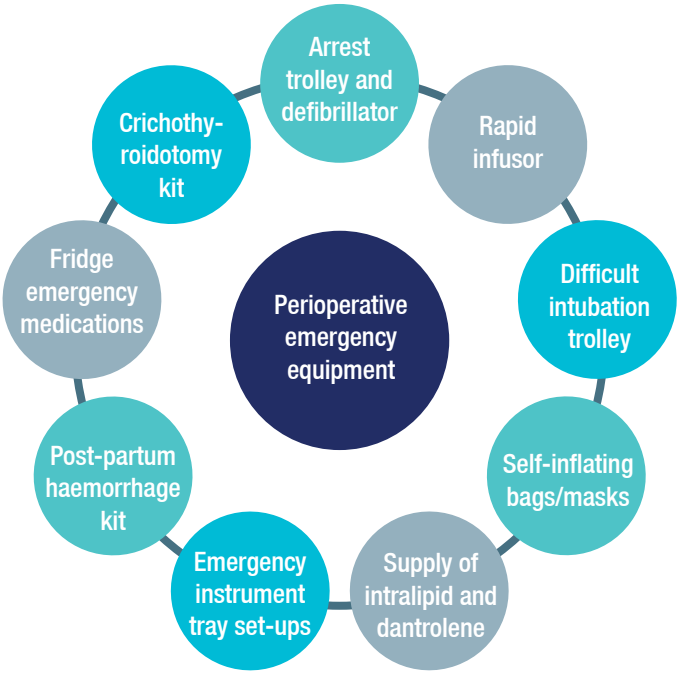
Patient safety

Patient safety at all times is a nursing priority. This is especially true in the perioperative environment where the potential for adverse events is high due to:

- the inherent risks of surgery and anaesthesia
- the increased vulnerability of the unconscious patient cohort
- frequent emergency situations
- the use of complex medical equipment.

A range of emergency equipment checks are regularly required (see Figure 2-5). All nursing staff, regardless of their primary role, should know the location of commonly used emergency equipment so that they can be quickly accessed in an emergency. In addition to keeping the clinical environment and areas clean, clear and de-cluttered, all emergency equipment must be checked and charged, and emergency equipment kept in a state of readiness. Emergency equipment will vary between operating suites, depending on the size and complexity of procedures undertaken. Each item will have a checklist to document the checking procedures.

Figure 2-5. Routine emergency equipment checks



ACTIVITY

2-3 Emergency equipment

Walk around your OS and locate the equipment listed above. Which items are present in your OS? Discuss the function of each with your facilitator.

Electrical safety

The OR has a large amount of electrical equipment and a number of unique safeguards in place to ensure both patients and staff are safe. These include line isolation monitors (LIM) and residual current devices (RCD) which will activate in the presence of an electrical fault with warning lights and audible alarms, and electrical supply to the piece of equipment is interrupted for safety.

The following reading describes these safety systems and also defines 'body' and 'cardiac' protected areas (see Figure 2-6) within the OS.

Figure 2-6. Signage denoting electrical protection

Source: NSW Health (2017)

READ

Hamlin et al. (2016) Chapter 5, pp 108-109, Electrical safety

ACTIVITY

2-4 Electrical safety
Walk around your OS and identify the line isolation monitors (LIM) and residual current devices (RCD). Ask your facilitator to show you how these items are checked. Record the method for checking in the Activity section.

Equipment failure: business continuity plans

Supply failure of any utility or service is possible, and all OS will have local contingency plans (known as business continuity plans) to manage such interruptions and ensure that delivery of essential perioperative services can continue. Each facility and department holds plans to manage short term disruption (e.g. local loss of power) and long term disruption (e.g. natural disaster) to key utilities and systems including power, gas, medical gases, water, lifts, communications, networks, vital systems, supply of critical materials (clinical, food), and relocation of services due to evacuation (NSW Health PD2012_067, 2012).

As in most clinical settings, the malfunction or failure of equipment or systems may impact detrimentally on patient safety, and clinicians must be alert to back up options and support mechanisms so the loss of function does not cause harm to the patient (NSW Health PD2014_012, 2014).

Trip hazards

Cables and tubing from clinical machinery pose a risk to staff as they move around the OR. Figure 2-7 shows examples of trip hazards. Managing trip hazards in the OR involves removing the cables and tubing from the floor and attaching them to ceiling 'boons' as can be seen in Figure 2-8. If this is not possible, adhesive anti trip covers should be placed on the floor over cables and tubing to reduce risks to staff (see Figure 2-9).

Figure 2-7. Example of trip hazards in the OR

Source: NSW Health 2017

Figure 2-8. Ceiling boons

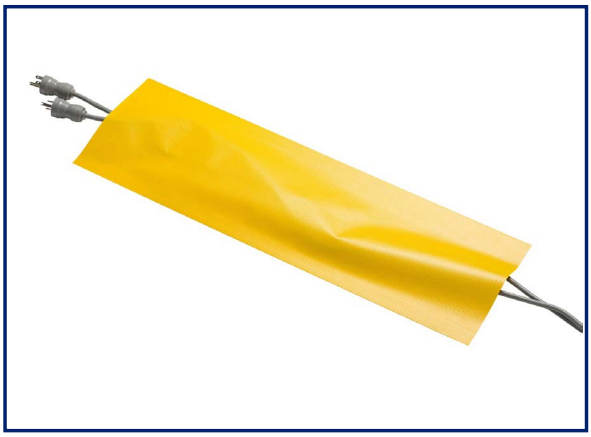
Source: NSW Health 2017

Slips

Any fluid spilt and not cleaned up immediately constitutes a hazard. Blood, body fluids, irrigation fluid and 'prep' solution are examples of fluids that are potentially hazardous and may cause injury to staff. The floor can also be slippery following cleaning in between cases. Education of ancillary staff on correct methods of cleaning and use of dry fibre mops can reduce risks to staff.

Any fluid spilt should be immediately cleaned up or managed to prevent injury. When performing surgery that uses irrigating fluid e.g. neurosurgery, orthopaedics and urology, the use of absorbent mats (see Figure 2-10) or an irrigation pouch connected to a suction canister (see Figure 2-11), are helpful in mitigating the risk from spills.

Figure 2-9. Anti-trip cover



Source: © Flagshipsurgical.com

Figure 2-10. Absorbent mat

Source: Sandelmedical.com

Figure 2-11. Irrigation pouch

Source: © Healthcare Purchasing News

Ionising radiation

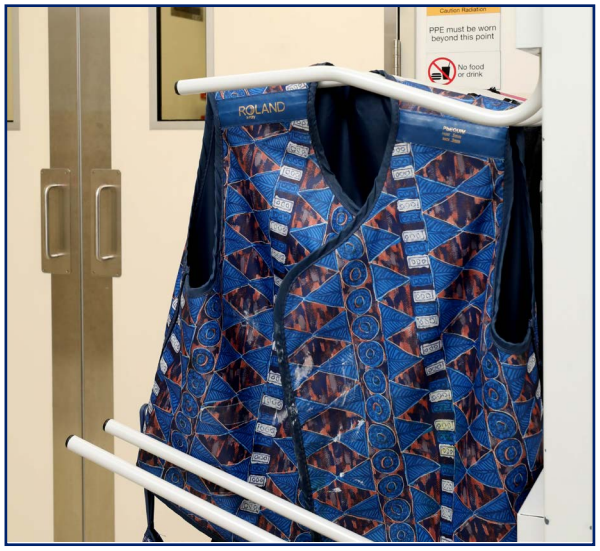
Ionising radiation is used in the OS for verification of surgical interventions by way of image intensification (II) and mobile x-ray, and is an inherent part of many types of surgery. There are three basic principles in limiting patient and staff exposure:

- **Justification**: radiation exposure is permitted only if more good than harm is done.
- **Optimisation of protection**: exposure to radiation should be 'as low as reasonably achievable' (ALARA), aiming for the greatest diagnostic information with the smallest dose.
- **Limitation of individual dose**: prescribed Australian dose limits exist (occupational exposure limit > public exposure limit) (Australian Government, 2012). Basic protection is essential for perioperative staff (see Figure 2-12), and those with significant potential exposure are required to wear a personal radiation monitor to track their annual dose. Patients should have uninvolved body parts protected.

NSW Health policy *Work health and safety: limiting staff exposure to ionising radiation* (PD2014_026, 2014) mandates that all NSW Health staff with occupational exposure to ionising radiation be provided with information and training, including hazards, safety arrangements, monitoring requirements, and how to contact the local Radiation Safety Officer. See Figure 2-13 for practical radiation protection in the perioperative context.

Figure 2-12. (L to R) Lead apron, thyroid protection, and protective eyewear; correct storage of lead aprons

Source: Rothband.com



Source: NSW Health 2017

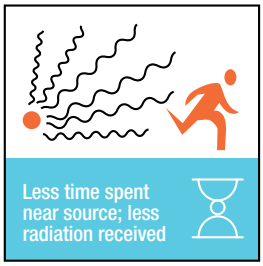
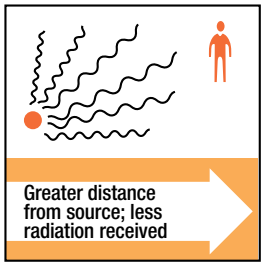
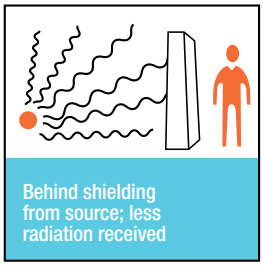
READ

Hamlin et al. (2016) Chapter 5, pp 117-119 on Radiation Safety
Example of local radiation policy from South Eastern Sydney LHD

ACTIVITY

2-5 Radiation protection
Walk around your OS and note the location of the x ray gowns and thyroid protectors. Describe how they are stored. Are they stored correctly?

Figure 2-13. Practical radiation protection for perioperative staff

Time	Distance	Shielding
		
• The longer the exposure, the greater the dose received and related risk of negative biological effect • Limit and record time exposed • Identify and communicate when radiation is to be used to allow time for others to leave area	• Inverse relationship exists between proximity to source and dose received • Doubling your distance from the source reduces dose by 75% • Tripling the distance gives 1/9 the dose rate	• Lead is used as an effective physical barrier in glass screens, aprons, thyroid protectors, eyewear, sheets, and gloves • If you are present in the OR when ionising radiation is in use, lead apron or shields must be used • Lead gowns must be hung after use to prevent cracking and compromised protection

ALWAYS
- Be aware of unexpected exposure: maintain situational awareness
- Wear your personal radiation monitoring device (if applicable)
- Contribute to a positive safety culture: inspect and enforce radiation safety

Source: NSW Health 2014, GeigerCounter.com

Electrosurgery units (ESU)

Electrosurgical units, also known as diathermy machines, are used to facilitate haemostasis and/or the cutting of tissue during surgical procedures. This is achieved by passing normal electrical current via the diathermy machine and converting it into a high frequency alternating current (HFAC) (Le, 2016). The HFAC produces heat within body tissues to coagulate bleeding vessels and cut through tissue. At this high frequency, the nervous system and muscles are not affected by the current passing through the body (Le, 2016).

The use of diathermy is associated with a high risk of injury to both patients and staff. Guidance, training, and caution are required for use.

There are two types of diathermy: **monopolar** and **bipolar.**

Monopolar diathermy – the current is discharged from the active electrode to the patient's tissue to coagulate or cut tissue. The current then passes through the patient's body and is collected by the patient return electrode. This forms an electrical circuit, ensuring the patient does not receive any electrical burns. The patient return electrode may be in the form of a disposable adhesive pad placed on the patient's body close to the surgical site or by a reusable capacitive pad on which the patient is lying. Both these return electrodes are attached to a diathermy machine (see Figure 2-14) completing the electrical circuit.

The active electrode is usually in the form of a sterile 'diathermy pencil', activated by the surgeon using the buttons (see Figure 2-15). In laparoscopic surgery, a different style of active electrode is used and a foot pedal is used to activate the electrode.

Figure 2-14. Active electrode diathermy pencil with suction attached

Source: Biggreen.com.au

Figure 2-15. Diathermy machine with foot pedal

Source: NSW Health 2017

Bipolar diathermy – the passage of the current from the diathermy machine uses only the patient's tissue grasped between a pair of bipolar forceps. One tine of the forceps is the active electrode and the other tine is the return electrode (see Figure 2-16). The current passes between each to form a complete electrical circuit within the patient. Bipolar diathermy does not require a patient return pad as both active and return electrodes are combined within the diathermy forceps.

Figure 2-16. Bipolar forceps

Source: Elitemedical.com.au

READ

Hamlin et al. (2016) Chapter 5, pp 109–112, Electrosurgical equipment.
This reading provides information to reduce risks of injury. Note Box 5-2 and Box 5-3 on important points of patient safety.

ACORN (2018) Standard on electrosurgery management.

ACTIVITY

2-6 Patient return electrodes
Identify the types of patient return electrodes used in your OS. In the Activity section, describe the general safety issues to consider when using:

- Disposable patient return electrode
- Reusable capacitive pad

Using the table in the Activity section, describe three occasions you have applied a patient return electrode, including the location of the patient return electrode, type of surgery and the patient safety actions you undertook.

Laser safety

Class 3b and 4 lasers are commonly used therapeutically in association with many types of surgery. However, laser energy can travel beyond the intended site and potentially cause injury to unprotected skin and eyes of the patient and staff in the area (Hamlin et al, 2016; see Figures 2-17 and 2-18 for safety measures). Lasers also carry a significant risk of fire, electrical hazard, and surgical plume, and require cautious, informed use (Hamlin et al, 2016). Staff must complete a recognised laser safety course prior to operating the laser.

Figure 2-17. Warning signs for perioperative laser and radiation use

Source: NSW Health 2017

Figure 2-18. Minimising laser risks: safety precautions for patients and staff

LASER SAFETY MEASURES

- Awareness training for all perioperative nurses working in an OS where lasers are used.
- Completion of a recognised laser safety course for those operating the laser.
- Signage verifying the OR has been adapted for specific laser use.
- Restricted entry to the OR where laser is in use and placement of warning signs on all entry doors.
- Availability and use of laser safety goggles.
- Provision of fire fighting equipment in the laser area. (ACORN, 2018)

READ

Hamlin et al. (2016) Chapter 5, p 113.
Note Figure 5-12 in the reading, protective goggles worn by staff. Also note the additional warning signage when laser is in use.

ACORN (2018) Standard on Laser Safety.
Example of local perioperative laser safety policy from Northern Sydney LHD

Surgical plume

Surgical smoke plume is a bio-hazardous by-product generated by devices such as lasers, diathermy, ultrasonic devices, high speed drills, bone saws, and other energy based devices used in surgery (ACORN, 2016). As these instruments cauterise vessels and vaporise tissue, fluid, and blood; a gaseous material known as surgical plume is created (NSW Health, GL2015_002). The plume contains noxious airborne contaminants which may include visible and invisible aerosol particulates, smoke, and gases, and has been shown to be as carcinogenic and mutagenic as cigarette smoke (Hill, O'Neill, Powell, & Oliver, 2012). This presents a hazard to all perioperative staff present within the OR as it may be inhaled (ACORN, 2016). Surgical plume is a unique workplace hazard which should be evacuated from the surgical site and not allowed to become airborne. The active electrode (diathermy pencil) has suction tubing incorporated into its design which is attached to a plume evacuation unit (see Figure 2-19). When the surgeon activates the diathermy pencil, the plume evacuation unit is activated and removes the plume from the surgical site. The plume evacuation units contain filters that absorb the plume preventing it from being dispersed into the atmosphere (Hamlin et al, 2016). Control measures must be applied to protect all staff in the OR (see Figure 2-20).

Figure 2-19. Surgical plume evacuation unit located beneath a diathermy machine

Source: Biggreen.com.au

Figure 2-20. Minimising surgical plume risk

SURGICAL PLUME SAFETY MEASURES

- Adequate plume evacuation at the source i.e. use plume evacuation systems.
- Effective room exhaust ventilation (air filtration systems).
- Use of standard precautions against exposure to bloodborne pathogens when entering or working in an area where infectious material from a plume could be present in the air or on surfaces.
- Use of high filtration masks during disease transmissible procedures e.g. ablation of genital warts (Harkavy & Novak, 2014).
- Maintenance of the plume evacuation system e.g. replacing filters in accordance with the manufacturer's instructions.
- Information for staff on the danger of surgical plume and risk mitigation.
- Training in the use/maintenance of plume evacuation equipment and PPE.
- Auditing for compliance by skilled persons (NSW Health guideline, GL2015_002, 2015).

READ

Hamlin et al. (2016) Chapter 5, pp 114-115 on Surgical plume. *Note Figure 5-13, p 115 on the constituents of surgical plume and Figure 5-14, p 115 showing the components of surgical plume evacuator.*

ACORN (2020) Standard on Surgical Plume. www.acorn.com.au

ACTIVITY

2-7 Surgical plume

Identify the surgical plume evacuation units used within your OS. Write your answer in the Activity section.

An undergraduate nursing student asks you why using a surgical plume evacuator is important. You respond by identifying three reasons for using a surgical plume evacuator. Record your reasons in the Activity section.

Surgical fires

ORs have an increased risk of fire due to the constant presence of the basic elements of fire: oxygen, heat sources such as electrosurgical units and lasers, and potential fuel sources such as drapes, swabs, alcohol skin preparation solutions (see Figure 2-21).

Figure 2-21. The fire triangle showing specific perioperative risks

Source: Bates 2011

Perioperative staff can prevent the three elements of fire from combining in the OR by controlling heat sources (safe use of laser and electrosurgical units), managing fuels (remove combustible rubbish prior to commencement of surgery), and by minimising atmospheric oxygen concentration through judicious use of oxygen (ECRI Institute, 2017). Risk minimisation actions include:

- when using alcohol skin preparation solutions, prevent pooling under or around the patient and allow thorough drying of surgical site prior to draping and use of diathermy
- protect heat/ignition sources e.g. keep the diathermy pencil in quiver/holster which is attached to the drapes, when not in use to prevent accidental activation
- where open oxygen delivery is required, this is to be communicated within the team and the minimum concentration of oxygen necessary is delivered
- supplemental oxygen should be ceased at least one minute prior to use of electrosurgery or laser
- oxygen is heavier than air and collects in low-lying areas (e.g. open chest cavity, drape folds). Some materials (e.g. some drapes) absorb and retain oxygen: with increased oxygen, a fire is easier to ignite, will burn faster and hotter, and will be more difficult to extinguish
- awareness and mitigation of high-risk procedures where oxygen delivery systems providing oxygen to the patient as part of their anaesthesia is in close proximity to the surgical site, for example, tonsillectomy, tracheostomy, surgery to the oropharynx, larynx, head, neck, eyes, or face. The drapes should be arranged to minimise the oxygen enriched atmosphere building up underneath and risking ignition. Moistened sponges can be used around the surgical site for ignition resistance
- avoid the application of bone cement during electrocautery
- storage of chemicals, gas bottles and flammable liquids away from combustible products
- adherence to Safety Data Sheets (SDS)
- participation in fire and evacuation drills (ECRI, 2009).

Fires in the perioperative environment are rare, but potentially devastating (Spruce, 2016). A miss-step in procedure or lapse of caution can quickly escalate to a catastrophe for the patient. Prompt action is required at the first sign of smoke or fire to avert a disaster. See Figure 2-22 for immediate response actions in the event of a surgical fire.

Figure 2-22. Team response to surgical fire

PERIOPERATIVE TEAM RESPONSE TO A SURGICAL FIRE	
Fire on/in the surgical patient	**Airway fire**
1. Stop the flow of all airway gases to the patient **2. Immediately remove the burning materials** (another team member is to extinguish). If needed, use CO^2 fire extinguisher to extinguish the fire **3. Care for the patient:** — Resume ventilation — Control bleeding — Evacuate the patient if the room is dangerous from smoke or fire — Examine the patient for injuries and treat accordingly **4.** If the fire is not quickly controlled, **call for assistance and follow RACE (remove, alert, confine, extinguish) procedures**. Quarantine the involved devices for later investigation.	At the first sign of an airway or breathing circuit fire, immediately: **1. Stop the flow of all gases to the airway and remove tracheal tube** (another team member is to extinguish). Remove any segments of burned tube remaining in airway **2. Pour saline or water into the airway** **3. Care for the patient:** —Assist in the re-establishment of the airway: resume ventilating with air until certain that nil burning remains then switch to 100% oxygen —Assist in airway examination to determine injuries: assist in treatment **4.** If the fire is not quickly controlled, **call for assistance and follow RACE procedures**. Quarantine the involved devices for later investigation.

Adapted from ECRI Institute 2009.

The NSW Health policy *Fire safety in health care facilities* (PD2010_024) requires staff to complete mandatory fire safety education annually. Perioperative units should also conduct local fire drills periodically. It is imperative that each staff member understands the fire systems within their work environment, including the location of gas isolation valves, break glass alarms, extinguishers, Warden Intercom Phones (WIP), fire compartments, fire exits, fire blankets, and the local evacuation plan.

Evacuation

During a fire alarm or other emergency affecting the OS, surgery that has not yet commenced is to be suspended until the emergency has been investigated and stood down (surgery in progress is completed as able). In most perioperative emergencies, a full evacuation will not be required however situations may arise that require a Stage 1 or Stage 2 evacuation (see Figure 2-23) to ensure safety of the patient and staff. Anaesthetised and/or intraoperative patients will require rapid preparation for transfer. Consider the following:

- alert OR management and ensure the facility's emergency number is called
- identify a safe relocation point: consider an OR located in an adjacent fire compartment or safe area, or PACU
- secure haemostasis where possible e.g. pack wound with saline soaked sponges and apply a clean dry sterile cover
- prepare to hand-ventilate for transfer
- transfer patients on beds with equipment where possible: place all essential equipment e.g. infusion pumps, monitoring etc. on the patient's bed.

If circumstances dictate that an intraoperative patient is unable to be moved, evacuation decisions are at the discretion of the surgeon and the staff working in the OR.

Figure 2-23. Evacuation basics

EVACUATION: NEED TO KNOW

Code Orange: Australian Standard emergency code for evacuation used by Australian healthcare facilities. Each facility will have a documented response to emergencies requiring evacuation and pre-identified evacuation assembly points.

Stage 1 evacuation: Removal of persons from the immediate danger area

Stage 2 evacuation: Removal of persons to an adjoining fire compartment

Stage 3 evacuation: Complete evacuation of the building (must be authorised by Fire & Rescue NSW or the facility incident controller)

Evacuation plan: Unit-level plans providing detail and planning on the safe and coordinated movement of patients and workers away from danger. May include egress routes, preferred relocation area, and evacuation aids available. Evacuation drills are conducted periodically to test the plans and educate staff.

RACE procedure: Remove (persons in immediate danger if safe to do so), **Alert** (inform occupants and the facility emergency number), **Confine** (fire and smoke by closing all doors on exit), **Extinguish** (the fire if safe to do so).

Source: NSW Health (2010, PD2010_024)

Emergency response information is located on the emergency procedure flipcharts located at every workstation/OR.

The following readings and videos provide a detailed description of fire hazards, the dangers and management strategies.

READ

Hamlin et al. (2016) Chapter 5, pp 115-117.
Note Box 5-4 and follow the links to news media reports of fires in the perioperative environment.

Seifert, P., Peterson, E. & Graham, K. Crisis management of fire in the OR. *AORN Journal. 101*, (2) pp 250-263.

Emergency Care Research Institute (ECRI) The patient is on fire! A surgical fires primer
Explore the ECRI website http://www.mdsr.ecri.org/ *and view the fire safety video.*

ACTIVITY

2-8 Fire safety
Walk around your OS and locate fire extinguishers, break glass alarms and fire plans. Where is each fire compartment located and how are they activated?
Scenario: You are the circulating nurse for a procedure, when the nurse educator enters and informs the team there is a fire in the equipment store room and the OS is to be evacuated. How will you and the team manage this situation?
Note your answers in the Activity section.

Chemicals

Many chemicals, gases, and therapeutic agents used in the OS may pose a risk to patients and staff if not handled appropriately, including but not limited to high grade disinfectants, volatile anaesthetic gases, bone cement and cytotoxic agents. Staff involved in using hazardous substances must be aware of the requirements for their safe use and handling, and the treatment of accidental exposure including spill kits and first aid (Hamlin et al, 2016; NSW Health PD2013_005). ChemAlert, NSW Health's electronic register of all hazardous substances used in the workplace, must be accessible and maintained as it is the central repository for safety data sheets (SDS), stock inventory and storage location reports, approvals for use, and assistance in conducting risk assessments for all hazardous materials related to each unit (NSW Health, 2013).

The following reading provides an overview on chemical safety including use of spill kits.

READ

Hamlin et al. (2016) Chapter 5, pp 119-120, Chemical Safety.

ACTIVITY

2-9 Chemical safety
Complete the exercise on chemicals used within your OS in the Activity section.

Latex

Many commonly used items within the OS may contain latex (see Figure 2-24). Whilst many items have warning labels attached (see Figure 2-25) e.g. sterile gloves, many do not and may place patients in danger of an allergic reaction which may lead to anaphylaxis. Patients most at risk of latex allergy are those with prolonged or frequent exposure to latex products (ASCIA, 2010). NSW Health policy on the prevention and management of latex allergy is that powder-free or latex-free gloves are to be used in NSW Health facilities (ACORN, 2018).

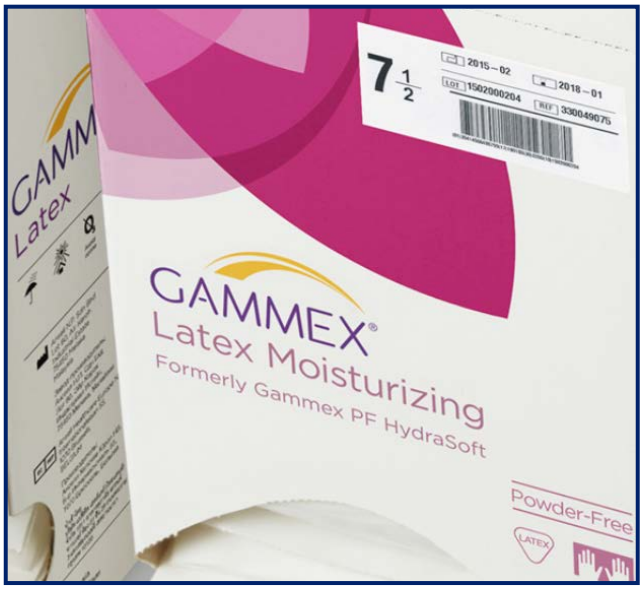
Figure 2-24. Equipment that may contain latex

Equipment used in perioperative areas that may contain latex	
Endotracheal tubes	Tourniquets
Urinary catheters	Operating theatre tables
Dressings	Older anaesthetic circuits
Special order sterile gloves	Oxygen masks
Non-sterile gloves	Other items used extensively in the provision of care

Patients known to be latex sensitive should be scheduled first on the morning operating list. If the OS is not latex-free, designated latex-free kits must be available containing key latex-free equipment. If latex-containing gloves are used within the OS, all staff entering the OR should change into clean clothes and thoroughly wash their hands. All staff should remain within the OR for the duration of the case, and the patient should be recovered in the OR to reduce potential exposure (ASCIA, 2010).

Perioperative staff are recommended to use powder-free or latex-free gloves to prevent self-sensitisation to latex (ASCIA, 2010). If latex gloves are used, hand washing after removal and the use of water based barrier cream is recommended (Hamlin et al, 2016). Perioperative staff with a latex allergy are encouraged to discuss their requirements and options with their manager: there are obvious challenges in completely avoiding latex in the perioperative environment.

Figure 2-25. Labelling on latex-containing gloves



Sharps

The use of sharps and sharp devices exposes perioperative nurses to the risk of injury and potential exposure to blood borne infectious agents (NHMRC, 2010). The established hierarchy of controls to prevent sharps injuries includes reduction/elimination of sharps where possible, isolation of the hazard by engineered controls, work practice controls, and the use of PPE (NHMRC, 2010). For perioperative nurses, specific risk reduction techniques are included in Figure 2-26.

Figure 2-26. Risk reduction in handling sharps

ACTIONS TO MINIMISE RISK OF SHARPS INJURY

- Wear PPE to protect against sharp injuries, for example double gloves, fully enclosed footwear (ACORN, 2016).
- Avoid distractions or rushing when passing or receiving sharps.
- Identify a position for intraoperative sharps: communicate this with the surgical team.
- Use blunt needles where possible.
- Do not recap or re-sheath sharps on the sterile field.
- Avoid hand-to-hand passing of sharps: use a basin or neutral zone.
- Place all disposable sharps in a designated sharps container immediately following use.
- Acknowledgement that the person who has used the sharp takes responsibility for safe disposal i.e. the instrument nurse at the end of the procedure (Hamlin et al, 2016).
- Give verbal announcements when passing sharps.
- Use instruments rather than fingers to grasp needles, retract tissue, and load/unload needles and scalpels.

(ACORN, 2018; NHMRC, 2010)

ACTIVITY

2-10 Workplace hazards
Complete the table in the Activity section on managing workplace hazards.

Waste management

The OS contributes to 20% – 70% of all healthcare waste each year (ACORN, 2016). The increased use of disposable medical supplies, for example, drapes, gowns and single use non-recyclable items have contributed to an increase in healthcare waste. Waste that is saturated with blood or body fluids is classified as contaminated as it has the potential to cause disease if not disposed of safely. However, much of the waste generated within the OS can be disposed of as general waste, this includes items such as swabs or gowns that may only be covered with a small amount of blood. Other items, such as, paper, instrument wraps, plastic bottles and some endoscopic staplers can be recycled. The OS can play an important role in managing the waste it generates by developing environmentally responsible policies and collaborating with local waste management companies to reduce, reuse and recycle. Educating staff on segregating waste items into the appropriate receptacles is a vital step in safe, sustainable and responsible practices (ACORN, 2018).

READ

Hamlin et al. (2016) Chapter 5, pp 121-122, Waste management.
This reading provides an overview on managing the various types of waste generated within the perioperative environment.

ACORN (2018) Guideline on Environmentally sustainable perioperative practices.
Note Appendices A and B for detailed waste disposal guidance.

ACTIVITY

2-11 Waste management
Investigate how each type of waste is segregated in your OS. Complete the table in the Activity section.

Manual handling and patient positioning

Perioperative staff require training in the safe and coordinated movement of patients and equipment, and in the use of a range of lifting and positioning aids (available aids will vary between facilities). Communication and team work are integral to the safe movement of patients and injury prevention of staff.

Commonly used manual handling aids to transfer patients to and from the operating table include slide sheets and boards (trade name: Patslide™, see Figure 2-27). Many OS use air-assisted lateral transfer devices (trade name: HoverMatt™, see Figure 2-28), which are particularly useful for bariatric patients. Regardless of which manual handling device is used, transferring the patient or positioning them for surgery should be a coordinated movement to ensure patient and staff safety. The anaesthetist manages the patient's airway

and therefore coordinates the move. There should be sufficient personnel to safely complete the move. ACORN (2018) recommends a minimum of three people to safely move patients weighing less than 30kgs. More personnel and manual handling aids will be required for patients weighing over 30kgs. A risk assessment must be made for each patient, as any comorbidities will influence the planning for moving patients and aids required.

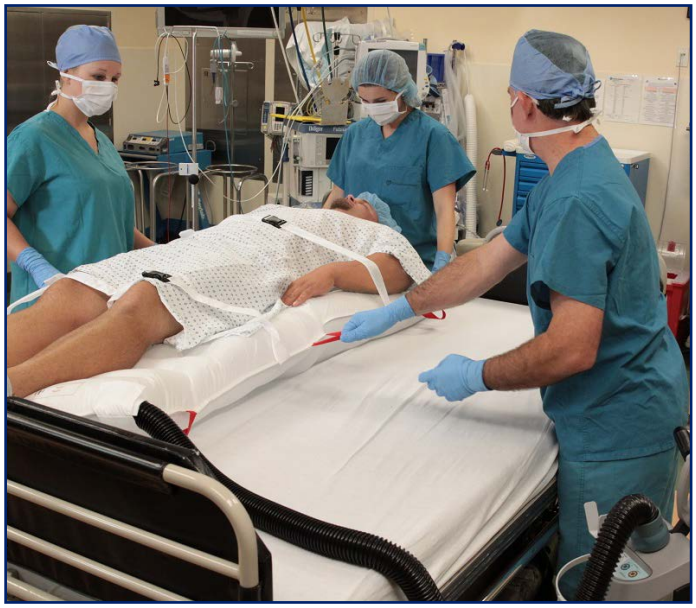
Positioning Essentials

- Knowledge of anatomy, physiology, surgical positions, positioning techniques.
- Clear and stable surgical and anaesthetic access, nil injury to patient.
- Planning and teamwork: anaesthetist takes the lead.
- Support and secure patient.
- Document positioning.

Figure 2-27. Patient transfer using slide board (note position of staff to ensure safety)

Source: Surgery101.com

Figure 2-28. Use of HoverMatt™ in patient transfer



Source: Activehealthcare.co.nz

The following two readings review the manual handling of perioperative patients, in particular the needs of bariatric patients.

READ

Hamlin et al. (2016) Chapter 5, p114, Manual Handling; also Chapter 9, pp 233-236, Patient transfer.
These readings review manual handling and the needs of bariatric patients (Feature Box 9-1).

ACORN (2018) Position statement on safe manual handling.

ACTIVITY

2-9 Chemical safety
Complete the exercise on chemicals used within your OS in the Activity section.

Patient positioning

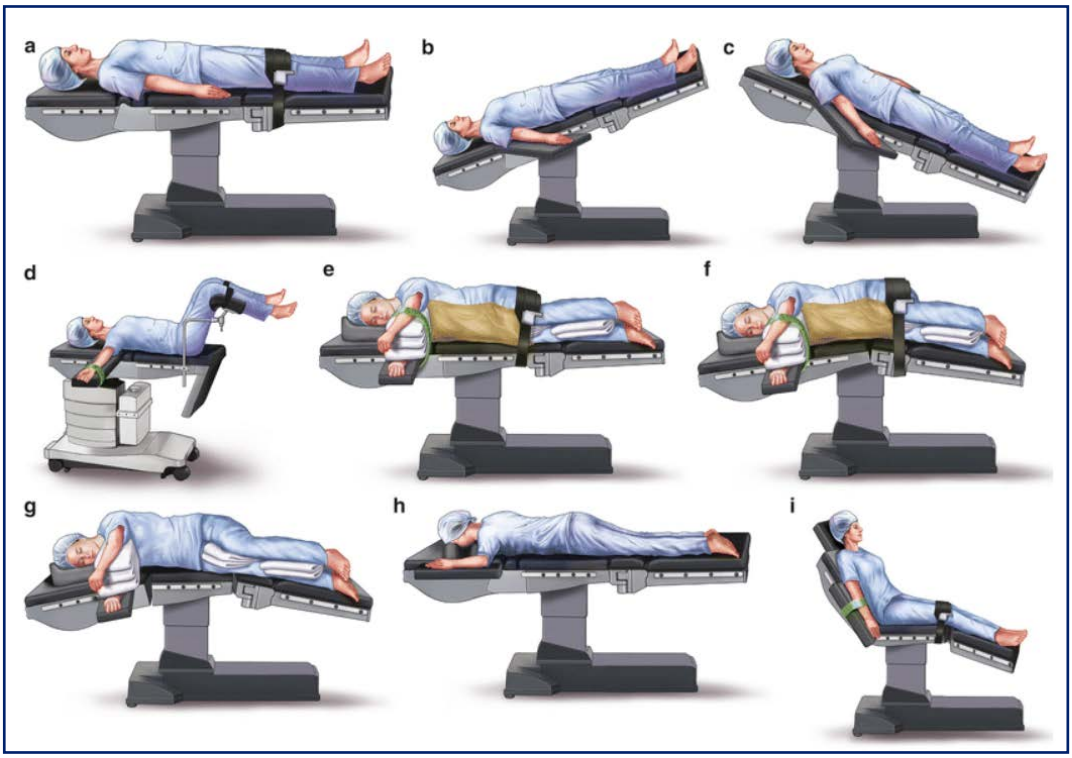
The principles of positioning are grounded in a basic knowledge of applied anatomy and physiology. All members of the team should have knowledge of the different surgical positions, the correct techniques needed to employ these positions and the careful planning required to prevent injuries to both patient and staff.

The main objective when positioning a patient for surgery is to ensure the surgeon has clear, stable access to the surgical site, however the anaesthetist also needs to maintain access to control the patient's airway, access the circulatory system for administration of medication, and to be able to monitor the patient's condition during the procedure. These needs are balanced with those of the patient to ensure injuries as a result of the surgical position are prevented. Musculoskeletal injuries, harm to the nervous and circulatory system, and pressure injuries must be avoided.

To achieve this delicate balance, the perioperative team works together using a range of operating tables and positioning aids to carefully position the anaesthetised patient. Planning ahead to ensure the required table and all positioning aids are present prior to moving the patient will prevent delays and possible patient injury. It is often necessary to uncover the patient to ensure correct body alignment when positioning. However, once the patient is secure in the correct position, they should be covered with sheets or warming devices to protect their dignity as well as preserving normothermia. All OS have a method of documenting patient positioning and the aids used (ACORN, 2018).

See Figure 2-29 for common operative positions.

Figure 2-29. Operative positions



(a) supine
(b) Trendelenburg
(c) reverse Trendelenburg
(d) lithotomy
(e) lateral decubitus
(f) lateral jackknife
(g) lateral kidney
(h) prone
(i) sitting

Source: Anesky.com

READ

Hamlin et al. (2016) Chapter 9, pp 236-251, Patient positioning.
This reading details the safety considerations with common surgical positions. Use the information to complete Activity 2-12.

ACORN (2018) Standard on Safe patient positioning in the perioperative environment.

ACTIVITY

2-12 Patient positioning
Consider your actions in transferring and positioning the following patient:
Mr Klim, 47, weighs 120kgs. He is admitted to your OR for a right open nephrectomy. Consider the position required for this procedure and describe how you and the surgical team will safely transfer and position Mr Klim on the operating table.
Complete your answer and the table in the Activity section.

Clinical procedure safety

In 2016 in NSW, there were three reported incidents where patients suffered injury as a result of surgery on either the wrong patient or the wrong body part (Auditor General, 2017). The NSW Health policy on Clinical Procedure Safety (PD2017_032, 2017) was developed to reduce clinical procedure related incidents, in accordance with the World Health Organization (WHO) Surgical Safety Checklist (SSC) and the Royal Australasian College of Surgeons Surgical Safety Checklist. The objective is to reduce clinical procedure related incidents by:

1. improving pre-operative verification of the planned procedure
2. ensuring all equipment and planning has been attended
3. strengthening communication both within the team and with the patient (NSW Health, 2017).

Clinical Procedure Safety is the responsibility of all perioperative team members, and relies on the team to be diligent, communicate effectively, and resolve discrepancies as they are identified, at all stages of the perioperative journey. The process involves engaging the patient and carer/parent as much as possible in verifying the patient's information and planned procedure. Some facilities use a paper-based checklist (see sample in Figure 2-30) while others use electronic versions or a combination of both. The use of checklists formalises the process and assists in the identification of risks to be addressed (Cabral et al., 2016).

As per the Clinical Procedure Safety policy, the anaesthetist is responsible for **Sign In One**. **Sign In Two** and **Team Time Out** involve the entire team and are led by the surgeon/proceduralist (see Figure 2-31).

Team Time Out, usually carried after the patient is anaesthetised and just prior to commencement of the surgery, is the final opportunity to check the identity of the patient, resolve any discrepancies or issues about the procedure and availability of equipment. The **Sign Out** section is completed by the intraoperative team before the patient leaves the OR, seeking to ensure all checks and documentation are completed appropriately and is then used to frame a clinical handover to PACU.

When a discrepancy or incident occurs, an incident notification must be completed via IIMS.

Figure 2-30. Sample of a Clinical Procedure Safety checklist

NSW GOVERNMENT Health
South Eastern Sydney Local Health District
Sydney Children's Hospital Randwick

Facility:

CLINICAL PROCEDURE SAFETY CHECKLIST LEVEL 3

If this checklist is not completed or check is incorrect, IIMs notification to be entered.

Name of Proceduralist who led checklist: _____

FAMILY NAME | MRN
GIVEN NAMES | ☐ MALE ☐ FEMALE
D.O.B. _____ / _____ / _____ | M.O.
ADDRESS
LOCATION / WARD
COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE

SIGN IN - Before Induction of Anaesthesia/Sedation

PATIENT / CARER HAS CONFIRMED
☐ Identity ☐ Procedure
☐ Site ☐ Consent

☐ **SITE MARKED**
☐ Not Applicable

☐ **ANAESTHESIA / SEDATION SAFETY CHECK COMPLETED**
☐ Not Applicable

☐ **PULSE OXIMETER ON PATIENT AND FUNCTIONING**

DOES PATIENT HAVE A KNOWN ALLERGY / ADVERSE REACTION
☐ Yes
☐ No

KNOWN DIFFICULT AIRWAY/ ASPIRATION RISK
☐ Yes, and Equipment/Assistance available
☐ No

RISK OF >500mL BLOOD LOSS (7mL/kg in Children)
☐ Yes and Adequate Intravenous Access and Fluids Planned
☐ No

PROSTHESIS / SPECIAL EQUIPMENT:
Special equipment needed is available and functional
☐ Yes

Name ..... **Designation** .....

Signature ..... **Date** .....

TIME OUT – Prior to Commencement of Procedure

☐ **CONFIRM ALL TEAM MEMBERS HAVE INTRODUCED THEMSELVES BY NAME AND ROLE**

SURGEON, ANAESTHETIST AND NURSE VERBALLY CONFIRM
☐ Patient ☐ Procedure
☐ Site ☐ Allergies

ANTICIPATED CRITICAL EVENTS
☐ **SURGEON REVIEWS:**
What are the Critical or Unexpected Steps, Operative Duration, Anticipated Blood Loss

☐ **ANAESTHESIA TEAM REVIEWS:**
Are there any Patient-Specific concerns

☐ **NURSING TEAM REVIEWS:**
Has Sterility (including indicator results) been confirmed
Are there Equipment Issues or any concerns

HAS ANTIBIOTIC PROPHYLAXIS BEEN GIVEN WITHIN THE LAST 60 MINUTES
☐ Yes ☐ Not Applicable

SPECIAL MEDICATION ADMINISTERED
☐ Yes ☐ Not Applicable

HAS THE PATIENT RECEIVED THROMBOPROPHYLAXIS
ANTICOAGULANT ☐ Yes ☐ Not Required
MECHANICAL ☐ Yes ☐ Not Required

IS ESSENTIAL IMAGING DISPLAYED
☐ Yes ☐ Not Applicable

PRESSURE INJURY PREVENTION PLAN IMPLEMENTED
☐ Yes ☐ Not Applicable

HAS POSITION OF PATIENT BEEN CONFIRMED
☐ Yes ☐ Not Applicable

Name ..... **Designation** .....

Signature .....**Time**..... **Date**.....

SIGN OUT - Before patient leaves Operating/Procedure Room

NURSE VERBALLY CONFIRMS WITH THE TEAM:

☐ **NAME OF THE PROCEDURE RECORDED**

☐ **ACCOUNTABLE ITEMS / INSTRUMENT CHECKS COMPLETED**

☐ **SPECIMEN / IMAGES ARE LABELLED CORRECTLY**
☐ Not Applicable

☐ **WHETHER THERE ARE ANY EQUIPMENT PROBLEMS / ISSUES DOCUMENTED & RELEVANT STAFF ADVISED**
☐ Not Applicable

☐ **SURGEON, ANAESTHETIST AND NURSE REVIEW THE KEY CONCERNS FOR RECOVERY AND MANAGEMENT OF THIS PATIENT IN CLINICAL HANDOVER (PRIOR TO LEAVING OPERATING ROOM)**

☐ **BLOOD LOSS DOCUMENTED AND ONGOING MANAGEMENT DISCUSSED**
☐ Not Applicable

POST PROCEDURE VTE PROPHYLAXIS ORDERED.
☐ Yes
☐ Not Required

PROCEDURAL TEAM CONFIRMS ADVICE FOR CLINICAL HANDOVER (IN POST ANAESTHETIC CARE UNIT)
☐ Yes
☐ Not Applicable

Name ..... **Designation** .....

Signature ..... **Date** .....

Source: South Eastern Sydney Local Health District 2017.

Figure 2-31. Elements required for Clinical Procedure Safety: Level 3 procedure

Requirements	
1. Pre-Procedure	**2. Sign In**
- Patient identification - Procedure verification – planned procedure + site/side/level, where appropriate, matches consent - Site/side/level marking, where appropriate	**SIGN IN ONE** - Patient identification - Procedure verification – planned procedure + site/side/level, where appropriate, matches consent - Allergy/adverse reaction check - Sedation/anaesthetic equipment checked - Patient sedation risk /anaesthetic assessment - Significant airway or aspiration risk - Clinician airway monitor identified - Clinician skilled to manage airway identified - Pulse oximeter working - Risk of major bleeding **SIGN IN TWO** - Essential imaging available - Site marking (exemptions) - Implants and special equipment - Proceduralist available to complete procedure
3. Team Time Out	**4. Sign Out**
- Team member introductions - Patient identification - Procedure verification - planned procedure + site/side/level, where appropriate, matches consent - Patient position - Essential imaging reviewed - Allergy/adverse reaction check - Special medication/s administered - Antibiotics - VTE prophylaxis - Anticipated critical events	- Name of procedure recorded - Counts/tray list checks correct - Specimens/images labelled correctly - Blood loss documented; ongoing blood loss discussed - Equipment problems/issues documented / relevant staff member advised or equipment / instrument labelled - Advice for clinical handover

Source: NSW Health PD2017_032 (2017)

The following readings provide detail on the NSW Health clinical procedure safety policy and further describe the clinical procedure safety process and checklists.

READ

NSW Health (2017) Clinical Procedure Safety PD2017_032.

Hamlin et al. (2016) Chapter 9, Ensuring correct site surgery, pp 256–258.

ACORN (2018) Position statement on surgical safety.

Infection prevention and control

Infection prevention and control is integral to clinical care and the way in which it is provided. Effective infection control practice forms a vital part of perioperative patient care due to the inherent risks that surgery presents to the patient, and staff. Infection prevention is the shared responsibility of the perioperative team. The aim of infection prevention and control is to minimise the risk to patients and staff in acquiring a healthcare associated infection (HAI) or occupational exposure, which can detrimentally impact patients, staff, and the organisation.

Practices to prevent surgical-site infections are aimed at minimising the number of microorganisms introduced into the operative site, including:

- removing microorganisms that normally colonise the skin
- preventing the multiplication of microorganisms at the operative site by using prophylactic antimicrobial therapy
- enhancing the patient's defences against infection by minimising tissue damage and maintaining normothermia
- preventing access of microorganisms into the incision postoperatively by use of wound dressings (NHMRC, 2010).

READ

Hamlin et al. (2016) Chapter 3, pp 129-132 on common microorganisms.
This reading revises knowledge of common microorganisms that are associated with HAI and in particular, surgical site infections (SSI).

Asepsis and infection prevention

The basis for infection-free surgery is aseptic technique. Every attempt is made to prevent microorganisms from entering the surgical wound during the intraoperative period. The aim of aseptic practices is to eliminate infectious organisms and minimise contamination of the wound, prevent other infections, and aid in post-operative recovery (NHMRC, 2010).

Perioperative attire

As identified in Component 1, there are three zones found within the OS. Whilst unrestricted and some semi-restricted zones permit the wearing of street clothes, staff working throughout the OS are required to change into perioperative attire prior to entering the environment. Effective infection prevention practices start with wearing correct attire consisting of laundered scrubs and overgowns.

Dedicated footwear that meets work health and safety standards is required and should be non-slip, close-toed, and provide protection against contamination from blood or body fluids and sharps. Shoe covers are not necessary for clean shoes (check local policy), but should be worn if there is any possibility that shoes are soiled or may become contaminated in procedures where there is a risk of substantial amounts of blood or body fluids, for example, trauma surgery (ACORN, 2016). If overshoes are used, hand hygiene should be performed after donning and removing them. Theatre attire should be changed daily or as soon as practicable during the shift if attire becomes visually soiled.

Hair is a significant source of bacteria and should be completely covered with a disposable theatre cap or a laundered lint free hat. Many nurses wear brightly coloured cotton hats which may still allow the passage of bacteria. Recommended practice requires the wearing of a disposable cap beneath the cotton cap (ACORN, 2016). Balaclavas are available to cover facial hair (see Figure 2-32). Local policy should be checked for any additional requirements, including local requirements for leaving and re-entering the OS.

Jewellery, for example rings, earrings and necklaces, can harbour microorganisms or be dislodged and contaminate aseptic fields, and should be kept to a minimum. Similarly, nail polish can also harbour microorganisms and should be removed (ACORN, 2016).

It is recommended that personal items such as bags, backpacks, and portable devices are left outside the OR due to the potential to introduce microorganisms. Food and drink is not permitted in restricted areas (ACORN, 2016).

Figure 2-32. Perioperative attire (note balaclava used to cover facial hair) for restricted areas and semi-restricted areas

Source: Intco Medical; NSW Health 2017

These readings provide further detail on the importance of correct perioperative attire as an infection prevention strategy. Note the discussion on home laundering of hats and personal scrubs, a practice which does not meet ACORN Standards.

READ

Hamlin et al. (2016) Chapter 6, pp 135-136, Healthcare Personnel Attire.

ACORN (2018) Standard on Perioperative Attire.

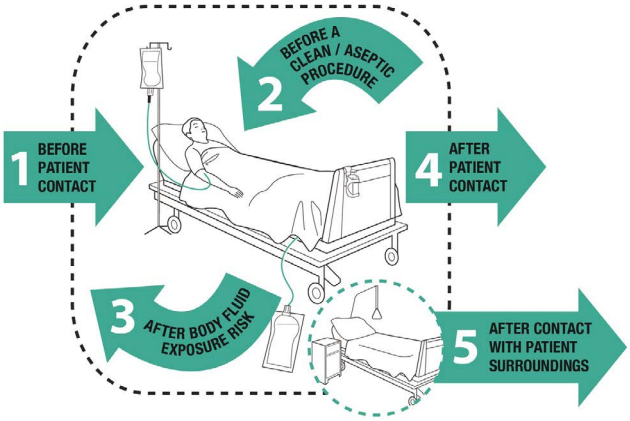
Cowperthwaite, L. & Holm, R. (2015) Guideline implementation: Perioperative attire. *AORN J 101,* 189-194. https://www.aorn.org/websitedata/cearticle/pdf_file/CEA15505-0001.pdf

Standard precautions

Standard precautions are applied to all patients and are key infection prevention and control strategies adhered to by all personnel. They are designed to reduce transmission of microorganisms and to protect both patients and staff when there is a risk of exposure to blood, body fluids, secretions and excretions (Hamlin et al, 2016).

Hand hygiene is the single most important practice to reduce transmission of infectious agents in healthcare. The '5 Moments of Hand Hygiene' launched by WHO in 2009 (see Figure 2-33), is well recognised throughout all healthcare settings. Whilst there are some adaptations to make this practicable in the perioperative environment, vigilance in hand hygiene practices must be adhered to at all times.

Figure 2-33. Five moments of hand hygiene



Source: Agency for Clinical Innovation 2017

The following readings contextualise the '5 Moments of Hand Hygiene' within the perioperative context and describe the key elements of PPE which should be worn when there is risk of exposure to blood and body fluids.

READ

Hamlin et al. (2016) Chapter 6, pp 138-139, Personal Protective Equipment.
Note Table 6-2 on '5 Moments of Hand Hygiene' in the Perioperative Environment

ACORN (2018) Standard on Infection Prevention: Statements 7 and 8.

ACTIVITY

2-13 Personal protective equipment
Identify the types of PPE available in your OS. Where is it stored? Is it easy to access? Reflect on its use: is it worn all the time and used/worn correctly? Is it disposed of appropriately? Complete your answers in the Activity section.

Transmission based precautions

Transmission based precautions are applied when standard precautions are not adequate to prevent transmission of microorganism by contact, airborne or droplet routes. These precautions are informed by NHMRC (2010), ACORN (2018) and local policies.

READ

Hamlin et al. (2016) Chapter 6, pp 140-141, Transmission based precautions.

ACORN (2018) Standard on infection prevention.

NHMRC (2010) Transmission based precautions Section B1.
https://www.nhmrc.gov.au/book/australian-guidelines-prevention-and-control-infection-healthcare-2010/part-b-standard-and-tran

Figures 2-34 and 2-35 summarise the pre and intraoperative infection prevention and control preparations for both perioperative personnel and also the patient. These areas will be expanded upon in later Components.

Figure 2-34. Infection prevention and control: preoperative preparation

Hand preparation	Surgical attire	Patient preparation
• Surgical team members should remove jewellery, artificial nails, and nail polish before preparing for a procedure • If hands are visibly soiled, perform hand hygiene with liquid soap prior to scrubbing • Remove debris from under fingernails using a nail cleaner, preferably under running water • Using a suitable antimicrobial soap, preferably with a product ensuring sustained activity, scrub hands and forearms for the length of time recommended by the manufacturer	• Surgical team members must wear sterile operation or procedure attire • All operating suite/room staff who are not operating within the critical aseptic field must wear dedicated non-sterile attire in all areas where operations are undertaken • Movements in and out of the operating area should be kept to a minimum	• Advise patients to wash preoperatively using soap • Avoid routine removal of hair — if clinical circumstances require hair removal, clip on the day of surgery or as close as possible to the time of operation. Hair must never be shaved • Provide antibiotic prophylaxis where appropriate, in accordance with the Australian Therapeutic Guidelines and Antimicrobial Stewardship • Consider screening for MRSA carriage and decolonisation with nasal mupirocin ointment and chlorhexidine body washes before elective surgery such as cardiac and implant surgery

Source: ACORN 2018; NHMRC 2010

Figure 2-35. Infection prevention and control: intraoperative considerations

Hand Hygiene
• Perform surgical hand antisepsis before the first operation on the list (5 minute scrub) using an antiseptic surgical solution, according to manufacturer's instructions. Use a single-use nail brush, and ensure hands and nails are visibly clean or use alcohol hand scrub solution • Before subsequent operations, perform a 3 minute scrub or use alcohol hand scrub solution
Surgical attire
• Sterile gowns are worn during the procedure • Consider wearing two pairs of sterile gloves when there is a high risk of glove perforation • Wear a surgical face mask and eye protection (PPE)
Patient preparation
• Prepare the skin at the surgical site immediately before incision using an antiseptic preparation • If electrosurgery is to be used, ensure antiseptic skin preparations are dried by evaporation and there is no pooling of alcohol-based preparations • If an incise drape is required, use an iodophor-impregnated drape unless the patient has an iodine allergy. Ensure skin preparation is dry before draping the patient
Wound management
• Avoid routine use of wound irrigation or intracavity antibiotic lavage as measures to reduce surgical-site infection • Avoid routine use of intraoperative skin re-disinfection or topical cefotaxime as measures to reduce the risk of surgical-site infection in abdominal surgery • At the end of the operation, cover surgical incisions with an appropriate dressing

Source: ACORN 2018; NHMRC 2010

Asepsis and aseptic technique

The principles of asepsis apply to all personnel regardless of their role in the perioperative team. Whilst it is most evident in the actions of the surgical team during the surgical procedure, the anaesthetic team are involved in procedures that require them to follow aseptic principles and practices, for example, insertion of central venous or arterial monitoring devices.

The term 'asepsis' is defined as absence of pathogenic microorganisms. Aseptic technique aims to prevent the pathogenic microorganisms entering the surgical site on hands, equipment or surfaces. The patient is the centre of the aseptic field created by the surgical team wearing sterile attire, sterile drapes and the sterile instruments and equipment used for surgery.

All these items have undergone a process of sterilisation to eliminate all microorganisms. These processes will be discussed in the section on sterilised equipment.

There are many principles of asepsis: most are evidence based, whilst others are based on logical and sometimes common sense principles. Together they provide the perioperative team with boundaries to determine where aseptic areas start and end, thus contributing to safe practice and patient safety.

Figure 2-36 identifies examples of principles of asepsis. The readings that follow identify many others and require practice to ensure the actions become familiar and consistently practiced.

NHMRC (2010) advocates a 'care bundle' approach to infection prevention and is included in the following readings. A 'care bundle' is a small set of evidence based processes which, when practiced consistently, are effective in infection prevention.

Figure 2-36. Principles of asepsis

PRINCIPLES OF ASEPSIS
All personnel within the sterile field must wear a sterile gown and gloves, and touch only sterile items: likewise, unsterile personnel must only touch unsterile items.
Items used within a sterile field must be sterile.
Sterile drapes are used to create a sterile field around the operative site.
Only the top horizontal surface of a draped table is considered sterile: items hanging below are considered unsterile.
The sterile field must be continually monitored and never left unattended.
Unsterile personnel should not lean across a sterile field or walk between two sterile fields.

Source: ACORN 2018; Hamlin et al., 2016

READ

Hamlin et al. (2016) Chapter 6, pp 141-146, Asepsis and Aseptic Technique. *Note Table 6-3 Care bundle approach.*

NHMRC (2010) B4.1.3 Care bundle approach. https://www.nhmrc.gov.au/book/australian-guidelines-prevention-and-control-infection-healthcare-2010/b4-1-3-care-bundle-appro

ACORN (2018) Standard on asepsis.

ACTIVITY

2-14 Hand hygiene
Name the '5 moments of hand hygiene' and identify an example of a clinical activity within the perioperative environment for each moment. Complete your answer in the Activity section.

Principles of opening sterile equipment

Circulating and anaesthetic nurses are involved in opening sterile items and presenting them safely to the aseptic field. When opening sterile items, the following actions should be followed:

- ensure hand hygiene has been attended prior to opening sterile items
- place heavy trays on a clean, stable, flat surface for opening
- check the expiry date (on commercial products) and external sterility indicators (on reprocessed equipment)
- check for tears, breaks in the seal, or other indications that integrity has been breached
- if opening trays/items on a flat surface, ensure the drapes cover the trolley when opened
- do not lean over or turn your back to the aseptic field
- peel wrappers rather than tear, and ensure wrapper edges are secure to prevent accidental contamination when retrieved by the instrument nurse or anaesthetist (see Figure 2-37)
- consider all edges of the packaging to be contaminated
- best practice is for the instrument nurse or anaesthetist to take the items as they are opened: 'flipping' items onto an aseptic is not recommended due to risk of contamination
- all reusable items (and some commercially available products) must be tracked as per local procedure.

If there is any doubt about the sterility of a product, do not use it.

Dispensing fluids and medications

All fluids added to the aseptic field must be checked by the instrument nurse or anaesthetist to verify contents and expiry date, including skin preparation, local anaesthetic, irrigation fluid, and any medications required for surgery. Fluids may be poured slowly into a jug or gallipot located close to the edge of the table or held away from the aseptic field to prevent splashing or dripping. The label should face the instrument nurse/anaesthetist to allow checking. Bottles must not be recapped once opened: the bottle with remaining contents should be discarded (Hamlin et al., 2016). Follow local procedures for documentation and retainment of fluid and medication containers.

Medications are drawn up by the instrument nurse/anaesthetist directly from an ampoule or vial. Many local anaesthetics and medications are available in sterile ampoules which are treated like other sterile goods.

If utilising medication from an unsterile ampoule, remove the top of the ampoule and ensure the ampoule is held very still to allow the fluid to be drawn up without contamination. Once the fluids and/or medication have been dispatched to the aseptic field, the container/syringe must be labelled utilising sterile medication labels, which should be opened as required. This will reduce the risk of the incorrect medication being administered. See Figure 2-38 for intraoperative medication labelling principles.

Figure 2-37. Opening sterile equipment

Source: NSW Health 2017

Figure 2-38. Intraoperative medication labelling principles

INTRAOPERATIVE MEDICATION LABELLING

1. Medicines and fluids removed from their original packaging must be identifiable
2. All containers that contain medicines (e.g. bags, syringes) that leave the hands of the person preparing them must be labelled
3. Only one medicine at a time should be prepared and labelled
4. Any medicine that cannot be identified is considered unsafe and is to be discarded and not to be used (ACORN, 2016).

READ

Hamlin et al. (2016) Chapter 3, pp 63-65, Medication management.
Note Figure 3-5 for examples of labels.

ACORN (2018) Standard on Medication safety.

ACSQHC (2015) National Standard for User-applied Labelling of Injectable Medicines, Fluids and Lines Section 6, pp 25-30, Labelling in Perioperative Areas.
https://www.safetyandquality.gov.au/wp-content/uploads/2015/09/National-Standard-for-User-Applied-Labelling-Aug-2015.pdf

ACTIVITY

2-15 Medication safety
Scenario: You are the circulating nurse for a procedure and the instrument nurse requests you to open local anaesthetic medication onto the aseptic field.
Complete the answers to the following in the Activity section.

- Identify at least four (4) items you will open for the instrument nurse to complete preparation and administration of the medication
- Describe the labelling requirements for medications opened onto the aseptic field
- Describe how you will ensure the safe transfer of a medication from an unsterile ampoule.

Surgical conscience

Surgical conscience refers to the professional honesty and moral obligation which allows zero compromise in practice. Surgical conscience is about using good surgical technique and not taking shortcuts, but more so it relates to consistently exhibiting ethical behaviour and promoting patient safety at all times, in every circumstance. It involves following correct procedure in a surgical setting, even if no one else is watching or is aware that patient safety has been compromised, however minor or insignificant the compromise may appear. It is advocating for the patient, upholding standards, and ensuring the safest intent (ACORN, 2016; Spry, 2015).

ACTIVITY

2-16 Surgical conscience
Consider your response to the following scenario. Write your assessment and actions in the Activity section.

SURGICAL CONSCIENCE – Scenario

After scrubbing, gowning, and gloving, RN Thomas is assembling his aseptic instrument table when he notices a superficial gouge in the impervious drape near where the instrument tray has been placed. The instrument tray was double wrapped and it is unclear whether this hole penetrates the outer wrap which is in contact with the unsterile trolley surface beneath. He discusses the situation with the circulating nurse, and neither can determine the extent of the damage or when it occurred. The case is a complicated general surgery case with a level of associated anxiety, and the surgeon has just walked into the OR and is waiting to 'prep' the patient.

What is your assessment of this situation? What actions are required?

Cleaning

Effective cleaning of the perioperative environment is integral in reducing the risk of transmission of microorganisms (NSW Health, 2012). The OS is classified as an extreme risk area according to NSW Health policy (2012), mandating that the perioperative environment is cleaned to the highest standards and frequency. All reusable cleaning items used in the OS are colour coded white according to NSW Health policy, ensuring that any reusable cleaning equipment is not used externally. A documented cleaning schedule must be checked off each day.

Key cleaning moments occur:

- **At the start of each list** each OR including all equipment is checked for cleanliness. This is usually attended by nursing staff and operating theatre assistants
- **In between patients**, all equipment used including computers and lights are wiped over with a neutral detergent impregnated disposable cloth, to reduce the risk of cross-contamination (NSW Health, 2012). The floors are mopped. This is usually attended by nursing staff and operating theatre assistants
- **On completion of the operative list for the day**, the OR additionally undergoes a 'terminal clean' which involves a thorough clean of all equipment, the floors, theatre lights, and walls, plus the scrub bay and adjacent corridors. This is usually attended by cleaning staff, but is checked by perioperative nurses
- **On moving equipment into an OR** from a storage area, it is checked for cleanliness and wiped over. Likewise, equipment removed from the OR after use must be cleaned prior to storage.

ORs and PACU spaces in which an infectious patient has been treated are subject to specific cleaning requirements. Check local policies: specific cleaning staff may attend these cleaning duties. Knowledge of infection prevention and control principles and practices are fundamental to safe surgical outcomes for patients. This will be explored further in each specialty role.

READ

ACORN (2018) Standard on Infection prevention
(Appendices A-D).
These Appendices detail requirements for Standard and Transmission Based Precautions.

ACTIVITY

2-17 Environmental cleaning

Using the above reading, identify the precautions required and cleaning protocols used for the following patients:

- *Mr K who has VRE*
- *Ms C who has a tattoo on her torso*
- *Mrs T who has active pulmonary TB*
- *Charlie, 6, who has suspected whooping cough*

Complete your answers in the Activity section.

Sterilised equipment

Sterile items are categorised into sterile consumables and reusable medical devices (RMDs, or instruments). RMDs are designed for use on multiple patients, with each device differing in its principle, engineering, and body contact area. RMDs may come into contact with the patient's sterile tissues, mucous membranes, skin, or may not have direct patient contact at all. RMDs must be correctly reprocessed after every use to ensure they are safe to be reused: reprocessing takes place in a sterilisation unit known as Sterilising Services Department (SSD) or similar, and involves either disinfecting or sterilisation. See Figure 2-39 for an example of RMDs.

Figure 2-39. RMD: example of a general basic instrument set

Note some items are arranged on a clip to provide ease of handling. Also note the tray is a basket variety that allows steam to penetrate.
Source: NSW Health 2017

Strict standards e.g. AS/NZS 4187: 2014 *Reprocessing of reusable medical devices in health service organisations* apply to the reprocessing, storage and handling of sterile items to maintain sterility and ensure product availability. This includes internal and external monitoring processes of each RMD which is undertaken in SSD by specially trained personnel.

Sterile consumables are single-use sterilised goods (e.g. dressings, drains, sutures etc.) from an external source or manufacturer.

Cleaning and reprocessing

Each reprocessing technique commences with cleaning: the cleaning process should ensure that all soiling is removed prior to disinfection or sterilisation as disinfecting or sterilising agents cannot penetrate (or become ineffective against) organic material if it remains on the item (NHMRC, 2010).

Cleaning of RMDs at the point of use is paramount. RMDs should be wiped by the instrument nurse during the procedure using a sponge dampened with sterile water only. This will keep tips and edges clean, maintaining optimum condition for use by the surgeon. At the completion of the procedure, each RMD is cleaned of gross contaminants before dispatch to SSD. Failure to clean properly makes removal of debris difficult in SSD and may also lead to incorrect functioning or render the equipment unusable (Hamlin et al., 2016).

Spaulding's classification system categorises RMDs according to their intended use and the method of reprocessing required (see Figure 2-40). The manufacturer's instructions for care must always be followed. See Figure 2-41 for the different modes of reprocessing used.

Figure 2-40. Spaulding's classification system for reprocessing reusable medical devices (RMD)

Critical e.g. abdominal retractors	• These items confer a high risk for infection if they are contaminated with any microorganism and must be sterile at the time of use • Includes any objects that enter sterile tissue or the vascular system, as any microbial contamination could transmit disease
Semi-critical e.g. flexible endoscopes, laryngoscopes	• These items come into contact with mucous membranes or non-intact skin, and should be single use or sterilised after each use • If this is not possible, high-level disinfection is the minimum level of reprocessing that is acceptable
Non-critical e.g. pulse oximeter probe	• These items come into contact with intact skin but not mucous membranes. Thorough cleaning is sufficient for most non-critical items after each use, although either intermediate or low-level disinfection may be appropriate in specific circumstances

Source: ACORN 2018; NHMRC 2010

Each step of reprocessing requires documentation in SSD, and every RMD used for each patient is recorded by perioperative nursing staff to enable tracking.

Failure to correctly reprocess RMDs increases the risk for transmission of infectious agents and adverse reactions from residual reprocessing agents.

Figure 2-41. Modes of reprocessing

1. Cleaning	2. Disinfection	OR	2. Sterilisation
• Definitive cleaning always precedes disinfection and sterilisation, and commences in the SSU • RMDs should be cleaned as soon as practical after use • Disassemble RMDs that may be disassembled prior to cleaning and disinfection/sterilisation • **2 types of automated cleaners** (recommended for cleaning basic, hardy instruments): **Ultrasonic cleaners** use high frequency, high energy sound waves to loosen and dislodge dirt. **Washer-disinfectors** use detergent at high temperatures to wash instruments • **Manual cleaning** is done for fragile of difficult to clean instruments. This requires two essential components: friction (scrubbing the soiled area with a soft brush) and fluids (use of fluids to remove soil and debris from internal channels)	• Instruments must be cleaned prior to disinfection • **Disinfection inactivates non-sporing infectious agents** using thermal (moist or dry heat) or chemicals • **Thermal disinfection** is used where instruments are heat and water resistant and do not require sterilisation. It is a simple and cost effective method of disinfection • **Chemical disinfection** is achieved with chemical alone or in an automatic washer-disinfector. High level chemical disinfectants must be TGA approved. Gluteraldehyde is commonly used in closed systems.		• Instruments must be cleaned prior to sterilisation • **Sterilisation destroys all microorganisms** on the surface of an RMD to prevent disease transmission • **Steam sterilisation** is recommended to reprocess resusable heat resistant items (instruments, metal/hard plastic bowls) • Heat and moisture sensitive items require a **low temperature sterilisation techniques** e.g. ethylene oxide (swabs and sponges), hydrogen peroxide plasma (cameras, telescopes), peracetic acid (endoscopes), gamma radiation (surgical gloves, swabs, sutures) • Records of sterilisation must be kept by SSD

Packaging of sterile equipment

The packaging of sterile equipment aims to uphold the product's sterility by providing an effective barrier. The packaging must be compatible with the method of sterilisation, and easy to open aseptically in the OR.

Once packaged, the item receives an external chemical indicator sticker, tape and symbol indicating the item has undergone a sterilisation process and notes the cycle number, machine number, and the date of reprocessing. Reprocessed equipment remains sterile as long as it is handled and stored correctly: this is termed 'event related' sterility and there is no expiry date.

Each item must be assessed for sterility prior to opening. Any compromise or breach to storage conditions or handling of sterile items must be identified and the item returned for reprocessing.

Tracking

Tracking allows reprocessed equipment to be traced to a patient for identification in the event a sterilisation issue is recognised. Tracking systems may be manual or electronic, and involve the sterilisation data of each RMD used being entered into the patient's medical record.

New reusable medical devices (RMD)

New RMDs are often trialled in or purchased for the perioperative environment. SSD staff are included in the consultation phase for new and trial items to ensure the sterilisation or disinfection requirements are available (ACORN, 2016). Each RMD has written manufacturer instructions for cleaning and reprocessing which must be adhered to, including the method and specifics of sterilisation.

Storage and handling of sterile equipment

All sterile items must be stored in a way that that maintains their level of reprocessing (e.g. sterile or disinfected). Dry, sterile, packaged instruments and equipment should be stored in a clean, dry environment and protected from sharp objects that may damage the packaging. Equipment that no longer functions as intended or cannot be properly cleaned and disinfected or sterilised should be repaired or discarded. See Figure 2-42 for specific storage and handling requirements.

READ

Hamlin et al. (2016) Chapter 6, Instrument cleaning, decontamination and sterilisation pp 150-157.

NHMRC (2010). B1.5.3 Cleaning. https://www.nhmrc.gov.au/book/australian-guidelines-prevention-and-control-infection-healthcare-2010/b1-5-3-cleaning

VIEW

My Health Learning: Decontamination of reusable medical devices.
You will need to access your My Health Learning account to view this program.

ACTIVITY

2-18 Methods of sterilisation
Locate your SSD and arrange to visit the area to view how RMDs are reprocessed. Complete the table and multiple choice questions on methods of sterilisation in the Activity section.

Figure 2-43. Example of a sterile stockroom

Note the wire racks which prevent accumulation of dust, and the solid plastic (blue) trays in which some trays are stored to protect the packaging from tears.
Source: NSW Health 2017

Figure 2-42. Storage and handling of sterile equipment

Storage	Handling
• Sterile stock must be stored in the temperature range 18-25°C, and relative humidity range 35-70% • HEPA filtration • No exposure to direct sunlight • Storage shelving must be cleanable with no sharp corners: nil cardboard boxes to be used • Stored ≥250mm off the floor and ≥440mm from the ceiling • Sterile stock rooms areto be cleaned weekly, and documented for auditing • Stored in a designated sterile stock area (see Figure 2-43). Nil non-sterile equipment or trolleys are to be stored • Access is restricted to authorised personnel, entered as infrequently as possible to ensure air pressure, temperature, and air flow remains constant • Hand hygiene is performed prior to entering the sterile stock room and before handling sterile packages.	• Hand hygiene is performed prior to handling sterile packages • Sterile stock should be rotated to ensure the older stock is used first, to reduce losses from deterioration • Expiry date is checked prior to use • Check sterility identification • Do not use rubber bands to group items as this can compromise sterility • Do not write on the packaging as this can compromise sterility: label the storage container instead • Consider container sizes: the sterile product should not be squashed or folded to fit • Lift don't drag: damage to packaging or wrap will render the product or tray unusable.

Sources: ACORN 2018, AS/NZS 4187 2014

Documentation & clinical handover

Documentation

Medical records are a method of communication for healthcare team members and provide an account of care. They are required to be an integrated, sequential, contemporaneous, and objective record of events, where possible. Documentation in the medical record must follow these principles:

1. Be legible, accurate, objective, clear, and concise
2. Comply with all federal and state requirements as well as local policies and procedures
3. Chronological and contemporaneous
4. Signed, dated, timed, and the designation of the writer identified (electronic or written) and if the documentation is written, it must be in ink
5. Be easily accessible and able to be understood.

Not only is documentation important for continuity of patient care, it provides an important record which may be used as evidence should an adverse event occur and is investigated.

READ

Hamlin et al. (2016) Chapter 4, Documentation, pp 84---85.

ACORN (2018) Position statement on Documentation.

VIEW

My Health Learning. Clinical documentation: getting it right
You will need to access your My Health Learning account to view this program.

Most documentation in the perioperative environment is electronic ('electronic medical record' or eMR). In many NSW public hospitals, a system known as Surginet is used to document perioperative care in real time. To ensure confidentiality and data security, users should log in for every entry and log out when leaving the computer, ensuring the correct patient episode is opened and edited. Training and education in the system used within each OS should form part of the local orientation program.

Clinical handover

Clinical handover is the transfer of professional responsibility and accountability for some or all aspects of care for a patient, or group of patients, to another person or professional group on a temporary or permanent basis (ACSQHC, 2016). Professional responsibility relates to the person's duty of care to the patient, and accountability is their obligation to the organisation, to colleagues, and the nursing profession.

Effective clinical handover ensures the continuity of care for patients when multiple staff or teams are involved in providing that care, either concurrently or sequentially. Handover policies and practices vary between units. The general principles underlying effective handover relate to exchange of information from one transition of care or shift to another, one area to another, and one team to another.

In the perioperative environment, handover occurs as the patient moves through episodes of their perioperative journey, and when there is a change of personnel caring for the patient, for example, oncoming shift. The handover includes the patient's condition, current care, and planned care. A systematic approach should be used to ensure that significant issues are identified and plans discussed. This should occur at the patient's bedside, to allow confirmation and immediate assessment of the patient, documentation, equipment, and infusions etc.

ISBAR and ISOBAR

The NSW Health Clinical Excellence Commission (CEC) recommends the use of ISBAR (Introduction, Situation, Background, Assessment, Recommendation: see Figure 2-44), an acronym used for a structured communication framework for a nursing clinical handover. This has been adopted for use in NSW Health settings where effective communication is critically important. The Australian and New Zealand College of Anaesthetists (ANZCA) adds one further point, 'observations' to make the acronym ISOBAR when conducting a handover from anaesthetist to PACU nurse (see Figure 2-45).

Figure 2-44. ISBAR for handover – instrument nurse to PACU nurse

Identification: patient's name checked with patient's wristband
Situation: details of procedure – dressings, drains, catheter, any emotional issues identified prior to surgery
Background: any significant intraoperative events e.g. blood loss, positioning issues, pressure injury, skin integrity, any patient impairments e.g. hearing loss, sight impaired
Assessment and actions: Postoperative orders in relation to drains and dressings
Recommendations (responsibility): whereabouts of relatives, belongings

Source: Hamlin et al. 2016

Figure 2-45. ISOBAR for handover – anaesthetist to PACU staff

Identification: patient is correctly identified
Situation: current clinical status – type of anaesthetic, drugs used and procedure undertaken
Observations: patient observations pre and intraoperatively, reportable parameters in postoperative period
Background: any significant intraoperative events e.g. blood loss, IV access and fluid orders
Assessment and Actions: postoperative orders of pain protocol, antiemetic etc. Any airway issues, epidural, intra-arterial monitoring
Recommendations (Responsibility): on-going management for postoperative issues e.g. who to call

Source: ANZCA (2013)

The following readings provide examples of both ISBAR and ISOBAR.

READ

Hamlin et al. (2016) Chapter 12, pp 334–335, Clinical Handover from Anaesthetist to Nurse (note Figure 12-4, ISOBAR) and pp 335-336, Patient Management in PACU (note Figure 12-5, ISBAR).

ACTIVITY

2-19

Scenario: Mr Shin Hyun, 67, has undergone an open resection of his sigmoid colon for a large, cancerous polyp. His wound has been closed with staples and he has an adhesive dressing. He has a closed wound drain sutured in situ. He has been fitted with graduated compression stockings (GCS) which remain in situ. There were no intraoperative issues in relation to positioning or skin integrity. His wife is waiting in the ward for Mr Hyun's return.

You have been the instrument nurse for Mr Hyun's procedure (above). You have accompanied Mr Hyun to PACU and are preparing to handover to the PACU nurse. Complete the table in the Activity section, using ISBAR/ISOBAR to provide your handover.

Coroner's cases

It is rare for patients to die in the OS. Patients who have received traumatic injuries as a result of accidents or have suffered unexpected medical episodes e.g. ruptured cerebral or aortic aneurysm, may not be able to be successfully treated. There are legal requirements for such cases which must be followed, according to the *Coroners Act 2009* (NSW). The Act requires that patients who die 'during the process or as a result of being administered anaesthetic' or whose death was unexpected during surgery must be reported to the Coroner for investigation to rule out any contributing factors. The responsibility for reporting the patient's death to the Coroner and completing all the relevant documentation rests with the surgeon and/or anaesthetist. The perioperative nurses' roles are to follow requirements of the Coroners Act and local policy in relation to handling the patient's body. The following reading provides background to the role of the Coroner and also managing the patient's body within the OR.

READ

Hamlin et al. (2016) Chapter 4, pp 83-84 on the Coroner's Court.

Conclusion

The OS is a complex and potentially hazardous environment, one in which the perioperative team must be vigilant to ensure both patients and staff are kept safe. Component 2 has provided detailed information on a number of aspects of environmental safety. It has also provided foundational information on infection prevention and asepsis which will be built upon in subsequent specialty Components.

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COMPONENT 2 – ACTIVITIES

ACTIVITY 2-1: NSQHS STANDARDS

Locate a copy of the 2016 NSQHS Standards in your workplace or online: http://www.safetyandquality.gov.au/ Select two of the Standards and provide an example of how each can guide your perioperative practice.

NSQHS Standards	How it guides my practice
1.	
2.	

ACTIVITY 2-2: CONSENT TO TREATMENT

You are admitting Mrs Frost to the operating suite. She is to undergo a laparoscopic cholecystectomy. As part of the preoperative checklist, you ask Mrs Frost to confirm the procedure she is about to undergo. She tells you 'It's something to do with my gallbladder, but I don't really know'. How will you respond to Mrs Frost's answer? Give your rationale.

ACTIVITY 2-3: EMERGENCY EQUIPMENT

Walk around your OS and locate the equipment listed below. Which items are present in your OS? Discuss the function of each with your facilitator.

Equipment	Location	Equipment	Location
Fridge emergency medications		Arrest trolley and defibrillator	
Rapid infuser		Emergency cricothryroidotomy kit	
Difficult intubation trolley		Emergency instrument tray set-ups	
Postpartum haemorrhage kit		Supply of intralipid and dantrolene	
Self-inflating bag/ mask			

ACTIVITY 2-4: ELECTRICAL SAFETY

Walk around your OS and identify the line isolation monitors (LIM) and residual current devices (RCD). Ask your facilitator to show you how these items are checked. Record the method of checking these devices.

ACTIVITY 2-5: RADIATION PROTECTION

Walk around your OS and note the location of the x ray gowns and thyroid protectors. Describe how they are stored and whether this meets requirements for correct storage.

Location of x-ray gowns and thyroid protector:
Storage method:

ACTIVITY 2-6: PATIENT RETURN ELECTRODES

- Identify the types of patient return electrodes used within your OS. Describe the general safety issues to consider when using:
  - disposable patient return electrode
  - reusable capacitive pad
- Using the table below, describe three (3) occasions you have applied a patient return electrode, including location of patient return electrode, type of surgery and the patient safety actions you undertook.

Patient	Type of surgery	Location of patient return electrode	Patient safety actions
Patient 1			
Patient 2			
Patient 3			

ACTIVITY 2-7: SURGICAL PLUME

Identify where the surgical plume evacuation units are located within your OS.

An undergraduate nursing student asks you why using a surgical plume evacuator is important. You respond by identifying three (3) reasons for using a surgical plume evacuator:

1.

2.

3.

ACTIVITY 2-8: FIRE SAFETY

Walk around your OS and locate fire extinguishers, break glass alarms and fire plans. Where is each fire compartment located and how are they activated?

Scenario: You are the circulating nurse for a procedure, when the nurse educator enters the OR and informs the team there is a fire in the equipment store room and the OS is to be evacuated.

How will you and the team manage this situation?

ACTIVITY 2-9: CHEMICAL SAFETY

Identify the chemicals used in your OS that require spill kits. Select two chemicals. What actions would you take in the event of exposure to these two chemicals? Complete the table below and discuss your answers with your facilitator.

Chemical	Location of spill kit	Actions

ACTIVITY 2-10: WORKPLACE HAZARDS

Complete the following table on managing workplace hazards. For each hazard identify a safety precaution you will take to protect yourself and your patients. Provide a rationale for each precaution.

Hazard	Precautions	Rationale
Electrosurgical equipment		
Radiation/ laser Surgery		
Electrical safety		
Latex allergy		
Cytotoxic drugs		
Surgical plume		
Chemicals		

ACTIVITY 2-11: WASTE MANAGEMENT

Investigate how each type of waste is segregated in your OS. Complete the table below.

Waste	Segregation
General	
Contaminated	
Recycled	

ACTIVITY 2-12: PATIENT POSITIONING

Mr Klim, 47, weighs 120kgs. He is admitted to your OR for a right open nephrectomy. Consider the position required for this procedure and describe how you and the surgical team will safely transfer and position Mr Klim on the operating table.

Describe the transfer method for Mr Klim.

Complete the table below describing the positioning of Mr Klim.

Mr Klim's position	Description	Positioning aids used	Possible complications	Prevention strategies

Complete the following table for common positions used in surgery.

Position	Description	Positioning aids used	Possible complications	Prevention strategies
Supine				
Lithotomy				
Prone				
Lateral				

Complete the following table detailing how you would manage the following positioning/pressure injury issues.

Safety issue	Potential adverse outcome	How will you prevent the adverse outcome?
You notice Mr Klim has a knot in the back of his gown		
Mr Klim's urinary catheter tubing is located beneath his thigh		
You notice Mr Klim's arm is unsecured		
Mr Klim's feet are hanging over the end of the operating table		

ACTIVITY 2-13: PERSONAL PROTECTIVE EQUIPMENT

Identify the types of PPE available in your OS. Where is PPE stored in your OS? Is it easy to access? Reflect on its use in your OS: is it worn all the time and used/worn correctly? Is it disposed of appropriately?

ACTIVITY 2-14: HAND HYGIENE

Name the '5 moments of hand hygiene' and identify an example of a clinical activity within the perioperative environment for each moment.

Moment	Definition of moment	Example of clinical activity in the perioperative environment
1.		
2.		
3.		
4.		
5.		

ACTIVITY 2-15: MEDICATION SAFETY

Scenario: *You are the circulating nurse for a procedure and the instrument nurse requests you to open local anaesthetic medication for use on the aseptic field.*

Identify at least four (4) items you will open for the instrument nurse to complete preparation and administration of the medication.

Describe the labelling requirements for medications opened onto the aseptic field.

Describe how you will ensure the safe transfer of a medication from an unsterile ampoule.

ACTIVITY 2-16: SURGICAL CONSCIENCE

Scenario: *After scrubbing, gowning, and gloving, RN Thomas is assembling his aseptic instrument table when he notices a small hole in the impervious drape near where the instrument tray has been placed. The instrument tray was double wrapped and it is unclear whether this hole has also penetrated the outer wrap which is in contact with the unsterile trolley surface beneath. He discusses the situation with the circulating nurse, and neither can determine the extent of the damage or when it occurred. This is a complex case with a level of associated anxiety and the surgeon has just walked into the OR and is waiting to 'prep' the patient.*

What is your assessment of this situation?

What actions are required?

ACTIVITY 2-17: ENVIRONMENTAL CLEANING

Identify the cleaning protocols used in standard, contact, airborne and droplet precautions.

Patient	Type of precaution Standard, Contact, Airborne, Droplet	Cleaning protocol
Mr K who has VRE		
Ms C who has a tattoo on her torso		
Mrs T who has active pulmonary TB		
Charlie, 6, with suspected whooping cough		

ACTIVITY 2-18: METHODS OF STERILISATION

Locate your SSD and arrange to visit the area to view how RMDs are reprocessed. Complete the activity on methods of sterilisation.

Method of sterilisation	Example of equipment
Steam	
Radiation	
Ethylene oxide	
Low temperature – peracetic acid	

Describe three (3) important points to remember when cleaning instruments at the operating table during the procedure.

1.	
2.	
3.	

What is event related sterility and list three (3) 'events' which may compromise the sterility of an item?

1.	
2.	
3.	

What defines a single use item? How is it identified?

What does the term 'tracking' mean in relation to sterile items and how is this achieved? Why is tracking important?

Multiple choice: select the correct answer from options below.

1. To use steam as a sterilant, it must be:

a) under pressure
b) wet steam
c) free steam
d) filtered

2. Three of the most important qualities that make steam an effective sterilant are:

a) cheap to produce, easy to control, safe
b) latent heat, moisture, penetration
c) environmentally friendly, cheap to produce, penetration
d) safe, moist, cheap to produce

3. Steam destroys microorganisms by :

a) dehydrating the cell wall

b) coagulating the cell protein

c) oxidation of the cell protoplasm

d) desiccation of cell nucleus

4. The steam sterilising cycle consists of:

a) penetration time and holding time

b) penetration time, holding time and safety factor

c) holding time and safety factor

d) safety factor and penetration time

ACTIVITY 2-19: CLINICAL HANDOVER

Scenario: *Mr Shin Hyun, 67, has undergone an open resection of his sigmoid colon for a large, cancerous polyp. His wound has been closed with staples and he has an adhesive dressing. He has closed wound drain sutured in situ. He has been fitted with graduated compression stockings (GCS) which remain in situ. There were no intraoperative issues in relation to positioning or skin integrity. His wife is waiting in the ward for Mr Hyun's return.*

You have been the instrument nurse for Mr Hyun's procedure (above). You have accompanied Mr Hyun to PACU and are preparing to handover to the PACU nurse. Complete the following table using ISBAR/ISOBAR to provide your handover.

ISBAR	Handover information on Mr Hyun
Identification	
Situation	
Background	
Assessment and actions	
Recommendations (Responsibility)	

— End of Component 2 —

COMPONENT 3

ANAESTHETIC NURSE

Aim

The aim of this component is to describe the responsibilities, knowledge, skills, and patient care required of the anaesthetic nurse for the patient to safely undergo anaesthesia.

Learning outcomes

1. Demonstrate an understanding of the anaesthetic nurse role as part of a multidisciplinary team.
2. Demonstrate an understanding of the range of responsibilities of the anaesthetic nurse across a range of anaesthetic techniques.
3. Examine the documentation and legislative requirements of the role including clinical handover of care.
4. Describe the requirements for induction and emergence of the patient from an anaesthetic.
5. Review the key considerations for special care groups.
6. Describe the role and skills of the anaesthetic nurse in managing anaesthetic emergencies.
7. Demonstrate knowledge of medications used in anaesthesia, their effects and precautions for use.

Working through this component

Some of the topics covered within this manual are presented in the format of a 'virtual operating suite'. As the anaesthetic nurse, you will be guided through the anaesthetic care of the patients and the assistance required by the anaesthetist according to an operating list of increasingly complex patients.

Role of the anaesthetic nurse

The anaesthetic nurse is responsible for patient care from the patient's arrival pre-operatively in the (operating suite) OS until care of the patient is handed over to the post anaesthetic care unit (PACU) nurse post-operatively.

The anaesthetic nurse works in partnership with the anaesthetist throughout the anaesthetic process, and in collaboration with other members of the surgical team. The anaesthetic nurse assists the anaesthetist to achieve anaesthesia, monitors the patient's status, facilitates pharmacological and equipment requirements, and communicates with the perioperative team to provide patient care.

The anaesthetic nurse requires education in anatomy, physiology, and pharmacology, and technical competence with anaesthetic equipment. The ability to communicate effectively and provide psychological support to the patient is important during a time of great vulnerability for the patient.

The anaesthetic nurse role may be undertaken by an RN or EN. In some facilities, the role may be held by an anaesthetic technician, however the scope will differ. In some facilities if workflows require, the anaesthetic nurse may also undertake some circulating nursing activities.

The following readings provide a detailed description of the role of the anaesthetic nurse and education requirements.

READ

ACORN (2018) Position statement on the Anaesthetic nurse role.

ANZCA (2016) PS08: Statement on the Assistant for the Anaesthetist. http://www.anzca.edu.au/documents/ps08-2015-statement-on-the-assistant-for-the-anaes

Hamlin et al. (2016) Chapter 1, pp 5, Box 1-2: Role and responsibilities of the anaesthetic nurse

As noted from the ANZCA reading, performing the role of anaesthetic assistant requires extensive knowledge and skills.

Overview of anaesthesia

The word *anaesthesia* arises from the Greek language meaning 'without sensation' (ANZCA, 2017). Anaesthesia refers to the practice of administering medications either by injection or by inhalation that blocks pain and other sensations, or that produces a deep state of unconsciousness to eliminate all sensations, allowing medical and surgical procedures to be undertaken without causing undue distress or discomfort (ANZCA, 2017).

Patients having an anaesthetic will have contact with the anaesthetic team from the pre-operative medical assessment which enables care planning and throughout the procedure until the patient is handed over to the PACU nurse. The anaesthetist continues to consult on the patient's condition in collaboration with the surgical team for up to 24 hours post-anaesthesia or until full recovery from the anaesthetic.

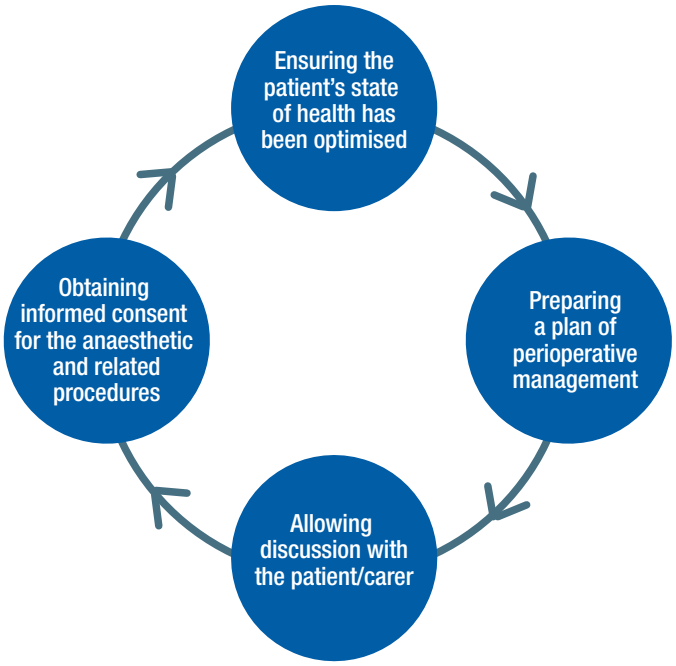
Despite an increase in the complexity of surgery, modern anaesthesia is relatively safe and Australia is one of the safest places to undergo anaesthesia in the world (ANZCA, 2017). This is due largely to the emphasis on quality and safety across the healthcare team and system, the extensive training of anaesthetists, having specialised and dedicated anaesthetic assistants, improvements in medications and equipment, and research to improve anaesthesia.

Pre-anaesthetic consultation

If the patient is requested to attend a pre-admission appointment, they will have a consultation with an anaesthetist as part of the process. The pre-admission consult includes an interview, physical assessment, review of investigations and previous medical notes, and the opportunity for discourse related to the anaesthetic. The patient will also meet a pre-admission nurse whose role includes clinical and risk assessment, education and discharge planning. In cases where the pre-admission process does not occur, the anaesthetic consultation will take place on admission to the OS, usually in the holding bay or anaesthetic bay. The extent of the anaesthetic consultation will vary depending on the patient's medical history and planned procedure. The consultation assists the anaesthetist in identifying the anaesthetic risks, formulating the anaesthetic plan, and allows for discussion and questions from the patient and parents/carer. There are two main goals: to evaluate the patient's general health, and to anticipate possible complications (ANZCA, 2016) (see Figure 3-1).

In some circumstances, the pre-anaesthetic consultation will need to be adapted, e.g. emergency surgery, labour ward, and some critical care patients.

Figure 3-1. Components of the pre-anaesthetic consultation



Anaesthetic history and examination includes:

- previous exposure to anaesthetics
- medication/treatment history
- concurrent illness
- allergies
- dentition
- airway
- classification of fitness for anaesthesia (ASA, Figure 3-2)

Adapted from ANZCA 2016.

The anaesthetist assesses the patient's fitness for anaesthesia using the American Society of Anesthesiologists (ASA) grading system and assigns an ASA score. The score influences the anaesthetist's decisions about anaesthesia and post-operative care (see Figure 3-2).

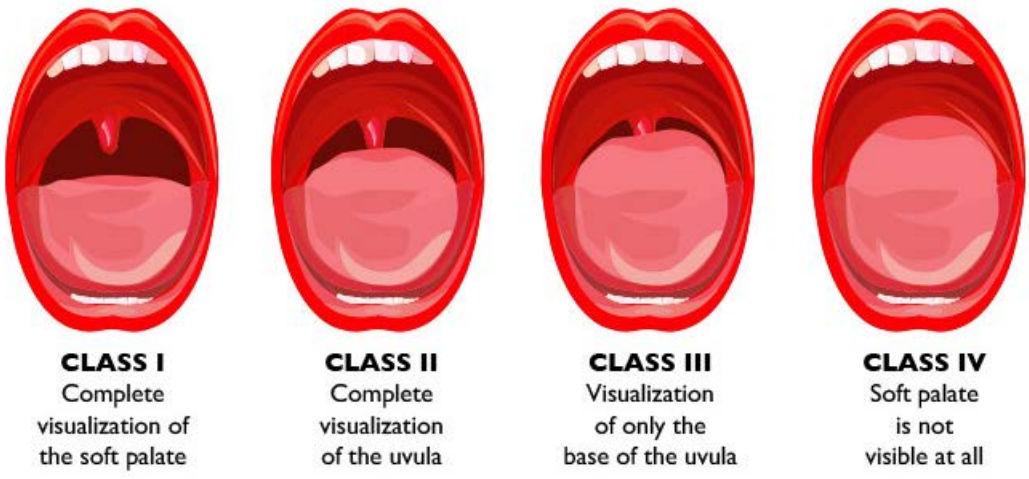
Figure 3-2. ASA Score

ASA Score: a global score that assesses the physical status of patients before surgery	
ASA 1	A normal healthy patient
ASA 2	A patient with mild systemic disease
ASA 3	A patient with severe systemic disease
ASA 4	A patient with severe systemic disease that is a constant threat to life
ASA 5	A moribund patient who is not expected to survive without the operation
ASA 6	A declared brain-dead patient whose organs are being removed for donor purposes
Modifications: additional 'E' denotes emergency surgery; additional 'P' denotes pregnancy	

Airway assessment

As part of the anaesthetic consultation, the anaesthetist assesses the patient's airway for features which may indicate possible difficulty with mask ventilation or intubation. These include prominent upper incisors, a protruding or receding chin, limited mouth opening, short neck, stiffness of the cervical spine, disease of the pharynx or larynx, and deviation of the trachea. If nasal intubation is required, patency of the nasal passages is checked. The soft palate and the uvula are visualised (Mallampati classification, see Figure 3-3) and used to predict the ease of intubation (Hung et al., 2016).

Figure 3-3. Mallampati classification



Source: ClinicalAdvisor.com

READ

Hamlin et al. (2016) Chapter 8, pp 194-195.
This reading describes the pre-anaesthetic airway assessment.

Anaesthetic nursing assessment

After checking the patient in to the OS, the anaesthetic nurse completes a nursing assessment of the patient's perioperative risks in the context of their medical history, planned procedure, and associated positioning (Hamlin et al., 2016). Figure 3-4 summarises the patient care issues which the anaesthetic nurse must consider for each patient. The focus is on person-centred care and nursing interventions. It is important to prepare all necessary equipment prior to the patient transferring into the OR to allow the focus to be on the patient during the preparation and induction phases.

Figure 3-4. Anaesthetic nursing: patient care considerations

ANAESTHETIC NURSING: PATIENT CARE CONSIDERATIONS

- Type of anaesthesia and surgery planned, and the anaesthetic equipment required
- How long has the patient been fasting?
- Does the patient require pre-warming?
- How long will the procedure take?
- What position will the patient be in? Will additional measures be required to protect the secured airway?
- What pressure relieving devices will be required? Will special pillows or head protection be required?
- What venous thromboembolism (VTE) prevention measures are required?
- How will the patient's normothermia be maintained during the procedure?
- How will falls be prevented?
- What is required to prevent other patient injuries, such as injury to the joints and nerves?
- Are specific theatre table attachments required for positioning? Are they available in the room?
- What monitoring is required?
- What infusion devices are required?
- Where is intravenous access to be sited, and is the IV line labelled?
- Has the above been documented?

Fasting

Fasting is necessary prior to procedures requiring sedation or general anaesthesia (GA) to minimise risk of regurgitation of stomach contents and aspiration. See Figure 3-5 for a summary of fasting guidelines, and the readings for detail on fasting requirements.

Figure 3-5. Preoperative fasting

Perioperative fasting

- Fasting guidelines are determined locally by each facility. Specific instructions for fasting are dependent on an individual patient's circumstances: final advice should be determined by an anaesthetist.
- Generally, adult patients may have solids until 6 hours before surgery, approved preoperative oral fluids until 2 hours before surgery, and then NBM until surgery.
- For healthy children >6 weeks of age having elective procedures, limited solid food and formula milk may be given up to 6 hours, breast milk may be given up to 4 hours, and clear fluids up to 2 hours prior to surgery.
- For healthy infants <6 weeks of age having elective procedures, formula or breast milk may be given up to 4 hours and clear fluids up to 2 hours before surgery.
- Continuing fluids until two hours before a procedure maintains hydration. Evidence shows that preoperative oral fluids can improve postoperative wellbeing and clinical outcomes.
- Preoperative clear fluids exclude all liquids containing fat, protein, and insoluble fibre, and include water, clear cordial, pulp free fruit juice, black tea and coffee.
- Generally, IV parenteral nutrition may continue until surgery: confirm locally.
- Prescribed medications may be taken with a sip of water.
- Chewing gum must be discarded preoperatively.
- A preoperative fluid diet is inadequate in nutrients and should not be in place for more than one day.

Source: ACI 2016, ANZCA 2017

READ

Hamlin et al. (2016) Chapter 8, pp 195-196, Nursing Assessment (to Types of Anaesthesia)

Agency for Clinical Innovation (2016) Preoperative fasting in NSW public hospitals https://www.aci.health.nsw.gov.au/__data/assets/pdf_file/0006/299301/ACI_Key_Principles_Preoperative_fasting_in_NSW_public_hospitals.pdf

ANZCA (2017) Fasting guidelines http://www.anzca.edu.au/patients/frequently-asked-questions/fasting.html

Types of anaesthesia

Anaesthesia may be systemic (general anaesthesia or sedation) or localised to a specific part of the body (regional or local anaesthetic), and may be used individually or in combination with other techniques.

Several factors influence the type of anaesthesia selected:

- the patient's past history of anaesthesia
- health status and comorbidities
- allergies
- the surgical objectives
- the risks of various anaesthetics.

General anaesthesia (GA)

General anaesthesia is a reversible medication-induced state of unconsciousness characterised by the absence of purposeful responses and protective reflexes (ANZCA, 2017). General anaesthesia is indicated during most surgical procedures and requires the exclusive attention of an anaesthetist and assistant: the anaesthetic nurse. A GA is achieved by intravenous injection and/or inhalation of anaesthetic agent, in combination with other medications including anxiolytics, analgesics, and muscle relaxants (neuromuscular blocking agents). Depending on the type of GA, patients may be paralysed and unable to breathe spontaneously, requiring tracheal intubation and mechanical ventilation.

General anaesthesia has three stages: induction, maintenance, and emergence (see overview in Figure 3-6).

Figure 3-6. Stages of general anaesthesia

OVERVIEW: STAGES OF GENERAL ANAESTHESIA		
Induction	**Maintenance**	**Emergence**
• Transition from an awake to an anaesthetised state • Physiological disruption with multi-system effects • Achieved via inhalational or IV anaesthetic agent, often with opioid to reduce the dose of agent required, +/- muscle relaxant • Airway is secured via tracheal intubation (ETT) or by using a supraglottic device (LMA)	• Maintaining airway patency and keeping the patient unconscious for the procedure • Achieved by continuous administration of volatile agent or IV propofol (target controlled infusion: TCI). Ketamine is used in some settings. Analgesia is titrated to requirements • Systemic effects of different anaesthetic agents vary and are favoured in different clinical contexts	• Maintenance anaesthetic agent is ceased when anaesthesia is no longer required • Analgesia and anti-emetics (if required) are given, and reversal agent is administered to counter the effects of muscle relaxant (if used) • Can be a time of physiological disturbance: patients may become agitated and as they 'lighten' • Airway devices are removed once breathing, airway tone, and consciousness return

Source: Donohue, Hobson, & Stephens, 2013

Pharmaceutical components of general anaesthesia

A general anaesthetic always involves a hypnotic agent, usually involves analgesia, and may also include muscle relaxation. The combination is referred to as the 'triad of anaesthesia' (Donohue et al., 2013), and is tailored for each patient's situation.

Induction agents/hypnotics

Intravenous induction

IV agents, for example propofol and sodium thiopental are commonly used to induce GA, providing a smooth and rapid induction. Some anaesthetists use propofol as a continuous infusion for the duration of the procedure, negating the need for inhalational agents. This technique is known as Total Intravenous Anaesthesia (TIVA). Propofol may be administered via a specialised infusion pump (commonly known as a 'Diprifuser') which uses pharmacokinetic modelling to adjust the infusion rate to achieve a specified concentration, known as target controlled infusion (TCI).

Inhalational induction

Inhalational agents (also known as volatile gases, see Figure 3-7) are commonly used for anaesthetic induction in paediatrics, in patients with difficult IV access, and in some cases of difficult airway (Donohue et al, 2013). Once the patient is unconscious, the anaesthetic is maintained using inhalational agents.

Figure 3-7. Inhalational volatile agents

INHALATIONAL VOLATILE AGENTS

Inhalational volatile anaesthetics agents are substances that are liquid at room temperature and converted to a gas as they pass through a vapouriser and mix with oxygen prior to being delivered to the patient.

Currently used inhalational anaesthetics include sevoflurane (agent of choice in paediatrics), isoflurane, and desflurane. Halothane and enflurane are rarely used in current clinical practice.

Each agent and associated vapouriser is colour coded, has an individual locking mechanism for attachment onto the anaesthetic machine, and agent-specific fill keys to ensure agents are matched to the delivery system to reduce the risk of error (see photo below). The anaesthetist dials the concentration of volatile agent for delivery to the patient depending on the depth of anaesthesia required.

Once inhaled into the lungs the agent is distributed via blood to the tissues. The main target of inhalational anaesthetics is the brain.

In addition to the volatile agent, gaseous nitrous oxide may also be added to mix as it potentiates the action of the volatile agents allowing their dosage and associated side effects to be reduced. Nitrous oxide, although having limited use as an anaesthetic when used alone, has an analgesic effect (Hamlin et al., 2016).

Sevoflurane keyed fill system; anaesthetic vapourisers

Source: © James Derrick Cinder.hk http://www.cinder.hk/ANZCAPrimary/equipment/Vaporiser/Keyed-Fillers.html;
© Drägerwerk AG & Co. KGaA, Lubeck Medicalexpo.com http://www.medicalexpo.com/prod/draeger/product-68268-505356.html

Analgesia

Analgesia is the reduction or elimination of pain perception. Despite a patient being unconscious and unaware intraoperatively, the stimulation of surgery will still elicit a sympathetic response which analgesia can offset (Donohue et al., 2013). Appropriate analgesia is also essential for smooth emergence and post-operative comfort. Analgesia is typically multi-modal and may be achieved with medications that act locally (by interfering with nerve conduction e.g. local anaesthesia) or generally (by depressing pain perception in the central nervous system e.g. opioids). Several classes of analgesics are useful in the management of pain as part of an anaesthetic (see Figure 3-8).

Figure 3-8. Perioperative analgesia and adjuvant analgesia

Class	Drugs
Opioids (all S8)	morphine, fentanyl, oxycodone, hydromorphone, remifentanil, alfentanil
Opioid-like	tramadol (S4)
NSAIDs	parecoxib, ibuprofen, ketorolac (S4)
Simple analgesic	paracetamol
Atypical analgesics	ketamine (S8)

Opioid drugs are commonly used for induction and analgesia. There are strict legislative and regulatory requirements when handling and administering Schedule 8 (S8) drugs (refer to NSW Health policy PD2013_043). The anaesthetic nurse is actively involved in acquiring S8 drugs according to anaesthetist's orders and must adhere to the checking, administration and documentation requirements. S8 drugs are only checked out as required for each patient. Any unused portion of S8 drugs must be disposed of according to NSW Health policy PD2013_043.

Within many OS there is one locked drug cupboard containing S8 drugs and the drug keys are kept with a designated RN who will check out S8 drugs with individual anaesthetic nurses. Some OS have locked drug cupboards in each OR containing a small amount of S8 drugs and individual drug registers. This allows for timely and efficient administration of S8 drugs. The key is kept with the anaesthetic RN who checks out the S8 drugs with the anaesthetist or another RN, for example, the circulating nurse. If the anaesthetic nurse is an EN, the drug keys are kept by the circulating nurse (or other RN). The drugs are checked by two RNs at the change of each shift and at the conclusion of the operating list, the keys are returned to a central locked cupboard.

Non S8 analgesia is stored out of patient access in a central locked cabinet or room and is decanted to lockable drawers in the anaesthetic trolley (see Figure 3-10) within the OR and in the anaesthetic bay.

Muscle relaxants

Muscle relaxation is required in many surgical procedures where access to the abdomen is required. In relaxing the muscles of the abdominal wall, the muscles controlling respiration will also be affected, requiring the patient to be intubated and mechanically ventilated.

Muscle relaxation is achieved by administration of drugs that block neuromuscular activity at the motor end plates of skeletal muscles. Anaesthetists may use a nerve stimulator ('train of four' monitor) to assess the level of muscle relaxation intraoperatively and ensure the patient is 'reversed' prior to extubation (see Figure 3-9). There are two types of muscle relaxant drugs: depolarising muscle relaxants and non–depolarising muscle relaxants.

Depolarising muscle relaxants

Suxamethonium is a short acting muscle relaxant which acts within 30 to 60 seconds of administration and lasts only 3 to 5 minutes before being metabolised by a naturally occurring enzyme, cholinesterase. It is used to facilitate endotracheal intubation. Its action is characterised by fasciculation or twitching which can be noted in the patient following administration.

Non–depolarising muscle relaxants

Vecuronium, cisatracurium, rocuronium, and pancuronium are examples of longer acting muscle relaxants used to maintain muscle relaxation for the duration of the procedure. Non-depolarising muscle relaxants require the administration of neostigmine towards the conclusion of the procedure to reverse the actions of the relaxant and restore normal muscle function, including spontaneous respiratory function. Neostigmine can cause bradycardia and is counteracted by the simultaneous administration of atropine.

Figure 3-9. Neuromuscular ('train of four') monitor: usually applied over the ulnar nerve or facial nerve.

Source: https://aneskey.com/depth-of-anaesthesia-and-neurophysiological-monitoring/

Other medications used in anaesthesia and surgery

A variety of adjunct medications are used during anaesthesia and surgery. These include:

- antiemetics e.g. ondansetron, tropisetron, granisetron, metoclopramide, droperidol. Given prophylactically to patients at risk of post-operative nausea and vomiting (PONV)
- benzodiazepines e.g. midazolam. Used immediately prior to induction as an anxiolytic, and to sedate patients having surgery under local/regional blocks
- antibiotics e.g. gentamycin, cefazolin. May be administered prophylactically pre-operatively according to antibiotic stewardship guidelines (ACSQHC, 2014). This is noted as part of the 'Time Out' procedure.

These medications and other anaesthetic supplies are located in the anaesthetic trolley found in each OR (also known as the Morgan trolley, see *Figure 3-10).* Restocking the anaesthetic trolley at the conclusion of a procedure and at the end of the list is important in ensuring sufficient supplies for subsequent patients.

Figure 3-10. Anaesthetic trolley

Source: NSW Health 2017

READ

Hamlin et al. (2016) Chapter 8, pp 196-201, Types of Anaesthesia
Describes the agents used in general anaesthesia.

ANZCA (2017) *PS51 Guidelines for the Safe Management and Use of Medications in Anaesthesia.* http://www.anzca.edu.au/documents/ps51-2009-guidelines-for-the-safe-administration-o

ACTIVITY

3-1 Anaesthetic medications
Consider the anaesthetic drugs used in your OR, and in the Activity section:

- complete the table on anaesthetic drugs
- describe how S8 drugs are dispensed in your OS i.e. the checking procedure at the drug cupboard
- describe the checking procedure carried out immediately prior to administration of S8 drugs to the patient
- describe how unused portions of S8 drugs are disposed
- describe the change of shift checking that occurs for S8 drugs in your OS

Anaesthetic patient care

Virtual Operating Suite

To facilitate the study of anaesthesia and the role of the anaesthetic nurse, an operating list of 'virtual patients' is provided. The guided readings and activities relate to the nursing care of each patient as they progress through their anaesthetic.

Virtual Operating List

Patient	Age	MRN	Surgical procedure	Comments
George RUBIN	66	87459061	Repair right inguinal hernia	VTE risk
Gemma ARMITAGE	46	76594302	Excision of lump left breast	N/A
Jill SIMPKIN	85	95420714	Carpal tunnel release right hand	Tourniquet required
Sanjay KUMAR	56	92348761	Excision of melanoma left thigh	Weighs 180kg BMI 35

Your first patient is Mr Rubin who is scheduled for a repair of his right inguinal hernia under a general anaesthetic.

PREPARING FOR GENERAL ANAESTHETIC: Environment and equipment

As anaesthetic nurse you will prepare the environment ready for the operating list ahead of Mr Rubin's arrival. This includes:

- checking the anaesthetic bay for cleanliness: clean as required
- ensuring all equipment and stock required for the operating list is available
- checking S8 and S4D drugs according to local policy at shift commencement
- checking equipment is working, for example, lights, suction, monitoring devices, oxygen
- communicating with the anaesthetist about the anaesthetic plan, equipment and medications required for each patient. You have noted that the final patient on the list is Mr Kumar, who is obese. You discuss with the anaesthetist the need for specialised equipment, for example, difficult intubation trolley and other airway management equipment. Planning actions for future patients and making sure the equipment is available is important and will prevent delays
- liaising with the instrument and circulating nurses about any specific requirements they may have for the patients on the list, for example, Mr Kumar and how to manage his manual handling and positioning needs. You may also discuss if they will need your assistance to facilitate tea/lunch breaks by acting as circulating nurse as required
- setting up the equipment required for the Mr Rubin according to the agreed anaesthetic plan
- sending for Mr Rubin according to facility processes: the timeliness of this action is important in meeting key theatre utilisation performance indicators.

Anaesthetic machine

A key task prior to the commencement of each anaesthetic list is to complete a Level 2 check of the anaesthetic machine to determine correct function (see Figure 3-11). Both the anaesthetic nurse and anaesthetist carry out this check separately using the manufacturer's or locally developed checklist. Many anaesthetic machines have automated checking of some components however these must be verified by the anaesthetic nurse and anaesthetist. Any discrepancies must be reported immediately and rectified prior to commencing the operating list.

Figure 3-11. Anaesthetic machine checks

ANAESTHETIC MACHINE CHECKS
Level 1. Detailed check of all systems prior to machine becoming operational in the OS, and after servicing or repair. Undertaken by trained service personnel to verify function and compliance with Australian Standards
Level 2. Performed at the start of each anaesthetic list Includes checks on: reserve oxygen, gas supply lines, flow controls, vaporisers, leak testing, breathing systems, ventilator, emergency ventilation, scavenging, suction, monitoring, capnography, filtering, emergency and planned airway equipment, IV and LA delivery devices, final machine purge with oxygen, documentation
Level 3. Performed prior to commencing anaesthesia for each patient Includes checks on vapourisers and breathing systems (if changed since Level 2 check), check on new filter and suction equipment, airway equipment, and other required equipment (ANZCA, 2014)

Anaesthetic machine models vary across NSW Health (see Figure 3-12). Functional components of the anaesthetic machine are outlined in this manual, however specific information relating to individual models is to be obtained locally from your facilitator.

The anaesthetic machine has three major components including:

1. gas mixing and delivery system, including the vaporisers for volatile agents
2. anaesthetic breathing system or circuit
3. ventilator.

Figure 3-12. Example of an anaesthetic machine

Source: NSW Health 2017

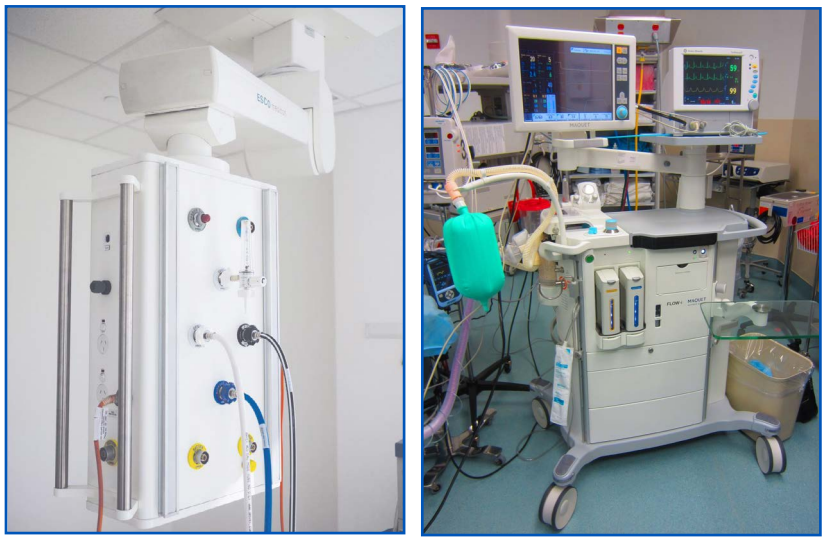
Other equipment incorporated into the anaesthetic machine includes:

- monitoring including ECG, pulse oximetry and capnography
- gas analyser: a safety feature which monitors gas outflow from the pipeline gas delivery systems
- a 'scavenger' suction system: fitted to all anaesthetic machines to extract any waste anaesthetic gases out of the OR, reducing the risk of inhaling anaesthetic gases to staff.

Gas mixing and delivery system

The anaesthetic machine is connected to a central bulk gas store and delivered to the OR by a network of pipes via an overhead pendant (see Figure 3-13). Gases including oxygen, nitrous oxide, and compressed or medical air are denoted by universal colour coding on the cylinder, tubing and valve outlets to provide differentiation. Each gas outlet has a unique valve fitting. This is an important safety feature and means that tubing cannot be connected to the incorrect supply valve (Hamlin et al, 2016). Similarly, the reserve gas cylinders attached to the anaesthetic machine have a unique pin connecting arrangement (pin index) to prevent the wrong gas being used through the anaesthetic machine to the patient. The flow of gases into the anaesthetic machine is controlled by the anaesthetist through a flowmeter with a digital or manual display (see Figure 3-13).

Figure 3-13. Colour identification of medical gases; digital gas flowmeter on anaesthetic machine



Source: © ESCO Industries; DiverDave/Wikimedia Commons

The following reading details how to manage gas pollution in the OR.

READ

ACORN (2018) Standard on Anaesthetic gas pollution.

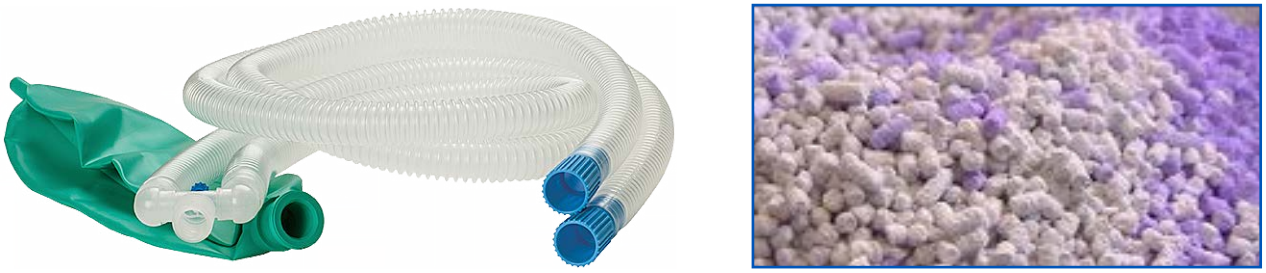
ACTIVITY

3-2 Anaesthetic machine
Carry out a Level 2 check of the anaesthetic machine with your facilitator and become familiar with each component. Using the list and diagram in the Activity section, label the main components of the anaesthetic machine.

Anaesthetic breathing system and circuit

Anaesthetic gases are delivered to the patient via a breathing or anaesthetic circuit, connecting the anaesthetic machine to the patient's airway and allowing both spontaneous respiration and ventilatory control. Most facilities use disposable circuits, available in adult, paediatric, and extra length variations. Adult circuits consist of two limb leads and a 2000ml reservoir bag with tube, which may be used to ventilate ('bag') or deliver positive pressure to the patient (see Figure 3-14).

Figure 3-14. Example of an adult anaesthetic breathing circuit; Soda lime granules with colour change indicating exhaustion



Sources: Vyaire Medical; NSW Health 2017

The circuit is attached to a canister of soda lime which absorbs carbon dioxide expired by the patient from the closed breathing environment to prevent carbon dioxide retention and carbon dioxide poisoning. Soda lime is a granulated mixture of chemicals (primarily calcium hydroxide) including an indicator that turns from white to purple to reflect absorption exhaustion and when it is time to be changed (see Figure 3-14). However, clinical indicators are also used to assess when the soda lime requires changing. These signs can include the capnography trace reflecting hypercapnia/hypercarbia, increased heart rate, increased respiratory rate (if breathing spontaneously), and increased BP. Check your local anaesthetic department policy on the management of soda lime.

The ventilator

Anaesthetic ventilators are relatively simple and are designed to deliver mechanical ventilation to the lungs of anaesthetised and pharmacologically paralysed patients. The ventilator can also be used to support the patient's breathing (pressure support) if the patient has not been paralysed. The anaesthetist will adjust the volumes and pressures of inspiration and expiration to deliver adequate ventilation and oxygenation to the patient.

Airway management equipment

Delivering anaesthetic gases to the patient requires the use of a variety of airway equipment.

Preparing for General Anaesthetic: Airway management	
Mr Rubin is having his right inguinal hernia repaired. The anaesthetist has requested endotracheal intubation and ventilation to deliver the anaesthetic. Your role as anaesthetic nurse is to set up the equipment required to intubate and ventilate Mr Rubin. This includes:	
Equipment	**Use**
Anaesthetic face mask	Creates a seal and a vehicle to deliver oxygen and anaesthetic gases to the patient via the anaesthetic machine. Various sizes available: usually size 5 for adult male (see Figure 3-15)
Heat and moisture exchanger (HME filter)	Filter made from hygroscopic paper in a plastic case. Viral and bacterial filtration efficiency of >99%. Provides humidification to reduce heat and moisture loss
Guedel (oropharyngeal) airway	Lifts the tongue off the posterior pharyngeal wall to prevent airway obstruction: may be used prior to intubation or post extubation (see Figure 3-15)
Endotracheal tube (ETT)	Inserted by anaesthetist under direct vision, through the vocal cords and directs anaesthetic gases into the lungs
Laryngoscope	Instrument consisting of a blade and handle which incorporates a light source for visualising the vocal cords and facilitating the insertion of the ETT
Lubricant	Applied to the ETT to facilitate smooth, atraumatic insertion
10 ml syringe	Used to inflate the ETT cuff with air following insertion to seal airway
Linen tie or elastoplast	Used to secure the ETT in place
Connector/catheter mount	Used to connect the ETT to the breathing circuit on the anaesthetic machine
Suction equipment	A dedicated sucker: Yankauer or Y-suction must always be available
Eye protection	A breathable film dressing or gentle adhesive tape is used to protect eyes from intraoperative corneal injury
Introducers, Magill forceps and bougies*	Have available to assist with insertion of ETT if necessary
* An introducer/stylet is a malleable metal rod that is inserted into the ETT to reshape it to facilitate intubation. A bougie is a plastic introducer that may be used to intubate a patient with a difficult airway, then the ETT is passed over the top ('railroaded').	

Figure 3-15. Various sizes of anaesthetic face masks and Guedel's airways

Source: NSW Health 2017

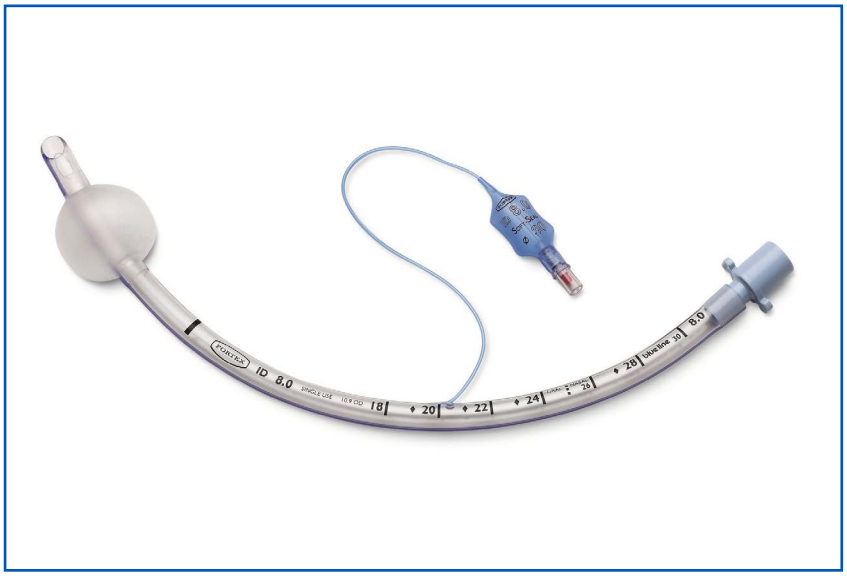
Endotracheal tubes (ETT)

ETTs are made of single-use PVC or silicone which are inserted through the vocal cords using a laryngoscope to visualise correct placement. The ETT has a bevelled distal end to aid in insertion through the cords. Adult ETTs have an inflatable cuff at the distal end which when inflated with air provides a seal that permits positive pressure ventilation and decreases the risk of secretions being aspirated into the lungs. There are a number of specialty ETTs available for different purposes (see Figure 3-16). See Figure 3-17 for an ETT in situ.

As a general guide, ETT sizes used in adults:

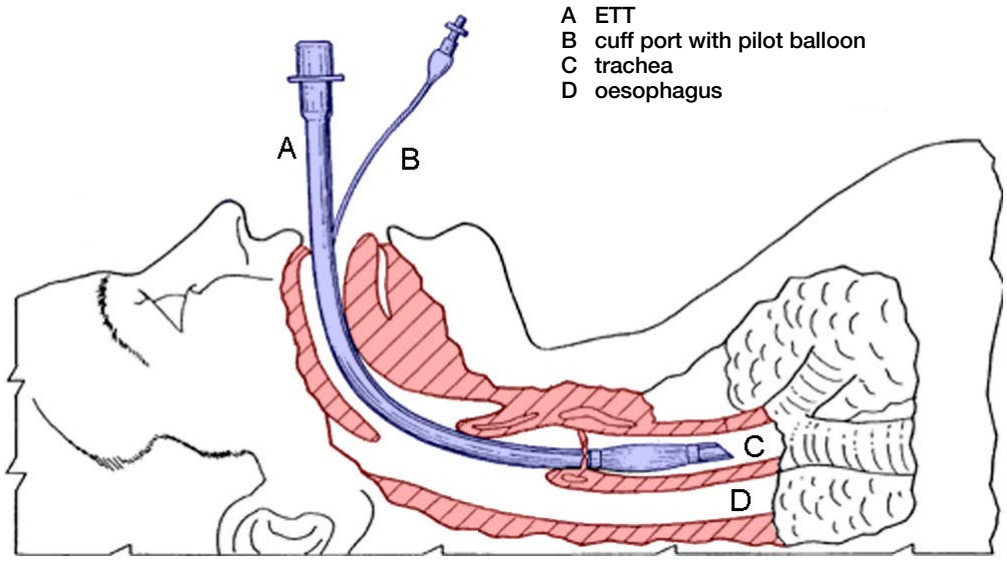
- adult male 8.0 – 8.5mm
- adult female 7.0 – 7.5mm
- adolescent/small adult 6.0 – 7.0mm.

Figure 3-16. Standard cuffed endotracheal tube; specialty ETTs (L to R: double lumen endobronchial tube (used in thoracic surgery), nasal RAE (used in oral surgery), standard adult cuffed ETT, nasopharyngeal airway



Source: Smiths Medical ; NSW Health 2017

Figure 3-17. ETT inserted in trachea



Source: PhillipN/Wikipedia Commons

READ

Hamlin et al. (2016) Chapter 8, pp 201- 207, Anaesthetic Management Equipment and Techniques.
Describes airway management equipment, including laryngeal mask airway. Note the photograph of the anaesthetic machine (Figure 8-4, p 205) and intubation equipment (Figure 8-9, p 206).

ANZCA (2017) Recommendations on minimum facilities for safe administration of anaesthesia in operating suites and other anaesthetising location.
http://www.anzca.edu.au/documents/ps55-2012-recommendations-on-minimum-facilities-fo.pdf
This link outlines the extensive requirements to administer anaesthesia: as an anaesthetic nurse, you require knowledge of the equipment described.

ACTIVITY

3–3 Anaesthetic equipment
Work with your facilitator and set up for endotracheal intubation. Handle and become familiar with each piece of equipment. When you are comfortable with assisting an intubation, carry out the *Clinical Skills Assessments* for Checking the Anaesthetic Machine and Airway Management (intubation) with your facilitator.

Figure 3-18. Equipment for basic GA with intubation
Clockwise from top right: temperature probe, dressing for eye protection, catheter mount, ETT with bougie in situ, Guedel's airway, laryngoscope with blade, Yankauer sucker, anaesthetic face mask with HME filter, BIS probe, lubricant, linen tube tie.

Mnemonic for basic intubation equipment: MABLES

Mask

Airway

Bougie

Laryngoscope handle and blade

Endotracheal tubes

Suction

(Cook et al, 2011)

Source: NSW Health 2017

Receiving and assessing the patient

RECEIVING THE PATIENT PRE-OPERATIVELY

Mr Rubin has arrived in the OS. If he has been escorted to OS (according to local policy), you greet him and receive a handover from the ward nurse. Depending on your facility, you (the anaesthetic nurse) or the admission nurse will complete the pre-operative check. Note the key areas that are assessed (see also Figure 3-19):

- patient identification
- fasting status
- medication taken
- dentition
- skin integrity and mobility issues
- consent is valid, signed, and matches operative list
- allergies
- VTE status
- baseline observations
- any other relevant issues, for example, is the patient hard of hearing? If, so their hearing aid may be left in situ until anaesthetic induction to facilitate communication.

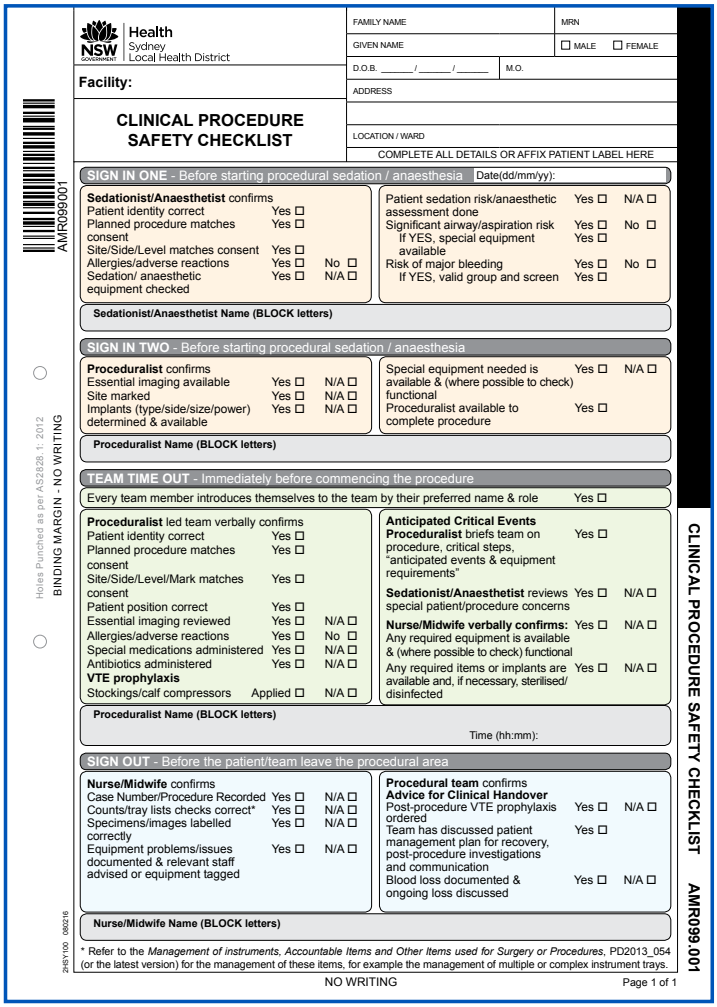
The nurse attending the pre-operative check signs the checklist.

If the consent or surgical marking does not correspond with the patient's understanding of the procedure or if any other discrepancy becomes apparent, the nurse attending the pre-operative check on arrival to OS must inform the surgical team as soon as practicable. The issue must be resolved before the patient can leave the check-in area or receive any sedation/anaesthesia.

If the admission nurse has completed the pre-operative check, you (the anaesthetic nurse) now greet Mr Rubin and carry out your own check to ensure you have the correct patient and correct documents. You also check the operative site has been marked.

All the relevant documentation is complete and Mr Rubin is escorted to the anaesthetic bay and prepared for anaesthetic induction.

Figure 3-19. Example of a preoperative checklist (SLHD)



Health
NSW GOVERNMENT Sydney Local Health District

Facility:

CLINICAL PROCEDURE SAFETY CHECKLIST

FAMILY NAME | MRN
GIVEN NAME | ☐ MALE ☐ FEMALE
D.O.B. _____/_____/_____ | M.O.
ADDRESS
LOCATION / WARD
COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE

AMR099001

SIGN IN ONE - Before starting procedural sedation / anaesthesia — Date(dd/mm/yy):

Sedationist/Anaesthetist confirms
Patient identity correct Yes ☐
Planned procedure matches consent Yes ☐
Site/Side/Level matches consent Yes ☐
Allergies/adverse reactions Yes ☐ No ☐
Sedation/ anaesthetic equipment checked Yes ☐ N/A ☐

Patient sedation risk/anaesthetic assessment done Yes ☐ N/A ☐
Significant airway/aspiration risk Yes ☐ No ☐
If YES, special equipment available Yes ☐
Risk of major bleeding Yes ☐ No ☐
If YES, valid group and screen Yes ☐

Sedationist/Anaesthetist Name (BLOCK letters)

SIGN IN TWO - Before starting procedural sedation / anaesthesia

Proceduralist confirms
Essential imaging available Yes ☐ N/A ☐
Site marked Yes ☐ N/A ☐
Implants (type/side/size/power) determined & available Yes ☐ N/A ☐

Special equipment needed is available & (where possible to check) functional Yes ☐ N/A ☐
Proceduralist available to complete procedure Yes ☐

Proceduralist Name (BLOCK letters)

TEAM TIME OUT - Immediately before commencing the procedure

Every team member introduces themselves to the team by their preferred name & role Yes ☐

Proceduralist led team verbally confirms
Patient identity correct Yes ☐
Planned procedure matches consent Yes ☐
Site/Side/Level/Mark matches consent Yes ☐
Patient position correct Yes ☐
Essential imaging reviewed Yes ☐ N/A ☐
Allergies/adverse reactions Yes ☐ No ☐
Special medications administered Yes ☐ N/A ☐
Antibiotics administered Yes ☐ N/A ☐
VTE prophylaxis
Stockings/calf compressors Applied ☐ N/A ☐

Anticipated Critical Events
Proceduralist briefs team on procedure, critical steps, "anticipated events & equipment requirements" Yes ☐
Sedationist/Anaesthetist reviews special patient/procedure concerns Yes ☐ N/A ☐
Nurse/Midwife verbally confirms: Any required equipment is available & (where possible to check) functional Yes ☐ N/A ☐
Any required items or implants are available and, if necessary, sterilised/ disinfected Yes ☐ N/A ☐

Proceduralist Name (BLOCK letters)
Time (hh:mm):

SIGN OUT - Before the patient/team leave the procedural area

Nurse/Midwife confirms
Case Number/Procedure Recorded Yes ☐ N/A ☐
Counts/tray lists checks correct* Yes ☐ N/A ☐
Specimens/images labelled correctly Yes ☐ N/A ☐
Equipment problems/issues documented & relevant staff advised or equipment tagged Yes ☐ N/A ☐

Procedural team confirms
Advice for Clinical Handover
Post-procedure VTE prophylaxis ordered Yes ☐ N/A ☐
Team has discussed patient management plan for recovery, post-procedure investigations and communication Yes ☐
Blood loss documented & ongoing loss discussed Yes ☐ N/A ☐

Nurse/Midwife Name (BLOCK letters)

* Refer to the *Management of instruments, Accountable Items and Other Items used for Surgery or Procedures*, PD2013_054 (or the latest version) for the management of these items, for example the management of multiple or complex instrument trays.

NO WRITING

Page 1 of 1

CLINICAL PROCEDURE SAFETY CHECKLIST AMR099.001

Holes Punched as per AS2828.1: 2012
BINDING MARGIN - NO WRITING

2HSY100 0902/16

Source: Sydney Local Health District 2017

READ

NSW Health (2017) Clinical Procedure Safety policy directive (PD2017_032)

Hamlin et al. (2016) Chapter 9, Ensuring Correct Site Surgery, pp 256–258

ANAESTHETIC ASSESSMENT

Mr Rubin is greeted in the anaesthetic bay (see Figure 3-20) by the anaesthetist who confirms his identity, his allergies, and reviews the anaesthetic plan. IV access is secured for administration of medication and fluids. The size and location of the IV cannula is documented according to local policy.

Mr Rubin, 66 years, is assessed as ASA I and Mallampati class 1 indicating that he has no comorbidities and difficulties with airway management are not anticipated. Due to his age and surgical procedure, Mr Rubin is at increased risk of VTE. As a result, he has been fitted with graduated compression stockings and these are in situ on admission to the OS. Intermittent pneumatic compression devices are also fitted to his calves. The sign in section of the Clinical Procedure Safety Checklist is completed by the anaesthetic team (see Figure 3-24).

Figure 3-20. Example of an anaesthetic bay with monitoring, equipment, fridge, and direct access to the OR

Source: NSW Health 2017

Anaesthetic preparation

Prior to induction, many patients are administered an anxiolytic pre-medication in the anaesthetic bay (e.g. midazolam) and require the continued presence of the anaesthetic nurse or anaesthetist to monitor the sedative effect. Pulse oximetry monitoring and supplemental oxygen may be required.

The location for anaesthetic induction may vary. Some facilities use the anaesthetic bay: this has the advantage of being quiet and potentially less stressful for patients than in the OR where the sights and sounds of surgical equipment being prepared may cause anxiety. However, transferring an anaesthetised patient from the anaesthetic bay onto the OR table carries risks of airway dislodgement and manual handling risks. The anaesthetist balances these risks and commonly patients are anaesthetised on the operating table.

TRANSFERRING INTO OR

Mr Rubin's anaesthetic induction will take place on the operating table. This is an anxious time for patients: as the anaesthetic nurse you have an important role in reassuring Mr Rubin and informing him of the activities that are going on around him. As hearing is the last sense to disappear when anaesthesia is being induced, activity in the OR should continue as quietly as possible and music turned down or off.

Mr Rubin is moved into the OR on his bed which is abutted against the operating table, and the brakes are applied. Mr Rubin is able to transfer himself onto the OR table with the assistance of the team. Once he is comfortable and covered with a blanket, you and the anaesthetist attach the monitoring equipment: ECG, BP cuff, and pulse oximeter.

Maintaining normothermia is achieved by applying a forced air warming blanket and device to Mr Rubin's upper body. An oral temperature probe will be positioned post induction to monitor Mr Rubin's temperature.

Patient care considerations

Inadvertent hypothermia

Hypothermia frequently occurs during anaesthesia and surgery, and is associated with adverse clinical outcomes including postoperative shivering, increased blood loss, decreased drug metabolism and clearance, postoperative myocardial ischaemia, wound infection, and delayed recovery from anaesthesia (Drain, 2016). Hypothermia results largely from a core-to-peripheral redistribution of body heat as a result of physical exposure, anaesthetic medications that have a vasodilatory effect, cold irrigation, and cold IV fluids amongst other factors.

Warming devices

Forced air warming devices (FAWD) are attached to full or half-length disposable blankets. The blankets are positioned on the patient to maintain the aseptic operative field whilst providing maximal body surface area warming. The blanket is inflated with warmed air via a hose attached to a heating unit from which the required body temperature can be adjusted (see Figure 3-21). It is important that the hose from the heating unit is never used independently of the disposable blanket supplied: the FAWD blankets are designed specifically to dissipate the significant heat delivered by the FAWD, protecting the patient's skin. The American Society of Anesthesiologists has reported thermal burns to patients when the hose is placed under the patient's own blankets and directly onto the skin (Mehta, 2013).

Figure 3-21. An example of a full length forced air warming device (note the hose attachment and heating unit); Blood/fluid warming devices: cassette style (top) and coil style (bottom).

Sources: McFarlane Medical; NSW Health 2017

A warming cassette or coil may be added in to a standard giving set to warm IV fluids as they are delivered to the patient. The temperature can be controlled and alarms set to indicate if the temperature falls too low or becomes too high (see Figure 3-21).

Irrigation fluids used intraoperatively should also be warmed in a temperature regulated warming cabinet prior to being used.

The following readings provide details on the importance of preventing inadvertent perioperative hypothermia.

READ

Chapter 9, pp 255-256, Prevention and Management of inadvertent perioperative hypothermia.

ACORN (2018) Standard on management of hypothermia in the perioperative environment.

Duff, J., Walker, K., Edward, K., Williams, R. & Sutherland-Fraser, S. (2014). Incidence of perioperative inadvertent hypothermia and compliance with evidence-based recommendations at four Australian hospitals: A retrospective chart audit. *The Journal of Perioperative Nursing in Australia 27*(3), 16-23.

Intraoperative fluids and electrolytes

Adequate hydration ensures good tissue perfusion and hence oxygenation (Donohue et al., 2013), and adequately hydrated perioperative patients will generally experience better post-operative outcomes (Lynne & Winner, 2014). This is achieved through fluid administration/resuscitation using crystalloids, colloids, and blood products as required (see Figure 3-22). A patent IV cannula is required for every patient.

Patients with prolonged preoperative fasting times, those who have had bowel preparation, bowel obstruction, or ongoing bleeding are associated with a decreased intravascular volume and will require more aggressive fluid replacement. Fluid balance is assessed intraoperatively by BP, heart rate, and urine output.

As part of preparing for anaesthesia, anaesthetic nurses prime an IV line for each patient with a litre of (usually) crystalloid solution e.g. compound sodium lactate, however the IV fluid requested by the anaesthetist will depend on the type of surgery and patient requirements. If rapid fluid administration is required, a rapid infuser pump will be used which applies pressure to the IV fluid flask to speed (and warm) the delivery of IV fluids. Policy on labelling IV fluids and lines must be followed.

The following tables provide a summary of the most common crystalloid and colloid solutions used and the associated nursing considerations.

Figure 3-22. Common IV fluids and their applications

Common crystalloids

Solution	Type	Uses	Nursing considerations
Dextrose 5% in water (D5W)	**Isotonic**	Fluid loss Dehydration Hypernatraemia	Use cautiously in renal and cardiac patients Can cause fluid overload May cause hyperglycaemia or osmotic diuresis
0.9% Sodium Chloride (Normal Saline-NaCl)	**Isotonic**	Shock Hyponatraemia Blood transfusions Resuscitation Fluid challenges Diabetic Keto Acidosis (DKA)	Can lead to overload Use with caution in patients with heart failure or oedema Can cause hyponatraemia, hypernatraemia, hyperchloraemia or calorie depletion
Lactated Ringer's (Hartmanns)	**Isotonic**	Dehydration Burns Lower GI fluid loss Acute blood loss Hypovolaemia due to third spacing	Contains potassium; don't use with renal failure patients Don't use with liver disease; can't metabolise lactate
0.45% Sodium Chloride (½ Normal Saline)	**Hypotonic**	Water replacement DKA Gastric fluid loss from NG or vomiting	Use with caution May cause cardiovascular collapse or increased intracranial pressure Don't use with liver disease, trauma or burns
Dextrose 5% in ½ normal saline	**Hypertonic**	Later in DKA	Use only when blood sugar falls below 250mg/dl
Dextrose 5% in normal saline	**Hypertonic**	Temporary treatment from shock if plasma expanders aren't available	Contra-indicated for cardiac or renal patients

Common colloids

Colloid	Action/use	Nursing considerations
Albumen (plasma protein) 4% or 20%	Keeps fluids in vessels Maintains volume Primarily used to replace protein and treat shock	May cause anaphylaxis (a severe, often rapidly progressive allergic reaction that is potentially life threatening) – watch for/report wheeze, persistent caught, difficulty breathing/ talking, throat tightness, swelling of the lips, eyes, tongue, face, loss of consciousness May cause fluid overload and pulmonary oedema
Dextran (Polysaccharide) 40 or 70	Shifts fluids into vessels Vascular expansion Prolongs haemodynamic response when given with HES	Can cause fluid overload and hypersensitivity Increased risk of bleeding Contraindicated in bleeding disorders, chronic heart failure and renal failure
Hetastarch (HES) (synthetic starch) 6% or 10%	Shifts fluids into vessels Vascular expansion	May cause fluid overload and hypersensitivity Increased risk of bleeding Contraindicated in bleeding disorders, chronic heart failure and renal failure
Mannitol (alcohol sugar) 5% or 10%	Oliguric diuresis Reduces cerebral oedema Eliminates toxins	May cause fluid overload May cause electrolyte imbalances Cellular dehydration Extravasation may cause necrosis

Source: Hills, 2013

The following readings explain the fluid and electrolyte requirements for surgical patients and the commonly used IV fluids and blood products.

READ

Hamlin et al. (2016) Chapter 8, pp 222-223, Electrolyte balance.
Note the specific requirements when handling and checking blood products.

National Blood Authority Australia (2012) Patient blood management guidelines.
Note there are six modules, including Module 2, Perioperative. It is a comprehensive document, so concentrate initially on Section 4, Anaesthesia and Patient Blood Management, pp 71–73. You can work through the remaining section gradually. Many OS have this resource as a hard copy. Liaise with your facilitator to locate.

Hamlin et al. (2016) Chapter 3, pp 6-65, Medication Management.
Note Figure 3-5 for examples of labels.

Australian Commission on Safety and Quality in Health Care (2015) National Standard for User-applied Labelling of
Injectable Medicines, Fluids and Lines Section 6, pp 25-30 Labelling in Perioperative Areas
https://www.safetyandquality.gov.au/wp-content/uploads/2015/09/National-Standard-for-User-Applied-Labelling-Aug-2015.pdf

ACTIVITY

3-4 Managing blood products
What is the local protocol for ordering, handling, checking and administration of blood products? What are the signs and symptoms of acute transfusion reaction and their management? Record your answers in the Activity section.

INDUCTION OF ANAESTHESIA

Following a final check that all equipment and drugs are ready for induction, you and the anaesthetist don PPE to protect against splash injury should the patient cough or vomit during induction.

The anaesthetist holds the anaesthetic mask on Mr Rubin's face to pre-oxygenate him, providing a reserve supply of oxygen before induction. This is important: there is always a possibility of encountering unexpected airway difficulties. Pre-oxygenation at 100% for 3-5 minutes can provide up to 7 minutes of oxygen consumption in the case that an apnoea is experienced during induction (Balla & Mendonca, 2017). As he breathes the oxygen, Mr Rubin is asked to lift his chin to attain the 'sniffing position': this position optimises the anaesthetist's airway view on laryngoscopy.

The anaesthetist is positioned at the patient's head, and as anaesthetic nurse, you position yourself at the right hand of the anaesthetist at the level of the patient's right shoulder, ready to hand the anaesthetist the intubation equipment.
The induction sequence is:

- pre-oxygenation
- IV injection of the induction drugs, including the anaesthetic and muscle relaxant. This can be a very anxious time for the patient and as the drugs are being injected, you can provide ongoing quiet reassurance to Mr Rubin, using therapeutic touch as required
- hand ventilation may be necessary if long acting muscle relaxant drugs have been administered. The anaesthetist will indicate when Mr Rubin is ready for intubation, and will signal for the laryngoscope which you open and pass by the handle into the anaesthetist's left hand – ensure you do not pass any equipment across the patient's face as this can cause injury if dropped
- the anaesthetist opens Mr Rubin's mouth and removes his dentures which you secure in a labelled denture cup. The anaesthetist inserts the laryngoscope blade into the right side of Mr Rubin's mouth and sweeps his tongue to the left. The blade is positioned midline then lifted upwards and forwards to expose Mr Rubin's epiglottis. The anaesthetist identifies the glottic structures and visualises his vocal cords. You then pass the ETT which the anaesthetist inserts through the cords into the trachea (see Figure 3-23). The anaesthetist will signal for you to inflate the ETT cuff, and you fill the ETT cuff slowly with air using a syringe, stopping when there is no leak audible (approximately 5-8 ml of air)
- the anaesthetist hand ventilates the patient whilst ensuring there is equal inflation of the lungs. Mr Rubin is then connected to the ventilator which is regulated by the anaesthetist to provide Mr Rubin with adequate respiratory function throughout the procedure
- the ETT is secured in place with a linen tie or tape by the anaesthetist
- you close Mr Rubin's eyes and gently apply paper tape to keep them closed and protected intraoperatively.

INDUCTION OF ANAESTHESIA

Once Mr Rubin's anaesthetic induction is complete and anaesthetic maintenance is commenced using oxygen, nitrous oxide and sevoflurane, the anaesthetist will advise the surgical team that the procedure can commence. The anaesthetic team together with the surgical team will participate in the 'Time Out' procedure and document as per local policy (see Figure 3-24).

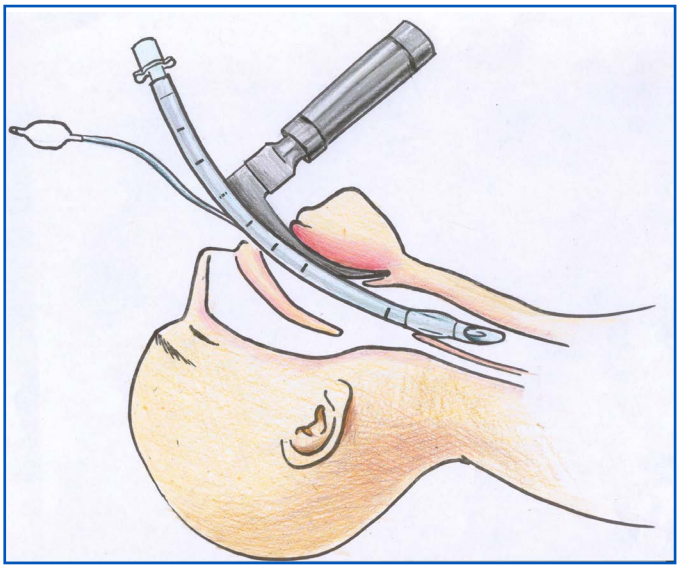
During the procedure, you will continue to provide assistance to the anaesthetist which may include:

- obtaining opioid drugs for Mr Rubin's continued pain management
- documenting IV fluids and fluid balance
- restocking supplies
- preparing for the next patient.

Throughout Mr Rubin's procedure, it is important to watch and listen to activities within the OR. Situational awareness will alert you to any changes in Mr Rubin's condition that may require anaesthetic intervention.

If you leave the anaesthetic bay to obtain equipment or have a break, you must ensure the anaesthetist is aware of your absence.

Figure 3-23. Laryngoscopy and intubation



Source: © Royal College of Anaesthetists UK; © Anaesthesia and Intensive Care, Chinese University of Hong Kong

Figure 3-24. Clinical Procedure Safety Checklist (SESLHD)

NSW GOVERNMENT Health
South Eastern Sydney Local Health District
Sydney Children's Hospital Randwick

Facility:

CLINICAL PROCEDURE SAFETY CHECKLIST LEVEL 3

If this checklist is not completed or check is incorrect, IIMs notification to be entered.

Name of Proceduralist who led checklist: _____

FAMILY NAME | MRN
GIVEN NAMES | ☐ MALE ☐ FEMALE
D.O.B. _____ / _____ / _____ | M.O.
ADDRESS
LOCATION / WARD
COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE

SIGN IN - Before Induction of Anaesthesia/Sedation

PATIENT / CARER HAS CONFIRMED
☐ Identity ☐ Procedure
☐ Site ☐ Consent

☐ **SITE MARKED**
☐ Not Applicable

☐ **ANAESTHESIA / SEDATION SAFETY CHECK COMPLETED**
☐ Not Applicable

☐ **PULSE OXIMETER ON PATIENT AND FUNCTIONING**

DOES PATIENT HAVE A KNOWN ALLERGY / ADVERSE REACTION
☐ Yes
☐ No

KNOWN DIFFICULT AIRWAY/ ASPIRATION RISK
☐ Yes, and Equipment/Assistance available
☐ No

RISK OF >500mL BLOOD LOSS (7mL/kg in Children)
☐ Yes and Adequate Intravenous Access and Fluids Planned
☐ No

PROSTHESIS / SPECIAL EQUIPMENT:
Special equipment needed is available and functional
☐ Yes

Name ..... **Designation** .....
Signature ..... **Date** .....

TIME OUT – Prior to Commencement of Procedure

☐ **CONFIRM ALL TEAM MEMBERS HAVE INTRODUCED THEMSELVES BY NAME AND ROLE**

SURGEON, ANAESTHETIST AND NURSE VERBALLY CONFIRM
☐ Patient ☐ Procedure
☐ Site ☐ Allergies

ANTICIPATED CRITICAL EVENTS
☐ **SURGEON REVIEWS:**
What are the Critical or Unexpected Steps, Operative Duration, Anticipated Blood Loss

☐ **ANAESTHESIA TEAM REVIEWS:**
Are there any Patient-Specific concerns

☐ **NURSING TEAM REVIEWS:**
Has Sterility (including indicator results) been confirmed
Are there Equipment Issues or any concerns

HAS ANTIBIOTIC PROPHYLAXIS BEEN GIVEN WITHIN THE LAST 60 MINUTES
☐ Yes ☐ Not Applicable

SPECIAL MEDICATION ADMINISTERED
☐ Yes ☐ Not Applicable

HAS THE PATIENT RECEIVED THROMBOPROPHYLAXIS
ANTICOAGULANT ☐ Yes ☐ Not Required
MECHANICAL ☐ Yes ☐ Not Required

IS ESSENTIAL IMAGING DISPLAYED
☐ Yes ☐ Not Applicable

PRESSURE INJURY PREVENTION PLAN IMPLEMENTED
☐ Yes ☐ Not Applicable

HAS POSITION OF PATIENT BEEN CONFIRMED
☐ Yes ☐ Not Applicable

Name ..... **Designation** .....
Signature .....**Time**..... **Date**.....

SIGN OUT - Before patient leaves Operating/Procedure Room

NURSE VERBALLY CONFIRMS WITH THE TEAM:

☐ **NAME OF THE PROCEDURE RECORDED**

☐ **ACCOUNTABLE ITEMS / INSTRUMENT CHECKS COMPLETED**

☐ **SPECIMEN / IMAGES ARE LABELLED CORRECTLY**
☐ Not Applicable

☐ **WHETHER THERE ARE ANY EQUIPMENT PROBLEMS / ISSUES DOCUMENTED & RELEVANT STAFF ADVISED**
☐ Not Applicable

☐ **SURGEON, ANAESTHETIST AND NURSE REVIEW THE KEY CONCERNS FOR RECOVERY AND MANAGEMENT OF THIS PATIENT IN CLINICAL HANDOVER (PRIOR TO LEAVING OPERATING ROOM)**

☐ **BLOOD LOSS DOCUMENTED AND ONGOING MANAGEMENT DISCUSSED**
☐ Not Applicable

POST PROCEDURE VTE PROPHYLAXIS ORDERED.
☐ Yes
☐ Not Required

PROCEDURAL TEAM CONFIRMS ADVICE FOR CLINICAL HANDOVER (IN POST ANAESTHETIC CARE UNIT)
☐ Yes
☐ Not Applicable

Name ..... **Designation** .....
Signature ..... **Date** .....

READ

Hamlin et al (2016) Chapter 8, pp 208-210, Sequence of General Anaesthesia.
Note Table 8-4, (p 209), which provides a summary of the sequence for GA, including emergence which will be discussed later in Component 3. Also note in Figure 8-12 (p 210) the position of the patient's head during laryngoscopy.

Non-invasive haemodynamic monitoring

Non-invasive haemodynamic monitoring is required for all patients and is a vital tool for continuously assessing the patient's condition and detecting changes. Monitoring is applied by the anaesthetic team prior to induction.

PATIENT MONITORING

Throughout Mr Rubin's procedure he will be closely monitored by the anaesthetic team. Standard non-invasive haemodynamic monitoring for anaesthesia and surgery includes:

- ECG: 3 lead (5 lead may be used in cardiothoracic cases or where the patient has a known cardiac condition)
- non-invasive blood pressure (NiBP): ensure correct sized cuff is selected for the patient. Cuff may be applied on calf or thigh if the use of the patient's arms is contraindicated. NiBP is usually measured and recorded every 5 minutes
- pulse oximetry: probe placed on patient's finger or ear lobe. Nail polish and artificial nails will obstruct the reading and an alternate site should be sought (or polish removed)
- capnography (end tidal $C0_2$): capnography tubing is attached to the heat and moisture exchange (HME) filter on the anaesthetic breathing circuit. As the tubing is attached post-filter, the tubing may be used for the whole operative list unless contaminated
- temperature: a single-use temperature probe is lubricated and inserted orally or nasally post intubation, and anchored to the ETT or patient's face with paper tape
- bispectral index monitoring (BIS monitoring): used to detect awareness/depth of anaesthesia (use of BIS is dependent on the patient, the surgery, and the anaesthetist).

(ANZCA, 2015)

Awareness under anaesthesia

Awareness under anaesthesia occurs in patients who are anaesthetised and paralysed with muscle relaxants, but have insufficient anaesthetic to maintain an unconscious state. This results in the patient having a level of awareness of their procedure. As the patient is paralysed, they are unable to communicate with the anaesthetic team. This situation can be very distressing to the patient and may lead to long term psychological harm (Hamlin et al, 2016).

Awareness under anaesthesia is rare, occurring in 1:19,000 cases of general anaesthesia (AAGBI, 2014). Close monitoring of the patient's depth of anaesthesia using bispectral index (BIS monitoring) detects 'lightness' of anaesthesia which can equate to awareness. The monitoring equipment consists of a sensor strip attached to the patient's forehead which monitors the patient's brain waves (see Figure 3-25). The BIS sensor relays the information to the monitor on the anaesthetic machine and provides a waveform and number reflecting the depth of anaesthesia. A reading of 40 to 60 is recommended for general anaesthesia (an awake patient's reading is 100) (Pandit & Cook, 2014).

Figure 3-25. Application of BIS monitoring

Source: Amazon.com

The following readings provide further information on awareness under anaesthesia.

READ

Hamlin et al. (2016) Chapter 8, Feature Box 8-1 (p 202): Awareness under anaesthesia

Association of Anaesthetists of Great Britain & Ireland (AAGBI) (2015) Joint RCoA and AAGBI Statement on accidental awareness under general anaesthesia, and neuromuscular monitoring
https://www.aagbi.org/news/joint-rcoa-and-aagbi-statement-accidental-awareness-under-general-anaesthesia-and-neuromuscular

Medical Directions (2013) Anaesthesia awareness awake during surgery! True stories
www.medical-directions.com/anesthesia-awareness-awake-during-surgery-true-stories/

Invasive haemodynamic monitoring

Invasive haemodynamic monitoring refers to modalities such as central venous pressure and intra-arterial pressure monitoring. Both require advanced skills and knowledge. In summary:

Central venous pressure (CVP) reflects the filling pressure in the right atrium or the vena cava. CVP gives information about intravascular blood volume, right ventricular end-diastolic pressure and right ventricular function (Morton et al, 2012). CVP provides IV access in patients who have poor peripheral access and can also be used to administer IV drugs. CVP catheters can be inserted into the jugular, subclavian, axillary and cephalic veins.

Arterial blood pressure monitoring (invasive blood pressure – iBP; known colloquially as arterial line) allows for continuous monitoring of systemic arterial blood pressure and provides vascular access for obtaining blood samples. Use of arterial lines is indicated in surgical patients undergoing major neuro, cardiac and thoracic surgery, or where there are significant co-morbidities. The arterial catheter is commonly inserted into the radial artery, however the brachial, femoral, and dorsalis pedis arteries may also be used. The radial artery is the preferred site due to accessibility and lower likelihood of infection (Koyfman, 2017).

Accountable items

Invasive monitoring devices are commonly inserted in the anaesthetic bay. Central venous access devices (and arterial lines in some cases) are sutured in place to avoid dislodgement. Anaesthetic nurses must be aware of the policies related to accountable items and how to manage the needle used in securing the device.

If any accountable item, e.g. a suture needle, is used within the anaesthetic bay, it must be discarded within the anaesthetic bay. The anaesthetist is responsible for ensuring that all accountable items are accounted for at the end of the anaesthetic procedure.

However, if the insertion of invasive monitoring occurs within the OR, the needle, as an accountable item, must be included in the count being carried out as part of the intraoperative management of accountable items. The accountable item must be sighted by both the instrument and circulating nurses and documented on the count sheet. Usually the needle is placed in a dry specimen container and retained in the OR for the purposes of the count.

Similarly, pharyngeal packs ('throat packs') must be managed as an accountable item and added to the count sheet. This ensures that it is removed and accounted for at the conclusion of the procedure.

The following readings provide information about haemodynamic monitoring and the management of accountable items used in anaesthetic procedures.

READ

Hamlin et al. (2016) Chapter 8, pp 218-221, Haemodynamic monitoring

ANZCA (2017) PS18 Guidelines on monitoring during anaesthesia
http://www.anzca.edu.au/documents/ps18-2015-guidelines-on-monitoring-during-anaesthe.pdf

NSW Health (2013) PD2013_054 Management of Instruments, Accountable Items and Other Items used for Surgery or Procedures
Read sections 6.1 and 6.2

ACTIVITY

3-5 Haemodynamic monitoring
Review the haemodynamic monitoring used in your OR and complete the table in the Activity section.

EMERGENCE FROM ANAESTHESIA

Mr Rubin's surgery has progressed uneventfully and whilst the surgeon is placing the final sutures in the skin incision and applying a dressing, the anaesthetist will commence emergence procedures.

During the emergence phase, you remain with Mr Rubin, monitoring for any changes in condition and assisting the anaesthetist as instructed. Ensure you are wearing appropriate PPE: aerosols may be generated during extubation potentially transferring microorganisms to those in close proximity.

Emergence activities

- Mr Rubin was administered a muscle relaxant as part of his GA, therefore he will receive **reversal agents** (neostigmine and atropine) to reverse the effects of the muscle relaxant. The anaesthetist will use a **nerve stimulator** ('train of four monitor') to assess the depth of neuromuscular blockade and ensure the correct dose of reversal is given. Neuromuscular blockade must be reversed prior to extubation, returning full function to Mr Rubin's respiratory muscles.
- The **anaesthetic agent is ceased** (volatile agent or propofol infusion).
- The **concentration of oxygen** being administered to Mr Rubin **is increased**.
- Mr Rubin will start to take spontaneous breaths: this is noted clinically with a change in chest movements and via the trace on the anaesthetic machine monitor.
- Mr Rubin's surgery has now finished and operating theatre assistants are called in to the OR to assist in transferring Mr Rubin to his bed. At a minimum, there should be four people to transfer Mr Rubin: the anaesthetist at his head, and one person at his feet and on either side of the bed/theatre table. A Patslide™ is used to facilitate the transfer. Mr Rubin has an IV line which must be protected during the transfer so it does not become caught in the table mechanism. The same applies for patients with drains and urinary catheters.
- The anaesthetist leads the transfer and always controls the patient's head, neck, and airway. During the transfer, Mr Rubin's skin integrity is assessed by the instrument or circulating nurse. Any 'prep' solution or blood is cleaned. You cover Mr Rubin with a warmed blanket and raise the bedrails to prevent a fall. The anaesthetist may request you elevate the head of Mr Rubin's bed to 30° to assist respiration.
- The anaesthetist now suctions Mr Rubin's oropharynx to remove secretions prior to extubation. Mr Rubin may cough or gag, signalling return of his airway reflexes. You reassure Mr Rubin that the operation is complete.
- In assessing Mr Rubin's readiness for extubation, the anaesthetist will be looking for spontaneous breathing, an increasing level of consciousness (response to verbal commands), and the return of muscle strength (squeeze hand or raise head off pillow). Once the anaesthetist is satisfied, the ETT cuff is deflated, the tape securing the ETT is released, and the ETT is removed by the anaesthetist (extubation).
- You administer oxygen via a Hudson mask and portable oxygen tank at 6-10L per minute, elevate the head of his bed to 30° (unless contraindicated) and assess Mr Rubin's respiratory rate and pattern: it is within normal range. You check his oxygen saturations prior to his departure from the OR for PACU: they are 99%. You provide reassurance to Mr Rubin and inform him his surgery is finished and he is moving to PACU.
- You ensure that all anaesthetic documentation, including the completed Clinical Procedure Safety checklist, accompanies the anaesthetist and Mr Rubin to PACU where a handover to PACU staff will be made by both the anaesthetist and the instrument nurse.

Complications of general anaesthesia

Anaesthetic complications are rare, however, when they do occur the anaesthetic nurse must be quick to react and assist the anaesthetist to manage the situation. Many complications relate to the airway and are the result of airway interventions and/or the effects of medication used during anaesthesia. By understanding the mechanisms and treatment of these complications, the anaesthetic nurse can anticipate what may be needed.

Intubation complications

Complications may occur during intubation, including:

- damage to lips, teeth and mandible from the laryngoscope or handling of patient's jaw. Care must be taken when performing airway interventions to avoid patient injury
- ETT is malpositioned (oesophageal or endobronchial intubation) which results in ineffective ventilation: repositioning is required

- secretions block the distal end of the ETT making ventilation difficult. The Murphy eye is a secondary opening that can allow ventilation if the primary opening is occluded (see Figure 3-26). Suctioning with a y-sucker may dislodge secretions, or re-intubation may be required
- unintentional extubation, particularly if the patient is repositioned. The security of the ETT must be checked prior to and following repositioning
- fire in the airway due to ignition of anaesthetic gases by diathermy or laser: use specific local protocols to reduce risks of fire
- ETT malfunction or cuff perforation: re-intubation is required (Hamlin et al., 2016).

These complications require rapid and effective management to ensure patient safety.

Figure 3-26. ETT showing the Murphy eye and blue radio-opaque line; sputum obstructing the ETT

Source: Royal College of Anaesthesists UK; e-safe-anaesthesia.org.

Laryngospasm

Laryngospasm occurs when there is an irritation of the vocal cords which leads to an involuntary spasm of the superior laryngeal nerve. This can result in complete or partial closure of the cords and subsequent airway obstruction. Laryngospasm can occur spontaneously and is most commonly associated with extubation and ENT procedures. Triggers include:

- secretions/vomit/blood in the airway
- suction equipment
- artificial oral or nasopharyngeal airways
- laryngoscope blade
- inhalational agents
- painful stimuli (Hamlin et al., 2016).

Laryngospasm may be characterised by a ‘crowing’ sound or stridor on inspiration, however a complete loss of airway will be silent. It may present as increased work of breathing (e.g. tracheal tug, ‘rocking’ chest movements), vomiting or desaturation. Laryngospasm may also be seen in the immediate postoperative period in PACU and is discussed in Component 5.

Prompt recognition is essential to re-establish ventilation and oxygenation as soon as possible. Treatment requires opening and clearing the oropharynx and applying continuous positive airway pressure with 100% oxygen. This may be followed by a deepening of anaesthesia with propofol, and/or paralysing with suxamethonium to facilitate endotracheal intubation and provision of ventilatory support.

Bronchospasm

Bronchospasm is the sudden constriction of bronchial smooth muscle resulting in spasm, and is a hyper-reactive airway response to mechanical or chemical irritants. Bronchospasm during anaesthesia is characterised by an expiratory wheeze (heard in the breathing circuit), prolonged expiration, and in intubated patients ventilation will become difficult. Perioperative causes of bronchospasm include:

- secretions
- airway equipment
- pulmonary aspiration
- anaesthetic drugs including volatile anaesthetic agents.

Patients with a history of smoking, asthma or respiratory infection are more susceptible to bronchospasm (Hamlin et al, 2016).

Treatment involves removal of the identified cause (anaphylaxis should be considered as a cause), deepening anaesthesia, and administration of inhaled or IV bronchodilators (e.g. salbutamol) (Hamlin et al., 2016).

Aspiration

Aspiration is defined as the inhalation of oropharyngeal or gastric contents into the respiratory tract (Hamlin et al., 2016). When anaesthetised, a patient's airway reflexes are depressed/absent and the passive regurgitation of gastric contents into the airway can occur in at-risk patients (see Figure 3-27). Aspiration causes significant morbidity (known as Mendelson's syndrome) and mortality: signs and symptoms increase with the acidity and volume aspirated, and include:

- dyspnoea
- tachypnoea
- bronchospasm
- hypoxia
- hypotension
- tachycardia
- atelectasis
- related lung injury such as chemical pneumonitis or aspiration pneumonia.

Prevention of aspiration is crucial, with at-risk patients identified preoperatively and an anaesthetic plan developed. This may include pre-medication, rapid sequence induction (RSI), and the use of a nasogastric tube to decompress the stomach.

If aspiration occurs, immediate action is needed to restore effective respiratory function, which if severe may require ventilatory support in ICU for prolonged periods (Hamlin et al., 2016).

Figure 3-27. Patient risk factors for aspiration

- bowel obstruction
- pregnancy including active labour
- obesity
- age>65 years
- head down operative position
- trauma/emergency surgery
- inadequate fasting time
- higher ASA status
- history of gastro-oesophageal reflux disease (GORD)
- hiatus hernia

READ

Hamlin et al. (2016) Chapter 8, p 207, Rapid Sequence Induction; pp 212–213, Laryngospasm, bronchospasm and aspiration.

Note Figure 8-17: flowchart for managing laryngospasm

‘Cannot intubate, cannot oxygenate’ (CICO)

CICO is a rare event occurring in 1:10,000 to 1:50,000 of routine general anaesthetics (ANZCA, 2016). When it does occur, it is life threatening and requires immediate intervention.

CICO is a situation where the anaesthetist is unable to intubate or oxygenate/ventilate the anaesthetised and paralysed patient. This is due to airway obstruction existing in the upper airway that cannot be overcome using routine airway management equipment e.g. ETT or laryngeal mask airway (see LMA discussion later in Component 3). The anaesthetic team must act quickly to secure a patent airway and restore respiratory function, and additional skilled help will be called for. A number of approaches will be deployed including reversal of muscle relaxant using Sugammadex (fast acting reversal agent), insertion of nasal and oral airways, 2 handed bag valve mask ventilation, and emergency oxygen flush.

The difficult intubation trolley with emergency airway equipment must be accessed immediately. It contains a variety of airways and adjuncts including a cricothyroidotomy set (needle to puncture the trachea to facilitate insertion of a fine tracheostomy tube). Depending on how the situation progresses, it may be necessary for a surgical team to perform an emergency tracheostomy to provide an airway.

The following readings and videos provide details of the emergency management of airway complications.

READ

Hamlin et al. (2016) Chapter 8, p 211, Feature Box 8-2, CICO: an anaesthetic emergency

ANZCA (2016) PS61 Guidelines to the management of evolving airway obstruction: transition to the Can’t Intubate Can’t Oxygenate airway emergency.
Note the flow chart in the Appendix. Also note the importance of human factors in Section 5.2.

Simpact (2014) *The Elaine Bromiley case – an Australian reconstruction* and *What if? Teamwork in emergency airway management*
http://simpact.net.au/bromiley.html
In Component 2, ‘Just a routine operation’ was recommended for viewing. It involved a CICO incident with a tragic outcome. An Australian version explores how this incident may have been managed more effectively. You will note the Australian team uses the ‘Vortex’ algorithm with CICO protocols, promoting teamwork and coordinated strategies when managing the emergency.

Rapid sequence induction (RSI)

Rapid sequence induction (also known as crash induction) is a specifically adapted induction process used to minimise the risk of regurgitation and aspiration during intubation (Donohue et al., 2013) (see Figure 3-27 for patients at risk). The equipment for an RSI is similar to a routine induction and intubation, however the process differs and is faster. The anaesthetist will request cricoid pressure to be applied by the anaesthetic nurse as the hypnotic agent is administered and the patient loses consciousness. Cricoid pressure (Sellick’s manoeuvre) is performed by placing two fingers on the cricoid cartilage and applying downward pressure. The concept is that the pressure occludes the upper end of the oesophagus against the cervical vertebrae, preventing aspiration of stomach contents (see Figure 3-28). The airway is maintained as the cricoid cartilage is an incompressible ring, and is the only complete ring of cartilage around the trachea.

NB: Some controversy exists regarding the effectiveness of cricoid pressure: aspiration may still occur despite correct application.

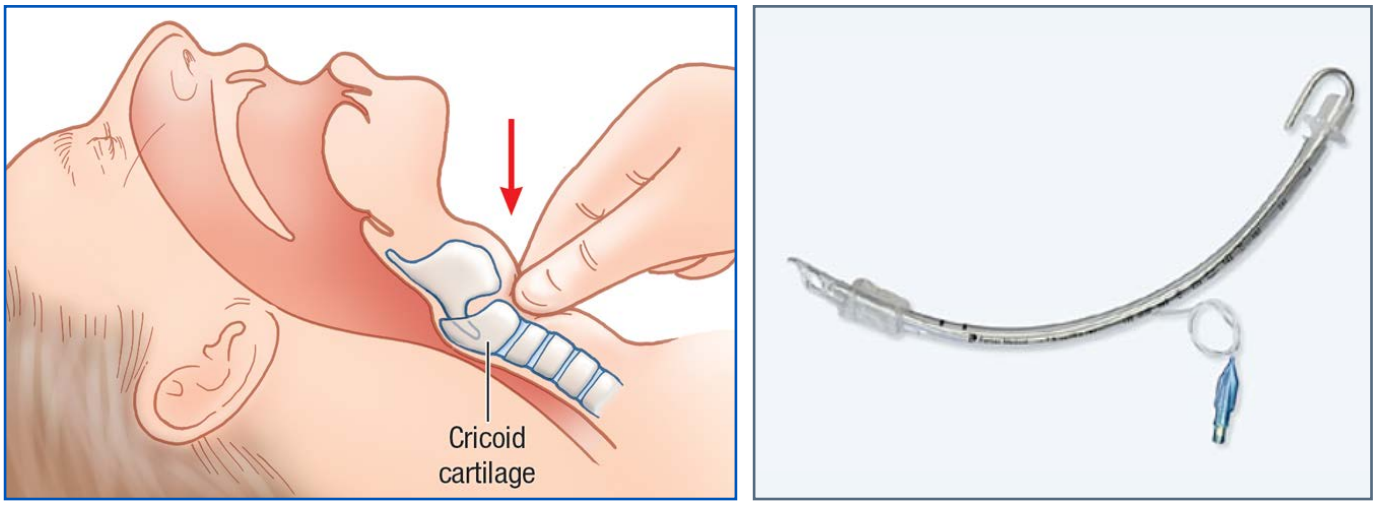
To find the cricoid cartilage, start at the sternal notch and palpate upwards: the first hard structure felt should be the cricoid cartilage. If there is any uncertainty, confirm the location with the anaesthetist. The anaesthetic nurse gently locates the cricoid cartilage during pre-oxygenation in readiness, but pressure is not applied until instructed by the anaesthetist. Once applied, cricoid pressure must be maintained until the anaesthetist instructs release: this occurs when the anaesthetist is satisfied the ETT is correctly positioned and the airway is secure (Hamlin et al, 2016).

You may be asked to adjust the amount or direction of cricoid pressure during intubation, as cricoid pressure may impair the anaesthetist’s view on laryngoscopy.

All intubation equipment needs to be on hand prior to pre-oxygenation, as you will have one hand committed to applying cricoid pressure. This includes having emergency airway equipment within reach. Many anaesthetists

prefer to have a lubricated stylet (introducer) inserted within the ETT for RSI to assist passage of the ETT through the vocal cords (see Figure 2-28). The anaesthetist may ask you to remove the stylet once the patient has been intubated. The stylet is simply withdrawn whilst the anaesthetist stabilises the ETT.

Figure 3-28. Cricoid pressure and cricoid cartilage location; ETT with stylet in situ



Sources: E. Reichman, Emergency Medicine Procedures. Reproduced with permission of McGraw Hill Education; Mercury Medical.

GENERAL ANAESTHETIC WITH LMA

Following Mr Rubin's transfer to PACU you commence cleaning and resetting the equipment ready for your next patient, Ms Gemma Armitage, 46. Gemma is scheduled for the excision of a lump from her left breast.

In earlier discussion with the anaesthetist, it was decided that Ms Armitage's airway is to be managed using a laryngeal mask airway (LMA). Ms Armitage's surgery does not require muscle relaxation and she will spontaneously breathe the anaesthetic gases throughout the procedure.

You have set up the equipment required for IV access and airway management. Although Ms Armitage's airway will be secured with an LMA, endotracheal intubation equipment and emergency intubation drugs must be available to hand in the event of an emergency or failed insertion of LMA. Commonly emergency airway equipment is located in a drawer on the anaesthetic machine, and must be checked at the start of each operative list.

Laryngeal Mask Airway (LMA)

An LMA is a supraglottic airway: it sits above the trachea and is not inserted through the vocal cords. LMAs are available in a variety of sizes from adult to paediatric.

An LMA consists of a silicone or PVC tube with an elliptical cuffed mask at the distal end, and provides a relatively airtight seal around the larynx. The cuff is lubricated to facilitate insertion and the LMA is inserted by hand without the use of a laryngoscope. Once inserted, the cuff is inflated, the LMA is secured in place with tape, and it is attached to the breathing circuit through which the patient breathes spontaneously.

As LMAs are not inserted through the vocal cords into the trachea, they do not provide the same protection against aspiration that is a feature of a cuffed ETT. LMAs are therefore indicated for elective anaesthesia in fasted patients with low risk of regurgitation, and are contraindicated in patients who may be at risk of aspiration (see *Aspiration* earlier in Component 3). The use of LMAs is also contraindicated in patients whose surgery requires muscle relaxation, who have suspected or known supraglottic abnormalities, for some oral and ENT surgery, and surgery where the patient is in the prone position.

The size of LMA required is based on the patient's weight e.g. size 3 is used for patients weighing 30 to 50kg. Sizing charts are commonly displayed in the OS to assist in preparing the appropriate size.

The standard LMA is most commonly used, however, there are varieties that facilitate intubation in an emergency or in patients with difficult airways. An LMA with gastric access allows gastric aspiration and may be used in patients who traditionally would have been intubated for general anaesthesia (see Figure 3-29).

Figure 3-29. Standard LMA; LMA with second lumen for gastric access; LMA with blind intubating capability

Source: LMA Co http://www.lmaco.com/home

READ

Hamlin et al. (2016) Chapter 8, pp 203-205, Laryngeal Mask Airway.
Note Figure 8-8 (p≈205) showing the insertion and placement of LMA

VIEW

University of the Sunshine Coast (2012) LMA insertion and removal
https://www.youtube.com/watch?v=Py57T8o-4A8
View the insertion and removal of LMA into a mannequin

PRE-OPERATIVE CHECKS AND CARE

Prior to Ms Armitage's arrival in the OS, you carry out a final check of all equipment required and have readied the appropriate airway equipment for the anaesthetist. You have tested the LMA cuff for patency and lubricant has been applied to the back of the LMA cuffed area to facilitate smooth insertion.

Ms Armitage has arrived in the reception/holding area and all routine checks noted for Mr Rubin are being conducted for Ms Armitage by the admissions RN. The phone rings in the anaesthetic bay: it is the admissions RN stating that Ms Armitage's consent form has not been signed and the surgical site is not marked. The RN asks your advice on managing the situation.

You walk to the holding bay and find a distressed Ms Armitage. She is crying and anxious about the breast lump being cancer. She does not want her surgery cancelled due to an incomplete consent form.

ACTIVITY

3-6 Consent for surgery
How will you manage Ms Armitage's distress? What are the implications for Ms Armitage and her surgery if her consent form is not signed? How will you manage the situation? Record your answers in the Activity section.

Ms Armitage's consent issue has been resolved and she is transferred into the anaesthetic bay.

ACTIVITY

3-7 Induction of anaesthesia and insertion of LMA
Review the induction sequence and video on insertion of LMA (University of the Sunshine Coast: details above). Complete the table in the Activity section on induction and insertion of LMA.

REMOVAL OF LMA

Ms Armitage's surgery and anaesthesia progress uneventfully and the breast lump has been removed. She has been breathing anaesthetic gases spontaneously via the LMA and as the procedure nears completion the anaesthetist reduces the amount of volatile agent, allowing Ms Armitage to emerge from the anaesthesia. When Ms Armitage is responding to verbal commands and the anaesthetist is satisfied that she is able to maintain her airway, the LMA is removed. Your role as anaesthetic nurse is to assist the anaesthetist with oral suction, release the tape securing the LMA, and apply oxygen. You reassure Ms Armitage the operation is complete and cover her with a gown and blankets prior to transfer to PACU

CONSIDERATIONS FOR REGIONAL ANAESTHESIA

Your next patient is Mrs Jill Simpkin, 86, who is undergoing a repair of carpal tunnel syndrome in her right wrist. Mrs Simpkin has suffered from emphysema for the past five years and has been assessed by the anaesthetist as ASA 3: a patient with severe systemic disease. The anaesthetist has recommended that Mrs Simpkin's procedure is carried out using an axillary block, due to her respiratory risk profile. The block will numb Mrs Simpkin's arm and allow the procedure to be carried out pain free. As Mrs Simpkin attended the pre-admission clinic for assessment, the axillary block procedure has already been explained to her and she has agreed. Her only concern is being awake during the procedure. The anaesthetist has reassured her that she will receive a sedative drug that will relax her, and make her drowsy and unaware of the procedure.

You greet Mrs Simpkin in the holding bay and carry out the necessary checks. She has been accompanied to the hospital by her daughter Rose. Rose tells you she is keen to stay with Mrs Simpkin for as long as possible and asks if she can come into the theatre with her mother.

Each facility has a local policy articulating specific visitor arrangements (see Figure 3-30 for general principles).

Figure 3-30. Visitor management principles for the OS

VISITOR MANAGEMENT PRINCIPLES: CARERS AND FAMILIES IN THE OS

- Visitors are permitted on a needs basis and are usually limited to one person per patient.
- Visitors must comply with local policy, e.g. sign visitors book and don visitor sticker.
- Staff supervise visitors at all times and provide reassurance as necessary: visitors are escorted in and out of the OS.
- Appropriate attire must be donned if visiting a restricted area (including over gown, shoe covers, head wear).
- The treating anaesthetist/surgeon and nursing staff must be made aware of the intended presence of the visitor in the OR.
- Staff advise the visitor they must leave when requested.

The following readings discuss the management of a range of visitors to the OS.

READ

Hamlin et al. (2016) Chapter 8, p 227, Table 8-7, Patient Care and the ageing process.

Oster, K. & Oster, C. (2015) Special Needs Population: Care of the Geriatric Patient Population in the Perioperative Setting. *AORN Journal*. http://onlinelibrary.wiley.com/doi/10.1016/j.aorn.2014.10.022/full

ACTIVITY

3-8 Visitors to the OS
How will you respond to Mrs Simpkin's daughter's request? What are two advantages and disadvantages of allowing relatives to accompany patients in the OS? Record your answers in the Activity section.

CONSIDERATIONS FOR ELDERLY PATIENTS

As you are preparing Mrs Simpkin for her procedure, you complete your nursing assessment. She is of advanced age, is thin (weighs 50kg), and has a number of related intraoperative risk factors. The following readings describe the main risk factors affecting elderly patients and management strategies.

READ

Hamlin et al. (2016) Chapter 4, pp 83-84 on the Coroner's Court.

ACTIVITY

3-9 Perioperative care of elderly patients
Identify four perioperative risk factors for Mrs Simpkin and complete the table in the Activity section with nursing actions for each.

Regional anaesthesia

Regional anaesthesia (also known as a block, conduction block, nerve block) involves the injection of local anaesthetic (LA) around major nerve bundles. Blocks range from simple blocks (e.g. infiltration anaesthesia, ring blocks) to more complex blocks (e.g. intercostal and interscalene blocks), and major regional blocks (epidural and spinal anaesthesia, also called central neuraxial analgesia/anaesthesia). LA medications used in blocks will vary depending on the objective and the anaesthetist. Examples include lignocaine, bupivacaine and ropivacaine (Hamlin et al, 2016).

Nerve stimulators and/or ultrasound may be used to determine the location of the nerves for improved accuracy of anaesthetic delivery (see Figure 3-31). Once the LA has been infiltrated, patients will experience paraesthesia in the area supplied by the nerves. Due to the patient's reduced motor and sensory function, additional care is necessary to protect the affected part of the body.

PREPARING FOR REGIONAL ANAESTHESIA

Preparing for Mrs Simpkin's regional anaesthesia requires setting up the following equipment:

- **sterile dressing pack** or **regional anaesthetic kit** (depending on local policy)
- **syringes** and **nerve block catheter**
- **local anaesthetic drugs** e.g. lignocaine
- **ultrasound machine** and **nerve stimulator** to assist anaesthetist identify nerves to be blocked
- equipment for anaesthetic induction and intubation (should the regional anaesthetic need to be converted into a GA)
- routine monitoring equipment.

Many OS centralise the regional anaesthesia equipment and a range of local anaesthetics on a 'block trolley' that is mobilised when needed.

Figure 3-31. Use of ultrasound to place a transverse abdominus plane (TAP) block

Source: PhillopN/Wikimedia Commons

The duration of the effects of regional anaesthesia depends on several factors: the agent used, the region into which it is injected, and whether it is maintained (single shot, continual infusion, or top-up injections). Typically, paraesthesia lasts for several hours but altered sensation may last up to several days. As the LA wears off post-operatively, varying degrees of surgical pain will be experienced and alternate methods of analgesia may be required.
The unique advantages of regional anaesthesia include superior analgesia, reduction of the stress response, increased alertness, patient cooperation, and the avoidance of systemic side-effects (Fleming & Egeler, 2014). Figure 3-32 summarises the benefits and risks of regional anaesthesia.

Regional anaesthesia may be used alone or combined with sedation or general anaesthesia.

ASSISTING IN REGIONAL ANAESTHESIA

The insertion of the axillary block requires setting up an aseptic field. The anaesthetist will carry out surgical hand antisepsis and don a surgical mask, sterile gown and gloves. As anaesthetic nurse, your role is to open sterile pack and additional items as required using aseptic technique. All medications opened must be double checked with the anaesthetist prior to use, and documented. Sterile medication labels must be available for the anaesthetist to place on syringes containing the local anaesthetic and any other medications opened on the aseptic field.

You provide Mrs Simpkin with explanations about the procedure and assist in positioning her ready for the insertion of the axillary block. Prior to commencing insertion of the block, an anaesthetic 'Time Out' is carried out between the anaesthetist, the anaesthetic nurse and Mrs Simpkin, to confirm the correct side for the placement of the axillary block. The 'Time Out' should be documented as per local policy.

Using an ultrasound probe, the anaesthetist locates the axillary nerves and injects the LA. The effectiveness of the block is tested and care is taken to position Mrs Simpkin's arm to avoid injury.

Mrs Simpkin is carefully transferred and positioned on the operating table with the team avoiding shearing forces which may lead to skin tears. All potential pressure points are padded. Non-invasive haemodynamic monitoring is applied. You assist the circulating nurse to apply extra padding around Mrs Simpkin's upper right arm prior to the applying the tourniquet which is used to provide a bloodless field for the procedure. The circulating nurse documents these actions.

You place a forced air warming device on Mrs Simpkin to maintain normothermia. This is applied before the patient is 'prepped' and draped, and will remain in place for the duration of the operative procedure. Elderly patients are at risk of inadvertent hypothermia due to the loss of adipose tissue, which can also increase the risk of pressure injury (Oster & Oster, 2015).

Figure 3-32. Risks and benefits of regional anaesthesia

REGIONAL ANAESTHESIA	
Benefits	**Risks**
• Avoids GA complications (trauma to lips, teeth, oropharynx, vocal cords; bronchospasm; aspiration; prolonged sedation) • Superior analgesia • Less need for systemic opioids • Earlier recovery of bowel function • Less postoperative nausea and vomiting (less opioid) • Less sedation post operatively (decreased confusion in elderly) • Analgesia continues into postoperative period • Potential earlier discharge • Relatively safe in remote locations and less equipment required	• Time delay in block reaching optimal effect • Patient factors: anxiety may be managed with anxiolytics • Surgeon factors: preference for anaesthetised patients • Anaesthetist factors: skilled, knowledgeable anaesthetist and equipment required • Nerve damage: minimal risk of permanent nerve damage (1:10,000) • Failure rate: up to 10% which may require conversion to GA • Surgery outlasting the block

Adapted from ANZCA 2014 and ASRA 2017

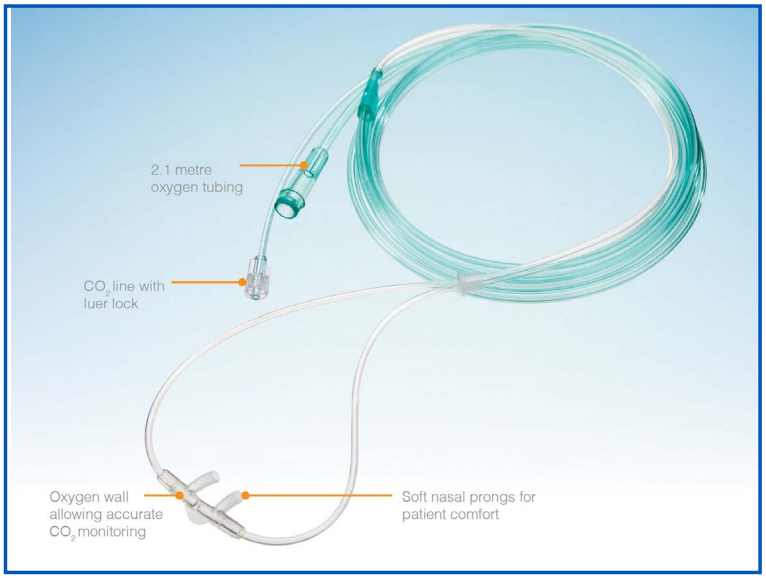
INTRAOPERATIVE CARE OF PATIENTS WITH A REGIONAL BLOCK

Mrs Simpkin's surgery is about to commence. Team 'Time Out' is performed and documented. As Mrs Simpkin expressed concern about being awake during the procedure, the anaesthetist is administering midazolam as an anxiolytic and sedative, monitoring that she is able to maintain her airway and respond to verbal commands. Supplemental oxygen is applied via nasal prongs with a CO_2 sampling line (see Figure 3-33). These prongs are chosen as they enable monitoring of Mrs Simpkin's respiration rate, ET CO_2, and airway patency from the CO_2 waveform viewed on the anaesthetic machine monitor.

The tourniquet* is inflated to the appropriate pressure and the time noted by the team and documented by the circulating nurse. Mrs Simpkin is sedated and receiving oxygen via a face mask. The surgery begins and the anaesthetic team is monitoring her condition.

* Information on tourniquet is found in Component 4: Instrument & Circulating Nursing.

Figure 3-33. Nasal cannulae with CO_2 sample line



Source: © Fairmont Medical

Sedation

Sedation is the medication-induced tolerance of an uncomfortable or painful procedure (however painful stimuli may still elicit a response). The aims of sedation are to enhance patient comfort whilst facilitating completion of the planned procedure. Procedural sedation includes conscious sedation, deeper sedation, and analgesia: the objective is to use the lowest dose that achieves the desired tolerance (ANZCA 2017).

Sedation is commonly achieved via boluses of midazolam or propofol, or a continuous target-controlled infusion (TCI) of propofol.

Continual monitoring of the patient's airway patency, pulse oximetry, blood pressure, and ECG (depending on procedure), and the level of sedation is necessary throughout the procedure. Supplemental oxygen is required via mask or nasal cannulae with CO_2 sampling attached (see Figure 3-33).

Conscious sedation is medication-induced sedation and anxiolysis whilst retaining consciousness throughout. Patients are able to respond purposefully to verbal commands or light tactile stimulation. Interventions to maintain a patent airway, spontaneous ventilation, or cardiovascular function may be required in exceptional situations. Conscious sedation is achieved with the use of medications such as propofol and midazolam, and may be used in conjunction with LA. Conscious sedation techniques operate with a margin of safety that renders loss of consciousness unlikely. Examples of when conscious sedation is used: colonoscopy, gastroscopy, peripheral surgery under block.

Deeper sedation is a medically-induced depression of consciousness that can readily progress to a loss of consciousness where patients respond only to painful stimulation. It is associated with loss of the ability to maintain a patent airway, inadequate spontaneous ventilation, and/or impaired cardiovascular function.

The following readings provide detailed information about the types of sedation and the key patient safety considerations (see also Figure 3-34).

READ

Hamlin et al. (2016) Chapter 8, p 214, Sedation/analgesia

ANZCA (2014) PS09 Guidelines on Sedation and/or Analgesia for Diagnostic and Interventional Medical, Dental or Surgical Procedures

ACI (2015) Minimum standards for safe procedural sedation. https://www.aci.health.nsw.gov.au/resources/anaesthesia-perioperative-care/sedation/safe-sedation-resources
Note Standard 2 which requires a dedicated clinician to be present. The risk in procedural sedation cannot be underestimated and the patient must be closely monitored at all times.

Figure 3-34. Essential standards of care for safe sedation practices

ESSENTIAL STANDARDS OF CARE FOR SAFE SEDATION PRACTICES

Standard 1
Pre-procedure: assessment and risk stratification of all patients receiving procedural sedation.

Standard 2
Intra-procedure: the presence of a dedicated clinician, with appropriate skills and training in monitoring and managing the patient's airway and circulation, including bag mask ventilation skills .

Standard 3
Post-procedure: appropriate monitoring and application of discharge criteria.

Source: Agency for Clinical Innovation 2015

SKIN INTEGRITY ASSESSMENT

Mrs Simpkin's procedure has been successfully completed. You and the anaesthetist rouse Mrs Simpkin and inform her that the procedure is over. Her vital signs have remained stable throughout and you remove the monitoring equipment and prepare her for transfer to PACU. You and the circulating nurse carefully check the skin under the tourniquet. As she is transferred onto her bed, you check the skin integrity of her sacral area and other potential pressure points. There is some redness on her upper arm which will be documented and noted in the handover to PACU. All other pressure points are intact with no redness.

Bariatric patients

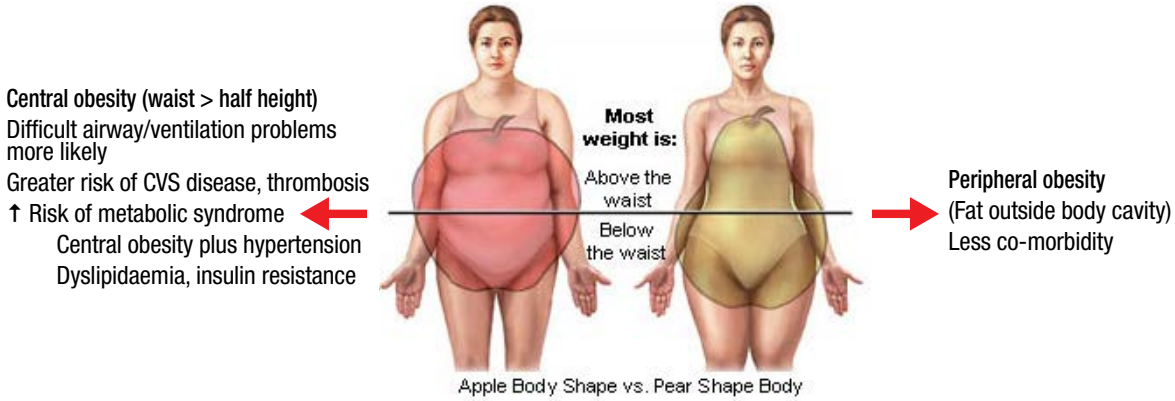
Patients generally weighing greater than 120kg and having a BMI >35 are referred to as bariatric. Bariatric patients require additional measures for general clinical management, and surgery and anaesthesia for bariatric patients requires careful planning. Airway, respiratory, cardiovascular, and other comorbidities need to be individually assessed and managed (Hamlin et al., 2016).

Figure 3-35 provides a summary of the anaesthetic considerations for bariatric patients.

Figure 3-35. Anaesthetic considerations for bariatric patients

BARIATRIC CONSIDERATIONS

- Cardiac function – increased blood volume, hypertension, increased O_2 consumption
- Airway function – increased difficulty to ventilate, increased adipose tissue, decreased neck flexion
- Respiratory function – obstructive sleep apnoea, decreased chest wall compliance
- Other – diabetes, metabolic syndrome, reduced mobility, increased risk of aspiration, thromboembolism
- Central obesity vs. peripheral obesity



- Additional time in PACU may be required.

Source: Specialists in Obesity and Bariatric Anaesthesia UK
www.sobauk.co.uk

CONSIDERATIONS FOR BARIATRIC ANAESTHESIA

The next patient on the elective list is Mr Kumar, 56 years old, who is scheduled for removal of a melanoma from the anterior aspect of his left thigh under a general anaesthetic. He weighs 180kg (body mass index = 36) which places him in an obese category. Due to his weight, Mr Kumar is at risk of a number of conditions which will need to be considered when planning surgery (see Figure 3-35).

As an elective patient, Mr Kumar has attended the preadmission clinic for anaesthetic and surgical risk assessment and care planning. A full physical assessment was carried out and co-morbidities likely to affect his perioperative care were noted by the anaesthetist.

From a surgical perspective, one of the main issues will be to ensure Mr Kumar is positioned safely on an operating table which is suitable for Mr Kumar's weight. Additional positioning aids e.g. side extensions to widen the table, pressure relieving devices and manual handling aids, such as a HoverMatt™ are available to ensure safe care of Mr Kumar.

It was noted in preadmission clinic that Mr Kumar has a short neck and coupled with his age (>55 years) and his BMI (>26), these factors indicate that he may have a difficult airway. The anaesthetist discusses the anaesthetic plan with you: you mobilise the difficult intubation trolley to your OR and prepared a range of additional intubation equipment to assist the anaesthetist to secure Mr Kumar's airway. The contents of difficult intubation trolleys will vary in each OS. Some OS have trolleys that are colour coded to make locating equipment quickly.

Predicting a difficult airway

Mr Kumar is noted to have a short thick neck which is a predictor that intubation may be difficult. Predicting a difficult airway is an inexact science (especially in emergency cases) however some anatomical features, injuries, and diseases that are often implicated in difficult intubations include:

- prominent chests/breasts including pregnancy
- incomplete mouth opening
- large and prominent incisor teeth
- short thyromental distance
- protruding jaw or overbite
- large tongue
- injury to cervical spine
- spondylitis, rheumatoid arthritis
- craniofacial syndromes e.g. Pierre-Robin (malformation of jaw and palate)
- known sleep apnoea
- oral or laryngeal pathology
- airway obstruction or compromise: stridor, hoarse voice, dysphagia, suspected airway burn, airway trauma
- recent intubation.

The anaesthetist assesses each patient's airway for features which may indicate possible difficulty with mask ventilation, positioning and mobility, or intubation. The sniffing position significantly improves the anaesthetist's view during direct laryngoscopy, particularly in obese patients (Crawley & Dalton, 2014).

The management plan for a suspected difficult airway will depend on the issue, the planned surgery, co-morbidities, and available support. Tools and methods available to assist the anaesthetist with a difficult airway include:

- seek assistance and review the notes regarding previous GAs
- positioning: optimal positioning includes neck flexed and head extended (sniffing position: pillows under the head may help), ensure the bed is at the correct height
- bag valve mask ventilation: dentures in, removal of facial hair, use of LMA if BVM ventilation is not effective
- drugs: use of non-depolarising muscle relaxant, use of nebulised or aerosolised local anaesthetic to enable awake nasal intubation
- laryngoscopy: short handle, straight blade (Miller), flex-tip blade (McCoy), video laryngoscope, awake fibreoptic oral or nasal tracheal intubation

- airway devices: bougie, stylet, intubating LMA
- external laryngeal manipulation: BURP (backward upward rightward pressure applied by the assistant to the thyroid cartilage may improve the glottic view)
- last resort: surgical airway (cricothryroidotomy, tracheostomy).

Each intubation attempt will not be longer than 30 seconds and no more than four attempts at intubation should be made before alternative plans are actioned. The anaesthetist requires skilled and knowledgeable assistance to manage a difficult airway: seek your facilitator's support if your patient requires a difficult intubation.

READ

ANZCA (2012) Guidelines on equipment to manage a difficult airway during anaesthesia. http://www.anzca.edu.au/documents/ps56-2012-guidelines-on-equipment-to-manage-a-diff.pdf

Difficult Airway Society UK (2013) Difficult Airway Trolley (DAT) https://www.das.uk.com/files/Difficult_airway_trolley_DAS.pdf
Difficult intubation guidelines. https://www.das.uk.com/guidelines/das_intubation_guidelines

OPTIMISING CONDITIONS FOR INTUBATION

IV access has been secured and you have applied an appropriately sized BP cuff on Mr Kumar's arm to ensure readings are accurate. Mr Kumar is transferred to the OR table using a HoverMatt™ inflatable device.

Side extensions have been placed on the operating table to ensure Mr Kumar's body is completely supported. An intermittent pneumatic compression device has been applied to his right (non-operative) leg to reduce risk of VTE and he will receive anticoagulant therapy post operatively.

The anaesthetist has requested additional pillows to lift Mr Kumar's head and shoulders higher than his chest into a 'ramp' position to assist with intubation (see Figure 3-36). Once Mr Kumar is in the correct position and all airway equipment is checked and ready, the anaesthetist commences induction. You have mobilised the difficult intubation trolley into the OR in case it is required. You position yourself ready to provide intubation equipment to the anaesthetist. The anaesthetist uses the video laryngoscope to assist in visualising Mr Kumar's vocal cords and insertion of ETT. Mr Kumar is intubated uneventfully and the procedure commences.

Figure 3-36. Example of positioning pre- and post-ramping. Note the difference in the angle from the ear to sternal notch

Source: Patient Positioning Systems

The following readings provide information about managing bariatric patients.

READ

Hamlin et al. (2016):
*Chapter 7, pp 176, Obesity.
Chapter 8, pp 211-212, Airway Emergencies.
Note Figures 8-15 and 8-16 showing video laryngoscopes.
Chapter 8, pp 228, Figure 8-8, Conditions associated with the pathophysiology of obesity.
Note Figure 8-26 (p 228) showing the 'ramp' position achieved using a HoverMatt adjustable positioning device, an alternative to pillows.
*Chapter 9, pp 234, Feature Box 9-1, Transferring and positioning the bariatric patient.

***Monash University Department of Surgery** Surgery in the obese patient: a modern plague
https://www.surgeons.org/media/23935890/2016-02-23_pre_w_brown_obese.pdf

ACTIVITY

3-10 Difficult intubation equipment
Locate the difficult intubation trolley and review the contents with your facilitator.
Locate the additional equipment that may be required when caring for a bariatric patient.
Complete the table in the Activity section.

* Indicates readings that are also included in Component 4.

END OF PROCEDURE

Mr Kumar's surgery is concluding and the anaesthetist commences the reversal procedure. Mr Kumar has been extubated and is breathing oxygen through a face mask. Using the HoverMatt™, he is transferred onto his bed and an assessment is made of his skin integrity. His skin is intact. The head of the bed is raised 30° to assist respiration and he is transferred to PACU.

ACTIVITY

3-11 Emergence from anaesthesia
Reviewing the relevant information in this Component, complete the table in the Activity section on reversal and extubation.

3-12 Handover to PACU
Using ISBAR or ISOBAR, complete Mr Kumar's handover to PACU using the table in the Activity section. You may wish to review the information on ISBAR/ISOBAR which was included in Component 2, Quality and Safety.

EMERGENCY SURGERY AND ADDITIONAL PATIENTS

Any surgical procedure performed in an OR that has not been booked on the elective surgery waiting list is considered emergency surgery (NSW Health, 2009). The volume of emergency surgery cases is generally predictable across facilities and the greater system, however considerable daily variation can occur (NSW Health, 2009). Depending on how the emergency cases are managed in your facility, you may find additional patients added to the operating theatre you are assigned to. The order of the operative list may be changed to accommodate urgent cases, sometimes with minimal notice. This is usually communicated via the NUM or team leader (see also *Emergency/ trauma patients* later in Component 3).

Following the transfer of Mr Kumar to PACU, you return to the OR and are informed that Natasha Raikuna, 33, is being transferred from Labour Ward for an emergency Caesarean section. She requires a spinal anaesthetic.

Neuraxial anaesthesia

Spinal anaesthesia

Spinal anaesthesia is a central neural block achieved with a single injection of LA into the subarachnoid space, usually at lumbar level, producing sensory and motor blockade. LA spreads easily and rapidly in the spinal fluid (ANZCA, 2014). Intrathecal fentanyl and/or morphine are often used as adjuncts, improving the quality of the block and reducing the need for intraoperative opioids (ANZCA, 2014).

Spinal blocks are used as an alternative to general anaesthesia for surgery below the waist in some patients. Patients may remain fully conscious, be lightly sedated, or may have a general anaesthetic in combination with a spinal anaesthetic.

Spinal anaesthesia lasts approximately 2 to 4 hours, however if intrathecal opioids are given as part of the spinal anaesthetic, the duration of analgesia may be up to 24 hours.

Epidural anaesthesia

An epidural block is a central neural block consisting of an intermittent or continuous infusion of local anaesthetic with or without opioid analgesia into the epidural space via a catheter to produce sensory blockade. Motor function is preserved by using the lowest effective LA concentration (RCoA, 2010).

Epidurals are used to control acute pain during and after surgery to the chest, abdomen, pelvis, or lower limbs, and provide excellent pain relief with minimal side effects. Epidurals may be used in combination with a general or spinal anaesthetic for surgery, or alone for pain management: they are commonly used for analgesia in labouring women, and can be 'topped up' to provide anaesthesia for a Caesarean section if required (ANZCA, 2014).

Prior to initiating major regional anaesthesia, the anaesthetist will conduct a risk assessment to consider and reduce the likelihood of adverse outcomes (see Figure 3.37).

Figure 3-37. Actions required prior to commencing central neuraxial anaesthesia

BEFORE COMMENCING CENTRAL NEURAXIAL ANAESTHESIA

The anaesthetist will action the following prior to performing an epidural or spinal block:

- clinical assessment of the patient's coagulation status
- obtain informed consent from the patient
- ensure the patient has patent intravenous access
- ensure monitoring is applied (pulse oximetry, EGG, BP)
- attend a 'block time out'
- ensure aseptic technique.

Source: ANZCA, 2014

Technique for epidural and spinal anaesthesia

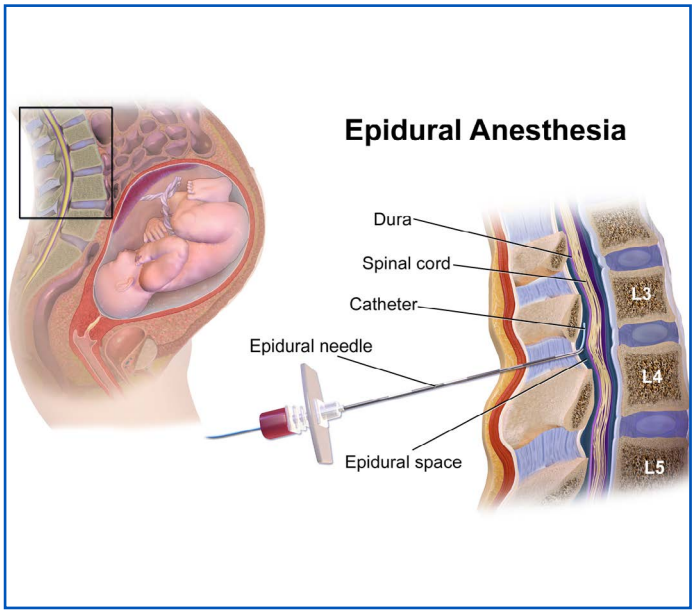
For all central and regional anaesthetics, the anaesthetic machine, monitoring, and emergency equipment needs to be checked and readied for immediate use. Conversion to GA may be required due to a variety of reasons including inadequate block, patient intolerance or anxiety, or an increase in the scope of surgery.

Strict aseptic technique must be adhered to when preparing for epidural and spinal anaesthesia. The anaesthetist performs a surgical hand antisepsis, donning PPE, sterile gown and gloves, before completing patient skin antisepsis and draping.

Skin antisepsis must be completed and the solution discarded before any medication is prepared on the aseptic field. This is to prevent the incorrect solution being injected. Medications drawn up into syringes are labelled using sterile labels.

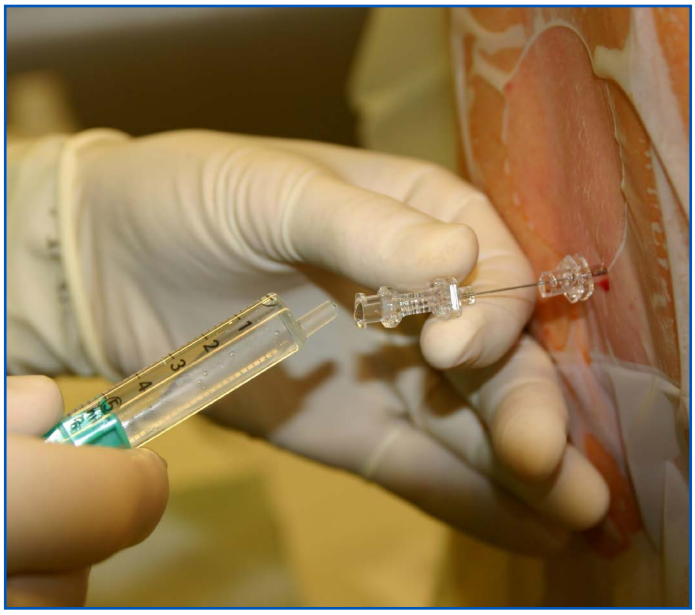
To allow optimal needle access to the epidural and subarachnoid spaces, the patient is positioned in a sitting position (preferred), shoulders rounded/slouched, pushing out their back in a 'c' shape (see Figure 3-38) with feet supported on a stool. If sitting is not possible, patients are asked to assume a lateral flexed position with their back parallel to the edge of the table, hip and knees flexed, and nose towards knees: the 'foetal position' (see Figure 3-39). The lateral flexed position may become uncomfortable for patients, particularly if pregnant. The anaesthetic nurse provides instruction, reassurance, and support to the patient, and assistance to the anaesthetist throughout the procedure.

Figure 3-38. Epidural anatomy



Source: Bruce Blaus/Blausen Medical

Figure 3-39. Backflow of cerebrospinal fluid through a spinal needle after puncture of the arachnoid mater during spinal anaesthesia



Source: DocP/Wikimedia Commons

PREPARING AND ASSISTING IN SPINAL ANAESTHESIA

Ms Raikuna has been checked in at the reception/holding bay and has been transferred to your anaesthetic bay. She is accompanied by her partner, Chris. Ms Raikuna is 38 weeks pregnant with her second baby and was scheduled for an elective Caesarean section in ten days' time, however labour started earlier today and a Caesarean section is now indicated. She is experiencing contractions every ten minutes and is in mild discomfort.

The anaesthetist is carrying out a pre anaesthetic check whilst you assemble the spinal equipment, monitoring equipment, and intubation equipment. If the spinal fails or an intraoperative emergency arises it may be necessary to anaesthetise Ms Raikuna. It is noted that Ms Raikuna already has IV fluids in progress: this is important as hypotension is a side effect of spinal anaesthesia. She is given supplementary oxygen to ensure oxygenation for the baby (see Figure 3-40 for complications of central neural blockades).

In the OR, Ms Raikuna is administered a dose of oral sodium citrate solution (30–40ml) to reduce the acidity in her stomach: being pregnant, she is at higher risk of aspiration should a general anaesthetic be required. You assist Ms Raikuna into the sitting position (see Figure 3-38) on the operating table with her feet supported on a foot stool. The anaesthetist 'preps' Ms Raikuna's back with antiseptic solution and hands you the 'prep' dish which is discarded. You have prepared the spinal equipment, and you check and open the LA, morphine, and fentanyl with the anaesthetist as requested. You provide reassurance and explanations to Ms Raikuna as required.

The following readings describe central neural blockades and highlight the tragic case of Mrs Wang in 2010. Mrs Wang was in labour, and had an epidural administered for analgesia. During the insertion of the epidural, Mrs Wang was accidently injected with chlorhexidine antiseptic 'prep' solution. This had a catastrophic effect, leaving Mrs Wang permanently disabled. The error occurred due to a mix-up in solutions on the aseptic set up. This incident led to a change in practice outlined in the NSW Health Safety Notice below.

READ

Hamlin et al. (2016) Chapter 8, pp 214-217.
Note Feature Box 8-3: Epidural error.

NSW Health (2010) Safety Notice 010/10: Correct identification of medication and solutions for epidural anaesthesia and analgesia

ACTIVITY

3-13 Local, central, and regional anaesthesia
Review the information on regional and central neural anaesthesia and complete the table in the Activity section.

OBSTETRIC ANESTHETIC CARE

The spinal anaesthetic has been administered and Ms Raikuna is repositioned into the supine position with a foam wedge positioned beneath her right hip. This position displaces her uterus and prevents aortocaval compression and the risk of severe maternal hypotension which can compromise the health of the foetus (Rothrock, 2018).

Ms Raikuna has anti-embolism stockings in situ, and you apply intermittent pneumatic compression devices to her calves for additional venous thromboembolism prophylaxis.

In the ward, the midwife has given Chris scrubs and a cap to wear so he can join Ms Raikuna in the OR: he is escorted in and takes a seat positioned near Ms Raikuna's head. You ask him to stay where he is positioned to avoid contaminating the aseptic field.

In spinal anaesthesia, a loss of sensation to cold occurs before a loss of sensation to touch. The anaesthetist assesses Ms Raikuna's block by gently touching her abdomen and legs with an ice pack. Ms Raikuna reports she cannot feel the cold ice. This signals the spinal is beginning to work as intended.

You and the anaesthetist monitor Ms Raikuna's BP every 5 minutes: hypotension is common due to the vasodilatory effect of spinal anaesthesia. The anaesthetist will titrate IV fluids to counter hypotension and may use phenylephrine, ephedrine or other medications to treat hypotension as needed. Ms Raikuna may experience nausea, vomiting, and dizziness related to low blood pressure.

You remain with Ms Raikuna throughout, monitoring her condition and informing her (and Chris) of what is happening. In particular, you inform her that she should not feel pain, but may feel pressure as the surgeons deliver the baby.

A registered midwife is present in the OR and will receive the baby when delivered. A paediatrician may be required should the baby require resuscitation. Resuscitation equipment for newborns is kept on hand in the OR. The midwife checks the foetal heart rate prior to the surgical team commencing the procedure.

A health baby boy is safely delivered. Once the baby is assessed by the midwife and the cord is cut, Ms Raikuna cuddles the baby on her chest. Meanwhile, the surgical team complete the procedure (see Figure 3-41).

As Ms Raikuna's procedure finishes, Chris and the baby leave the OR with the midwife to conduct the newborn check. Blood and amniotic fluid has soaked the sheets and prior to transfer from the OR table, Ms Raikuna is cleaned and made comfortable. Care is taken with her legs during transfer as the spinal block remains in effect. Ms Raikuna, with Chris and their new baby, are transferred to the PACU (some facilities have a Recovery Unit within the Delivery Suite).

Figure 3-40. Complications associated with central neuraxial anaesthesia

CENTRAL NEURAXIAL ANAESTHESIA: COMPLICATIONS

Frequent complications	Infrequent, but well recognised complications
• hypotension • respiratory depression (with opioid use) • motor block (epidural) • urinary retention • inadequate analgesia • pruritus (opioid use)	• cardiovascular collapse • respiratory arrest • unexpected development of high block e.g. catheter migration, intrathecal injection • local anaesthetic toxicity • post dural puncture headache syndrome (including sub-dural haematoma) • medication administration errors (particularly wrong route) • pressure injury • infection around catheter • epidural haematoma or abscess • meningitis • spinal cord ischaemia • permanent harm e.g. paraplegia, nerve injury.

RESUSCITATION EQUIPMENT, OXYGEN, AND APPROPRIATE MEDICATIONS MUST BE READILY AVAILABLE WHENEVER NEURAXIAL ANAESTHESIA IS BEING USED: PROMPT TREATMENT OF SIDE EFFECTS IS CRITICAL

Adapted from RCoA, 2010

Figure 3-41. Baby delivered by LSCS; procedure is completed under spinal anaesthesia

Source: © Salim Fadhley/Wikimiedia Commons; © Sunnybrook Hospital

End of list procedure

At the conclusion of the operating list, the anaesthetic bay and OR are terminally cleaned. This includes wiping all surfaces and equipment with neutral detergent impregnated wipes, together with all leads, ECG, BP cuffs, pulse oximeters, theatre table and attachments, anaesthetic machine and trolley.

The anaesthetic bay and OR must be left in anticipation of the next patient, particularly for emergency surgery (Hamlin et al, 2016). Equipment, consumables, and medications must be re-stocked. Local policy will guide you for the management of S8 drugs at the completion of the list, but it is important to ensure that drug registers and patient documentation are completed by the anaesthetic team.

Anaesthetic emergencies

Anaphylaxis

Anaphylaxis is a rare, antibody-mediated reaction to an antigen. It represents a life-threatening emergency requiring prompt recognition of signs and symptoms, early administration of adrenaline in adequate dosage, and aggressive volume replacement. Signs and symptoms can range from skin rashes or mottling, hypotension, tachycardia (or sometimes bradycardia), bronchospasm or difficulty in ventilation.

The cause of anaphylaxis in the perioperative setting may be an adverse reaction to a muscle relaxant, opioids, antibiotics, blood, latex etc. The reaction usually occurs within three minutes of administration/ exposure and the anaesthetic nurse must provide prompt and effective support to the anaesthetic team during management of the medical emergency (Hamlin et al, 2016).

Anaesthetic management of anaphylaxis consists of:

- prompt diagnosis – anaphylaxis should be considered if skin rashes co-exist with bronchospasm or hypotension
- immediate treatment – IV adrenaline is a pivotal in the management of anaphylaxis together with aggressive fluid resuscitation
- refractory management – further measures may be required e.g. arterial line, further vasopressors, fluid resuscitation
- post crisis and further management – transfer to ICU, steroids, etc. (ANZCA & ANZAAG, 2016)

IV adrenaline is the first line treatment of anaphylaxis. Adrenaline produces vasoconstriction and bronchodilation, increases cardiac output, and reduces mucosal oedema and mediator release (ANZCA & ANZAAG, 2016). An immediate bolus dose is given, followed by titrated IV adrenaline with adequate IV fluid via a large bore IV cannula. Close monitoring is vital to assess effectiveness of treatment and to ensure adrenaline overdose does not occur (ANZCA & ANZAAG, 2016). Ensure you are familiar with the local supply and use of adrenaline minijets and ampoules including the concentrations available in your OS.

READ

Hamlin et al. (2016) Chapter 8, p 223, Anaphylaxis

ANZCA (2016) Perioperative Anaphylaxis Management Guidelines
http://www.anzca.edu.au/documents/bp-anaphylaxis-2016.pdf
Explore the various sections, noting the 'anaphylaxis box' and management cards to guide the team in an anaphylactic crisis.

Local anaesthetic (LA) toxicity

Infiltration of LA drugs (e.g. lignocaine, bupivacaine, ropivacaine) is used commonly to facilitate minor surgery, such as suturing of a laceration or excision of a skin lesion. Local anaesthetic is also frequently injected into wounds by the surgeon intraoperatively to provide post-operative analgesia. The use of LA combined with adrenaline provides vasoconstriction and reduced bleeding at the operative site.

Figure 3-42. Intralipid; dantrolene

Source: NSW Health 2017

LA is generally associated with few complications and high patient and surgeon satisfaction. However, patients must be closely monitored for indications of LA toxicity or allergic reaction (Fenci, 2016). Toxicity can occur if an accidental overdose of LA is given or if it is injected directly into the blood stream (Christie et al, 2015).

Indications of toxicity can range from early symptoms such as dizziness, confusion, agitation and tinnitus, to severe reactions such as convulsions, bradycardia, circulatory collapse and cardiac arrest (Hamlin et al, 2016).

If toxicity is suspected, the administration of LA must be ceased immediately and life support measures commenced. The administration of IV lipid emulsion (intralipid, see Figure 3-42) is the recommended treatment for LA toxicity (Hamlin et al., 2016). Ask your facilitator how to access intralipid, and how it is administered.

The following readings provide further information on LA toxicity.

READ

Hamlin et al. (2016) Chapter 8, p 218, Local anaesthetic toxicity.
Note Feature Box 8-4, Local Anaesthetic Toxicity

The Association of Anaesthetists of Great Britain & Ireland (2010) Management of severe LA toxicity.
https://www.aagbi.org/sites/default/files/la_toxicity_2010_0.pdf

Malignant hyperthermia (MH)

Malignant Hyperthermia (MH) is a rare, life threatening syndrome that can occur in susceptible people when they are administered certain anaesthetic drugs, particularly suxamethonium. The predisposition to developing MH is genetically inherited. MH results in a very high temperature and muscle rigidity developing during an anaesthetic that must be treated immediately (Malignant Hyperthermia Australia & New Zealand (MH ANZ), 2009).

There are a number of signs and symptoms:

- sudden and unexplained rise in end tidal CO_2 levels and hypercarbia in patients who are breathing spontaneously
- tachycardia, labile BP and arrhythmia
- acidosis
- muscle rigidity in masseter muscles of the face
- fever – a late sign
- dark coloured urine
- mottled, cyanotic skin (Marley & Calabrese, 2014).

Management centres on the prompt administration of IV dantrolene, the only effective treatment for MH (see Figure 3-42). All OS should have access to dantrolene (minimum 36 ampoules), and an MH trolley with emergency equipment (e.g. water for injection, syringes, task cards, location of reserve dantrolene supplies, amiodarone, beta blockers etc.). Storing these items together reduces time spent gathering equipment and

expedites treatment. The anaesthetic nurse plays an important role in assisting in the preparation of the drug and providing support to the anaesthetist during resuscitation of the patient.

The following readings provide detailed information about MH and its treatment. The resource from MH ANZ is comprehensive and provides information on developing an MH kit.

READ

Hamlin et al. (2016) Chapter 8, pp 223-224, Malignant hyperthermia; Chapter 3, p 59, Feature Box 3-3: The hidden dangers of malignant hyperthermia

Royal Melbourne Hospital, Malignant hyperthermia.
http://www.anaesthesia.mh.org.au/what-is-malignant-hyperthermia/w1/i1002691/
Explore the various sections, in particular the MH resource kit.

ACTIVITY

3-14 Anaesthetic emergencies
Reflect on the information on anaesthetic emergencies studied in this Component. Complete the table in the Activity section on the management of anaesthetic emergencies.

Additional anaesthetic considerations

Paediatric patients

Paediatric anaesthesia is a specialty in its own right, and not all facilities offer paediatric anaesthesia and surgical services. If your unit does, explore this topic further with your facilitator and seek to complete additional education on paediatric anatomy, medications, and special care needs. A brief overview of the anaesthetic management of paediatric patients is provided in this component (see Figure 3-44). The Resus4kids: Advanced Airway Management session (via My Health Learning) must be completed by staff in facilities which undertake paediatric surgery.

Children and young people have special healthcare needs due to both physical and emotional differences from adults, and their need for the constant care and support of their parents/support person. As a priority, the anaesthetic team should consider the child and parents' emotional needs and create an environment that minimises fear and distress (see Figure 3-43).

Figure 3-43. Supporting the patient's parents and carers

SUPPORTING THE PAEDIATRIC PATIENT'S PARENT/CARER
Key nursing actions: • provide perioperative attire to allow attendance in the OR • explain what to expect in the anaesthetic bay and OR, the steps involved in preparing for and inducing anaesthesia, their role in the process, where they can wait, and how they will be contacted post-operatively • ensure they understand what to do should they feel unwell or overwhelmed • stay close throughout and offer support as needed.

Paediatric anaesthetic equipment is smaller and is designed for the anatomical and ventilation differences of a paediatric patient (Hamlin et al, 2016). Induction of anaesthesia is generally via inhalation ('breathing down') to avoid causing distress by attempting IV access when conscious. IV access is obtained once the patient is anaesthetised. Once anaesthetised, the parent/support person is escorted from the OR by a staff member (some OS have trained volunteers to assist). Any regional blocks are usually inserted once GA is established.

Paediatric patients have a lessened ability to balance heat production and can rapidly lose heat. In order to maintain normal body temperature, the ambient OR temperature should be increased, and depending on the duration and exposure of surgery, forced air warming devices, warmed IV fluids, and thermal head protection should be applied (Hamlin et al, 2016).

Paediatric patients have different blood volume, fluid and electrolyte requirements, and renal function which influences medications and IV replacement fluid types and amounts. Figure 3-44 provides a quick guide to paediatric anaesthesia.

The following resources will introduce you to some of the specific considerations required when providing anaesthetic care for paediatric patients.

READ

Hamlin et al. (2016) Chapter 8, pp 224-226, Paediatric considerations in anaesthesia
Note the differences in anaesthetic equipment

VIEW

Association for the Wellbeing of Children in Healthcare (AWCH) Comfort positions for medical procedures
http://www.awch.org.au/information-for-health-professionals.php

Figure 3-44. Paediatric anaesthesia: basic concepts

PAEDIATRIC ANAESTHESIA: BASIC CONCEPTS

Paediatric differences

- Anatomical differences: large head, short neck, prominent occiput, relatively large tongue, larynx is high and anterior, epiglottis is long and stiff – **head to be in neutral position** for optimal bag/mask ventilation.
- Airway is funnel shaped: narrowest point is at the cricoid cartilage. Trauma to the airway easily results in oedema. **ETT are usually uncuffed** and a small leak is maintained around the ETT to prevent trauma and subsequent post-extubation stridor until age 8-10 years.
- Neonates and **infants have limited respiratory reserve**.
- Airway management systems are age/weight related.
- Large surface area to weight ratio and poorly developed shivering, sweating, and vasoconstriction mechanisms: a **higher ambient temperature is needed to prevent heat loss**.
- Medication doses relate to body weight: all paediatric patients must have current weight recorded. Weight estimation = (Age + 4) x 2 [less accurate after 10 years of age].
- Some medications will have a longer duration of action due to slower metabolism.

Nursing management

- **Warm** the OR and prepare patient warming devices.
- Airway and IV equipment ready and checked: have **paediatric trolley accessible and paediatric resuscitation equipment available**.
- Straight Magill blades are useful in paediatrics under ~6-10kg.
- ETT size estimator = age/4 + 4 (up to 10 years of age): also have available ETT 0.5 larger and smaller.
- LMA size: size 1 ≤ 5kg; size 1.5 5-10kg; size 2 10-20kg; size 2.5 20-30kg; size 3 >30kg.
- Inhalational induction is a 2 person technique: assistant maintains the airway whilst IV access is obtained.
- **Care of the parent/support person is required**.

Sources: Hamlin et al., 2016; NSW Health PD2010_034, 2010

Emergency/trauma patients

Patients admitted for emergency surgery require additional consideration. The extent of preoperative preparation of the patient will vary according to the urgency of the surgery required, and in a life- or limb-threatening situation may be minimal.

Many OS have emergency equipment set up ready for trauma/emergency patients in an identified area. Where possible, discuss specific patient requirements with the anaesthetist, however trauma situations are dynamic. Key anaesthetic nursing considerations include:

- warm the OR and prepare patient and fluid warming devices
- prepare for RSI: have the difficult intubation trolley accessible
- consider invasive monitoring requirements e.g. arterial line and CVP set up
- ready a large bore cannula/s and/or rapid infusion exchange catheter for fast infusion of IV fluids/blood
- prime IV pump sets
- consider rapid IV infuser
- consider colloid and blood product requirements
- have the resuscitation trolley accessible
- receive the patient and escort to the OR in a timely manner

- provide calm emotional support and information to (conscious) patients and relatives/carers who may accompany the patient
- consider the post-operative destination and arrangements: once the surgery is established, request the physical bed.

Shared airway/ENT patients

Sharing the airway with the surgeon is a challenging task for the anaesthetist (see Figure 3-45). Patient safety needs to be maintained while the best conditions are created for the surgeon. In many circumstances, intubation with a standard endotracheal tube is not possible, and ventilation techniques including mask ventilation, ventilator bronchoscope, or high frequency jet ventilation are needed. Familiarity with LASER use is necessary if assisting an anaesthetist where LASER is used. There is a risk of fire with the use of LASER or diathermy being used in close proximity to the airway and the oxygen supply. Specific local management protocols must be followed to reduce risks to the patient and staff.

Airway problems such as stridor, supra- and sub-glottic stenosis are common in some ENT patients. Clear communication between team members is essential to coordinate surgery and anaesthesia requirements.

Figure 3-45. Shared airway in ENT surgery

Source: James C Mutter & Mani Zadeh

Remote/outpost anaesthesia

Many facilities offer anaesthetic services remote from the OS in areas of the hospital such as radiology, endoscopy, and the cardiac catheter laboratory. Challenges can range from having to transport all the required equipment to the location to accessing S8 medications, and setting up a safe work environment in a restricted space. Communication and planning with the anaesthetist is essential in maintaining patient safety.

READ

Jayaraman., L., Sethi, N., Sood, J. (2010) *Update in Anaesthesia*. Anaesthesia outside the operating theatre.
http://e-safe-anaesthesia.org/e_library/06/Anaesthesia_outside_the_operating_theatre_Update_2010.pdf
This article outlines the general requirements and challenges related to administering anaesthesia remotely from the OS.

Vanderbilt Medical Center: Poster identifying key points in preventing and managing airway fires.
http://www.mc.vanderbilt.edu/documents/periopservices/files/PosterAirway%20Fire%20Poster.pdf

ACTIVITY

3-15 Emergency surgery scenarios
Consider each of these scenarios and develop an anaesthetic management plan for each patient (consider any additional information you may require).
Scenario 1: An 87 year old female patient is admitted for removal of skin lesions from her left calf under local anaesthetic.
Scenario 2: A 48 year old man is admitted for emergency laparotomy for bowel obstruction. He has been vomiting for two days prior to presenting at Emergency Department.
Scenario 3: A 23 year woman is admitted from Labour Ward for an emergency Caesarean section.

Conclusion

This Component has provided a description of the role and responsibilities of the anaesthetic nurse, including the importance of nursing assessment and close collaboration with the anaesthetist. A range of anaesthetic modalities, equipment, processes, and medications used in the safe anaesthetic management of the patient have been discussed in the context of several virtual patients.

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COMPONENT 3 – ACTIVITIES

ACTIVITY 3-1: ANAESTHETIC MEDICATIONS

Complete the table below.

Two examples of anaesthetic drugs used for:	Name of drug	Action	Possible side effects
Induction			
Muscle relaxant			
Analgesia			
Reversal of muscle relaxant			
Antiemetic			

Consider how Schedule 8 drugs are managed within your OS and answer the following questions:

1. Describe how S8 drugs are dispensed in your OS i.e. the checking procedure at the drug cupboard.
2. Describe the checking procedure carried out immediately prior to administration of S8 drugs to the patient.
3. Describe how unused portions of S8 drugs are disposed of.
4. Describe the change of shift checking that occurs for S8 drugs in your OS.

ACTIVITY 3-2: ANAESTHETIC MACHINE

Carry out a Level 2 check of the anaesthetic machine with your facilitator and become familiar with each component.

Label the main components of the anaesthetic machine using the list and following diagram:

1. Suction
2. Reservoir breathing bag
3. Ventilator
4. Monitors
5. Volatile agent
6. Monitoring leads
7. Oxygen flush button
8. Breathing circuit
9. Control panel for volatile agents
10. Additional storage for volatile agents

ACTIVITY 3–3: ANAESTHETIC EQUIPMENT

Work with your facilitator and set up for endotracheal intubation. Handle and become familiar with each piece of equipment.

When you are comfortable with assisting an intubation, carry out the *Clinical Skills Assessments* for Airway Management and Checking the Anaesthetic Machine with your facilitator.

ACTIVITY 3-4: MANAGING BLOOD PRODUCTS

Using the tables below, explain the protocol used in your OS for ordering, checking, handling and administration of blood products.

Process	Protocols/policies
Ordering	
Checking	
Handling	
Administration	

Detail the signs and symptoms of acute transfusion reaction and their management.

Signs & symptoms of transfusion reaction	Management

ACTIVITY 3-5: HAEMODYNAMIC MONITORING

Complete the table below on the haemodynamic monitoring used in your OS.

Monitoring equipment	Use in perioperative context	Considerations
Non-invasive BP		
Pulse oximeter		
Capnography		
ECG		
Temperature		

ACTIVITY 3-6: CONSENT FOR SURGERY

How will you manage Ms Armitage's distress?

What are the implications for Ms Armitage and her surgery if her consent form is not signed?

How will you manage the situation?

ACTIVITY 3-7: INDUCTION OF ANAESTHESIA AND INSERTION OF LMA

Review the induction sequence and video on insertion of LMA (link on p 106). Complete the table on induction and insertion of LMA.

Induction sequence	Rationale	Nursing considerations
IV access		
Pre oxygenation		
Administer short acting induction agent e.g. Propofol		
Insert lubricated, deflated LMA		
Attach to breathing circuit		
Ensure patient is breathing spontaneously		
Secure LMA in position with tape		

ACTIVITY 3-8: VISITORS TO THE OS

How will you respond to Mrs Simpkin's daughter's request?

Describe two benefits and two challenges of allowing relatives to accompany patients in the OS.

Benefits	Challenges

ACTIVITY 3-9: PERIOPERATIVE CARE OF ELDERLY PATIENTS

Identify four perioperative risk factors for Mrs Simpkin and complete the table below with nursing actions for each.

Risk factors with rationales	Nursing actions

ACTIVITY 3-10: DIFFICULT INTUBATION EQUIPMENT

Locate the difficult intubation trolley and review the contents with your facilitator. Locate the additional equipment that may be required when caring for a bariatric patient. Complete the following table.

Difficult intubation equipment	Uses

Equipment for bariatric use	Uses

ACTIVITY 3-11: EMERGENCE FROM ANAESTHESIA

After reviewing the relevant information from this Component, complete the following table on reversal and extubation.

Emergence sequence	Anaesthetist role	Anaesthetic nurse role

ACTIVITY 3-12: HANDOVER TO PACU

Using ISBAR or ISOBAR, complete Mr Kumar's handover to PACU in the table below. You may wish to review the information on ISBAR/ISOBAR which was included in Component 2, Quality and Safety.

ISBAR/ISOBAR	Handover information on Mr Kumar
Identification	
Situation	
Observations	
Background	
Assessment and actions	
Recommendation	

ACTIVITY 3-13: LOCAL, REGIONAL AND CENTRAL NEURAL BLOCKADE

Complete the table below.

Anaesthetic	Advantages	Disadvantages	Potential complications	Drugs used	Nursing considerations
Local anaesthetic					
Regional block					
Epidural					
Spinal					

ACTIVITY 3-14: ANAESTHETIC EMERGENCIES

Complete the table below on anaesthetic emergencies.

Emergency	Signs/symptoms	Treatment	Drugs/equipment used
CICO			
Laryngospasm			
Bronchospasm			
MH			
Anaphylaxis			
Aspiration			

ACTIVITY 3-15: EMERGENCY SURGERY SCENARIOS

Consider the scenarios below and develop an anaesthetic management plan for each patient. Consider the additional information that is required to develop your care plans. Complete the table below.

Scenario 1: An 87 year old female patient is admitted for repair of lacerations on her left calf under local anaesthetic.

Scenario 2: A 48 year old man is admitted for emergency laparotomy for bowel obstruction. He has been vomiting for two days prior to presenting at the Emergency Department.

Scenario 3: A 23 year woman admitted from Labour Ward for an emergency Caesarean section.

Patient	Type of anaesthetic & drugs required	Equipment required	Nursing considerations	Other information you may require
Scenario 1 87 yr old female Repair of lacerations under LA				
Scenario 2 48 yr old man emergency laparotomy				
Scenario 3 23 yr old woman emergency Caesarean section				

— End of Component 3 —

COMPONENT 4

CIRCULATING NURSE AND INSTRUMENT NURSE

Aim

The aim of this component is to explain the roles of the circulating nurse and the instrument nurse, and the skills and knowledge required to ensure safe patient outcomes.

Learning outcomes

- Demonstrate an understanding of the instrument and circulating nurse roles as part of a multidisciplinary team.
- Describe the legislative requirements of the role, including documentation, medication administration and clinical handover of care.
- Demonstrate the preparation of the operating room to meet the ergonomic and infection prevention principles.
- Performing the circulating role within the perioperative setting.
- Develop beginning skill level in the role of instrument nurse.
- Apply evidence based asepsis and infection control practices in the perioperative environment.
- Demonstrate skin antisepsis and draping operative sites prior to the surgical procedure.
- Analyse the concept of surgical conscience and its implications for positive patient outcomes.
- Assess the physiological, psychological and emotional reactions of the surgical patient and implement appropriate care planning.
- Correctly manage accountable items.
- Apply principles of work health and safety when managing technology within the OS.
- Demonstrate correct management of pathology specimens.
- Integrate knowledge of anatomy and physiology, the inflammatory process and principles of wound healing to the management of surgical incisions.
- Describe the common types of surgical incisions and suture materials used.
- Demonstrate correct handling of wound closure material and equipment.
- Name the classification of surgical instruments and give examples of instruments contained within each classification.
- Describe the care and handling of instruments and additional equipment used intraoperatively.
- Demonstrate competence in the safe passing of instruments to the surgeon.

Working through this component

Some of the topics covered within this component are presented in the format of a ‘virtual operating suite’. In the role of the instrument or circulating nurse, you will be asked to consider the intraoperative care of a variety of increasingly complex patients.

The roles of circulating and instrument nurses

The circulating nurse and the instrument nurse perform important roles in the perioperative team. Although they may appear to be separate roles with different responsibilities, they are strongly connected, interchangeable, and they combine to provide support for both the patient and the surgical team during the intraoperative phase.

Key responsibilities of the circulating nurse include to:

- establish and monitor the aseptic field
- open sterile items and equipment
- ensure and maintain patient safety and dignity
- assist the surgical team as a mobile resource within the OR to ensure all supplies and equipment are available during the surgical procedure
- collaborate with the surgical team to ensure that all instruments, accountable items, and other items used during surgery/procedures are retrieved, accounted for, and appropriately documented.

Figure 4-1. Instrument nurse; circulating nurse

Source: NSW Health 2017

Key responsibilities of the instrument nurse include to:

- establish and monitor the aseptic field
- manage the instruments and associated sterile items
- assist the surgeon with access to instruments and supplies required to undertake the surgical procedure
- recognise intraoperative complications or changes in the patient's condition and responding promptly
- manage accountable items (as described above in circulating nurse role).

The following readings provide a detailed description of the roles of the instrument and circulating nurses including education requirements.

READ

ACORN (2018) Position Statements on the Role of the circulating nurse and Role of instrument nurse.

Hamlin et al. (2016) Chapter 1, pp 5-7 Roles of circulating and instrument nurses

Overview of surgery

Historical evidence suggests that surgery was performed as far back as 350,000BC (Hamlin et al, 2016). The type and extent of surgery performed throughout the centuries was hampered by a lack of effective anaesthesia and the probability of haemorrhage and wound infection: both the latter complications resulted in high mortality rates. It was not until there was a better understanding of microbiology and the causes of infection with the resultant development of aseptic techniques, together with the discovery of anaesthesia in the late 1800s, that surgery began to develop into the specialty recognised today (Gawande, 2012). Surgery continues to evolve, with numerous sub specialties e.g. neurosurgery, cardiac, and orthopaedic. Surgical techniques, in particular minimally invasive and robotic surgery are now in common use (see Figures 4-2; 4-3; 4-4).

The roles of the intraoperative nurses will evolve as new techniques are developed. However, regardless of the type of surgery performed or the technology used, the patient remains the centre of the surgical activity and the priority for the surgical team is a safe outcome for the patient.

Figure 4-2. Surgery in progress

Source: US Navy

Figure 4-3. Minimally invasive surgery

Source: US Air Force

Figure 4-4. Robotic surgery

Source: Cmglee Wikimedia Commons

READ

Hamlin et al. (2016) Chapter 10, pp 270-271, Historical surgical perspective

Intraoperative patient care

Virtual Operating Suite

To facilitate the study of surgical procedures related to the roles of the instrument and circulating nurse, you are provided with an operating list of 'virtual patients'. The guided readings and activities relate to each scenario as the patients progress through their procedure.

Virtual Operating List – OR 1

Patient	Age	MRN	Surgical procedure	Comments
George RUBIN	66	87459061	Repair right inguinal hernia	VTE risk
Maria DIAZ	46	98321867	Laparoscopic cholecystectomy	N/A

Preparing for the patients

Each member of the team has individual responsibilities in preparing the OR environment, depending on their role. In Component 1, teamwork was highlighted as an important strategy for ensuring patient safety. Part of the preparation of the environment is the team (nursing, surgical, anaesthetics) communicating with each other about the patients and procedures on the operating list in relation to any potential critical issues, equipment or possible complications. This 'shared mental model', described in Component 1, is an important non-technical skill ensuring that all team members possess the information required to effectively collaborate in their care of the patient. The Surgical Safety Checklist provides documentation that this exchange of information has occurred.

Circulating nurse actions

Preparing the OR environment

On entering OR 1, you find the instrument nurse looking at the operating list and preparing the set-ups for the procedures. They ask you to prepare the OR for the day. All nursing team members will work concurrently to prepare the OR including:

- the anaesthetic nurse is checking anaesthetic equipment and supplies according to the types of procedures and anaesthetic requirements for each patient
- the instrument nurse is checking instrument set ups and reviewing them against the operating list to ensure all equipment required is available. This may involve asking the operating theatre assistant to obtain additional equipment.

The role of the **circulating nurse** is cleaning and checking. This includes damp dusting and/or spot cleaning of horizontal surfaces according to local policy. All general and specialty equipment must be present and checked for correct function. Equipment to be checked includes:

- suction systems – ensure there are sufficient suction liners
- diathermy – if disposable patient return electrodes are used, ensure sufficient supply. If a reusable pad is used, ensure it is present on the OR table
- operating lights
- operating table – check with the instrument nurse that the correct table for the patients and procedures is in place.
- computers
- X-ray boxes
- surgical towers and/or pendants
- wall gas and electricity panels, line isolation monitors
- linen and rubbish bins and liners.

Check stock drawers or cupboards for adequate stock of items, for example, swabs, sponges, dressings, specimen containers, specimen labels, disposable gloves, hand hygiene dispensers. The types of items will vary within each workplace.

Some ORs have a checklist to complete of the daily checks and may also have a diagram of the OR to show the location of furniture and equipment for each procedure.

The following reading summarises the preparation of the OR and also provides an insight into the sights, sounds and smells in the environment and the effect these may have on the patient.

READ

Hamlin et al. (2016) Chapter 5, pp 120-121, Preparation of the Operating Room
Note Feature Box 5-4 on p121

ACTIVITY

4-1 Setting up the OR
In the Activity section, draw a diagram of your OR including the fixed equipment and determine where mobile equipment, trolleys and staff are best placed for Mr Rubin's procedure.

Faulty or missing equipment

During the course of the preparation, if any equipment is found to be faulty or missing, it should be reported and managed according to local policy. A replacement item must be located prior to surgery commencing to avoid undue delay and potential for patient safety to be compromised.

ACTIVITY

4-2 Electrical equipment

Answer the questions below for the electrosurgery unit and 3 additional pieces of OS equipment selected from the following: pneumatic compression devices, suction, laparoscopic towers, tourniquet, surgical plume evacuation.

1. Explain the checking process for each
2. What is the machine/equipment used for?
3. What are the associated risks?
4. Explain the safety requirements/processes
5. Are manufacturer instructions available?
6. What are the documentation requirements, if any?

Suction

A space with significantly lower pressure than atmospheric pressure is termed a *vacuum* and is measured in millimetres of mercury (mmHg). Suction is the 'vacuum' flow of air or fluid or solids through a tube, which is initiated by creating negative pressure at one end of the tube (Lamb & Pursley, 2014).

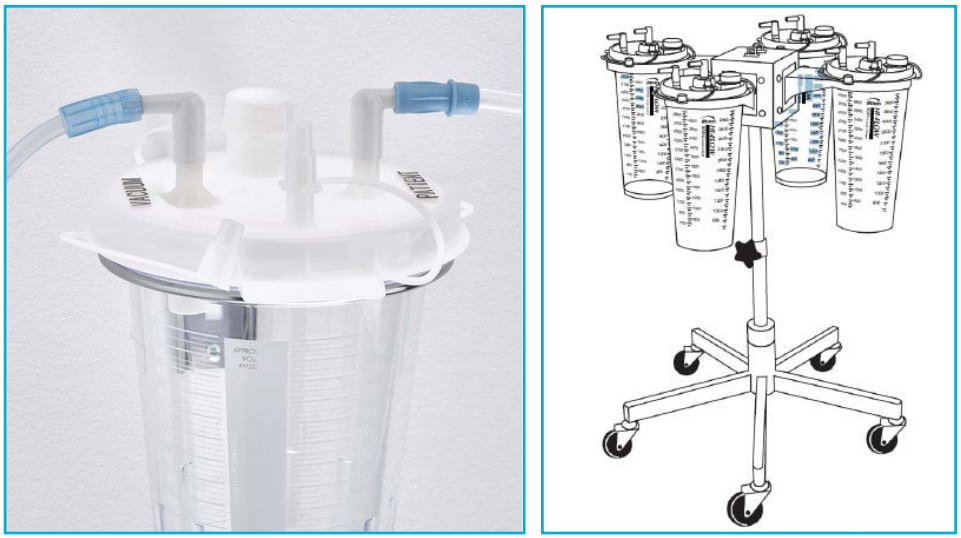
Suction is a central piece of equipment that is used in all procedures, either by the anaesthetist or the surgeon. Suction must be used correctly to ensure patient safety. Its applications include:

- clearing airways
- removing blood from surgical site
- obtaining specimens
- attachment to drainage systems
- scavenging anaesthetic gases
- removing surgical plume.

The type of suction units may vary in different ORs, however the components of a suction unit always include:

- rigid outer canister
- inner disposable liner
- canister top including a variety of ports to connect to wall suction, sterile suction tubing and a shut off valve to prevent overflow (see Figure 4-5).

Figure 4-5. Example of surgical suction unit and carousel



Sources: http://www.amsino.com/assets/products/receptal-canister-disconnect-disposal-01.jpg
http://gismedical.com/wp-content/uploads/2017/05/533910.jpg

Suction canisters are usually arranged on a movable stand (usually called a carousel which allows the canisters to be connected to each other). The carousel also allows for positioning close to the aseptic field. Unsterile tubing will connect the canisters to the wall suction. As wall suction cannot generally be regulated (see Figure 4-6), it is important that the length of tubing attached to the suction canisters is kept a short as possible. The longer the tube, the less powerful the suction: this can affect the surgeon's ability to clear the surgical field of blood.

Where there are suction regulators (Figure 4-7), it is important that these are checked for correct functioning so they deliver the correct pressure of suction i.e. the minimum amount of suction required to achieve the desired result.

Figure 4-6. Wall suction outlet: no regulator

Source: Medical Australia Limited

Figure 4-7. Wall suction outlet with pressure regulator

Source: Medical Australia Limited

READ

Mathias, J. (2013) Stryker's Neptune recall raises stakes for compliance. http://www.ormanager.com/wp-content/uploads/2013/05/ORM_0513_16_Stryker.pdf
This reading is about the death of a patient whose chest drain was incorrectly connected to high pressure suction. This case and its resultant action by the company highlights the dangers of the incorrect use of suction.

ACTIVITY

4-3 Suction
Look around your OS and identify the types of suction used. Do they have regulators? If so, how are these checked and regulated to deliver the correct amount of pressure? Work with your facilitator on the procedure for changing and disposing of suction liners. Identify the PPE required for this procedure and why. Record your answers in the Activity section.

Preparing for and meeting the patient

Once all the necessary OR checks have been finalised, the OR can be set up for the first patient, Mr Rubin. He will undergo formal 'checking in' to the OS following local policy and be escorted to the anaesthetic bay where the anaesthetic team will begin preparations for the induction of anaesthetic. The circulating or instrument nurse (depending on local policy) also meets Mr Rubin preoperatively. Mr Rubin's identity is verified and any information that may be relevant to his intraoperative care is noted and communicated. This is also an opportunity to introduce the nursing team to Mr Rubin and provide psychological support and reassurance.

The instrument nurse is completing the surgical scrub, gowning and gloving ready to set up the aseptic field for Mr Rubin's surgery. Your role as the circulating nurse is to open sterile equipment ready for the instrument nurse to create the aseptic field.

Opening sterile supplies and managing the aseptic field

The principles of aseptic technique and surgical conscience were described in Component 2. The following reading provides an opportunity to review the main principles and practices that must be followed as circulating nurse.

READ

Hamlin et al. (2016) Chapter 6, Asepsis and aseptic technique, pp 141-145
Note Figures 6-3, 6-4 and 6-5 on opening sterile items

ACORN (2018) Standard on Asepsis.
Note the criteria in Standard statement 3 as these provide the key practice points for aseptic technique
Apply the related information from Component 2 and the above readings to the following Activity.

ACTIVITY

4-4 Asepsis
To flip or not to flip? Are there occasions within your OR when 'flipping' is carried out? Discuss this issue with your facilitator.
Work with your facilitator to practice opening techniques of sterile bundles, instrument trays and additional sterile items.
Whilst opening a wrapped steam sterilised item, you notice the outer chemical indicator has not changed colour. What does this mean? How will you manage this situation? Record your answers in the Activity section.

KEY POINTS: OPENING STERILE SUPPLIES AND MANAGING THE ASEPTIC FIELD

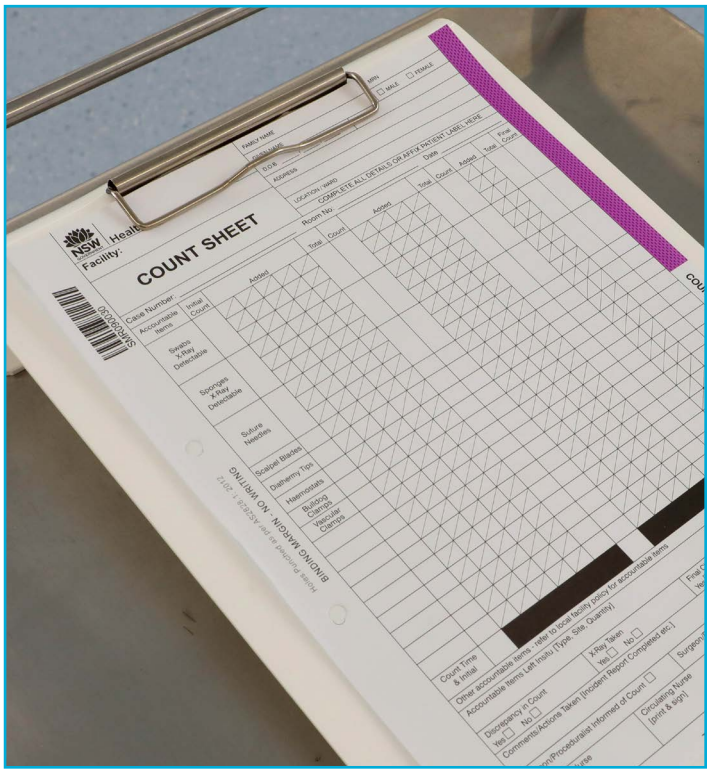
- Check sterile packages for integrity – if in doubt, do not use.
- Check external sterility indicators to ensure the item has been sterilised.
- Open items ensuring contamination does not occur during the process of opening or transferring the item to the aseptic field or the instrument nurse.
- Always face an aseptic field and keep a safe distance.
- Do not walk between two aseptic fields.
- Do not reach across aseptic field when opening items or pouring fluids.
- Always monitor an aseptic field for contamination by unscrubbed personnel and never leave it unattended.
- If sterility is compromised, report it immediately and take corrective action to discard the contaminated item.

Management of accountable items

Prior to the commencement of surgery, all accountable items readied for use during the procedure must be counted and documented on the count sheet (see Figure 4-8). The importance of counting procedures was illustrated in the case of *Langley & Another v Glandore Pty Ltd (in liq) & Another* (see Hamlin et al. 2016, page 78, and Component 2). This negligence case involved a sponge inadvertently retained inside a patient during a hysterectomy. Initially the surgeons were found to be negligent, however, on appeal by the surgeons it was determined that the instrument and circulating nurses were 'primarily' responsible for the count and therefore were also negligent. This case illustrates the importance of adhering to policies and procedures related to managing accountable items. In NSW public hospitals, the procedures for counting are detailed in NSW Health policy PD2013_054 *Management of instruments, accountable items and other items for surgery or procedures.*

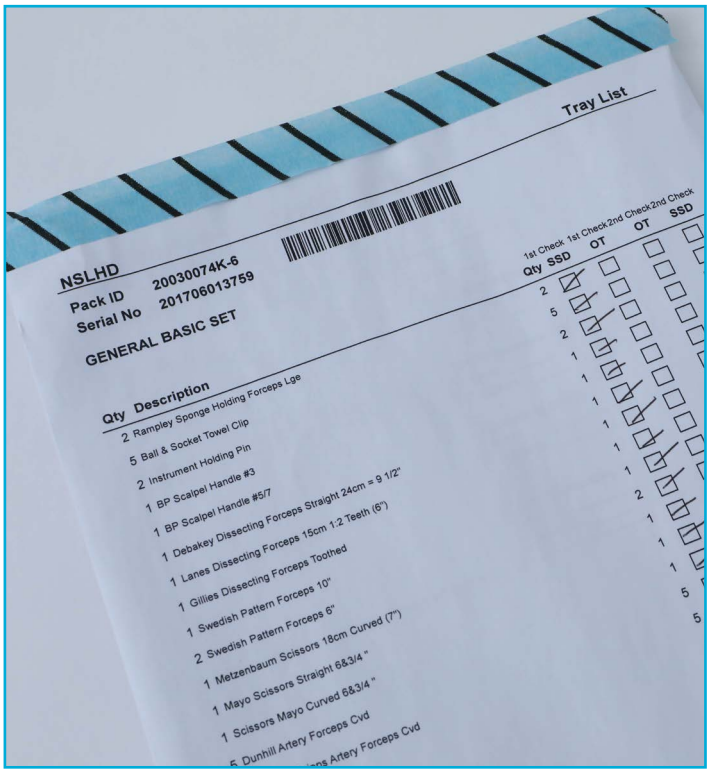
In addition to counting items such as swabs, sponges and sutures, the instrument nurse requires the circulating nurse to check the instrument tray with her/him prior to the commencement and at the conclusion of the procedure. The tray list that accompanies the instruments is used to check the tray for completeness and is kept for return to SSD or as per local policy (see Figure 4-9).

Figure 4-8. NSW Health count sheet



Source: NSW Health 2017

Figure 4-9. Sample of tray list (NSLHD)



Source: NSW Health 2017

READ

NSW Health (2013) NSW Health policy PD2013_054 Management of instruments, accountable items and other items for surgery or procedures.
Read Sections 1 – 4 to identify the basic principles of the count. Read Section 5.1 and 5.2 on instruments trays.

KEY POINTS: COUNTING

- The count must be carried out by two nurses, one of whom must be an RN.
- Counting of items is carried out aloud, simultaneously by both nurses.
- A minimum of two counts (prior to commencement of procedure and at skin closure) must be performed – a third count is performed when a body cavity has been opened.
- All counts are documented on a paper based 'count sheet'.
- Additional accountable items must be counted and documented – the instrument nurse should visualise the count sheet to ensure documentation is correct.
- Any discrepancy in the count must be notified to the surgeon and managed according to NSW Health policy PD2013_054 *Management of instruments, accountable items and other items for surgery or procedures.*

(NSW Health, 2013)

Sterile cockpit

Sterile cockpit describes an aspect of non-technical skills used in aviation to convey to the flight crew the need to concentrate on a critical point in the flight and refrain from distracting behaviour or 'chatter' (Hamlin et al., 2016). An example in aviation would be preparing to take off or land the plane. The term has relevance within the perioperative environment when the team requires full concentration at critical moments during the intraoperative phase. The surgical count is one example when the instrument and circulating nurses require a 'sterile cockpit' to concentration wholly on the count without distraction from other activities. Further examples of activities requiring a sterile cockpit are during the induction of and emergence from anaesthesia and in unexpected intraoperative bleeding.

Transferring into OR

The count is completed and the instrument nurse has set up all instruments and equipment. Mr Rubin is wheeled into the OR accompanied by the anaesthetic team. As circulating nurse, you provide assistance to the team in transferring Mr Rubin safely onto the OR table which already has the patient return electrode mattress in place. Once Mr Rubin is anaesthetised, you rearrange the blankets with the anaesthetic nurse, exposing only the area that requires skin preparation. This helps preserve normothermia and dignity.

ACTIVITY

4-5 Patient positioning
Revisit the section on patient positioning in Component 2. How will Mr Rubin be positioned for his surgery? Identify four main safety issues to consider and why. Complete your answer in the Activity section.

VTE risk assessment

Part of Mr Rubin's preoperative preparation is to assess and manage his venous thromboembolism (VTE) risk. VTE is a preventable surgical complication; however, it remains a significant cause of post-operative mortality and morbidity. Mr Rubin is aged >60 years, putting him at increased risk of VTE (Hamlin et al, 2016). He has been fitted with graduated compression stockings (GCS). You and the anaesthetic nurse also fit intermittent pneumatic compression devices to his calves and turn them on.

READ

Hamlin et al. (2016) Chapter 9, pp 251-254 on the Prevention and management of VTE

NSW Health (2014) NSW Health Policy Directive PD2014_032, Prevention of Thromboembolism
http://www1.health.nsw.gov.au/pds/ActivePDSDocuments/PD2014_032.pdf
Read Sections 2.4.4 – 2.5.5 about anaesthesia and VTE, and mechanical prophylaxis

Victorian Institute of Forensic Medicine (2017) – Clinical Communique.
This edition is devoted to coronial inquests into deaths associated with VTE. Whilst all the readings are interesting, concentrate on Case 1, Mr SM as it highlights a number of nursing issues related to observations and the unrestricted use of oxygen.
http://vifmcommuniques.org/wp-content/uploads/2017/03/Clinical-Communique-Vol-4-Issue-1.pdf

'Time out'

Prior to commencement of Mr Rubin's surgery, the surgical team participate in 'Time Out' to ensure that all aspects of the Surgical Safety Checklist have been completed. The time out check is documented according to local policy. Any discrepancies must be resolved prior to surgery proceeding.

'Time Out' is completed and Mr Rubin's surgery can commence.

Skin antisepsis

Skin antisepsis is undertaken to mechanically kill and inhibit transient and resident microorganisms that may cause a surgical site infection (SSI) (Hamlin et al, 2016). The surgeon usually carries out skin antisepsis, however, this task may be delegated to the instrument nurse. Skin antisepsis (or 'prepping') is carried out using swabs soaked in the preferred antiseptic solution using sponge holding forceps or a commercially produced sterile disposable applicator incorporating an antiseptic solution (see Figure 4-10). Prepping commences at Mr Rubin's proposed incision site (cleanest) and progresses in increasing circles/squares outwards (to less clean).

Skin preparation

The two surgeons have completed their scrubbing, gowning and gloving procedure and are ready to prepare Mr Rubin's skin with antiseptic solution. The body hair adjacent to Mr Rubin's proposed skin incision has been removed in the pre-admission ward using clippers. Hair removal can be a source of SSI and should be actioned as close to the time of surgery as possible to reduce the risk for microbial growth in breaks in the skin (ACORN, 2017).

Figure 4-10. Left to right: skin antisepsis using disposable applicator; prep solutions

Source: © Becton Dickinson and Co. Reprinted with permission; NSW Health 2017

The following readings describe the solutions and technique used in skin antisepsis, and the principles of draping.

READ

Hamlin et al. (2016) Chapter 6, pp 149-150, Skin preparation of the patient

ACORN (2018) Standard on Preoperative patient skin antisepsis.

KEY POINTS: PREPPING

- Pre-operative hair removal must be carried out as close to surgery as possible, prior to entry to the OR.
- Hair removal must be carried out using disposable clippers.
- Aseptic technique must be used when 'prepping'.
- Prepping commences at the proposed incision site (cleanest) and progresses in increasing circles/squares outwards (to less clean).
- Procedure is repeated 2–3 times using a new swab/applicator each time.
- The area prepped must be large enough to facilitate extension of the incision if required.
- Follow the principle of working from cleanest to dirtiest: areas of higher microbial count are prepped last.
- Avoid excess prep solution from pooling under the patient – this can cause skin damage. An absorbent pad should be used to soak up excess solution. This is removed prior to draping.
- The 'prep' swabs are part of the surgical count and must be retained for counting.
  NB: The selection of prep solution will depend on patient sensitivities, type of surgery and surgical site e.g. when prepping for eye surgery and other sensitive mucous membranes, care must be taken to use a solution that will not damage the sensitive membranes.

(Hamlin et al., 2016)

Draping

Following prepping, the surgeons use aseptic technique to open and place the drapes, creating an aseptic field exposing only the surgical site and covering the whole patient. In Figure 4-11, note the configuration of the drapes, commonly called 'square draping'. This refers to the use of four drapes (two large drapes covering the top and lower areas of Mr Rubin, with two drapes either side of the body) to create a 'square' around the operative site. The drapes are disposable and made of a synthetic, water repellent material. They are secured to the patient with adhesive strips. The top drape is extended out over Mr Rubin's arm which has been secured on an arm board to allow the anaesthetist IV access.

Figure 4-11. Example of abdominal square draping

Source: © Healthcare Purchasing News

KEY POINTS: DRAPING

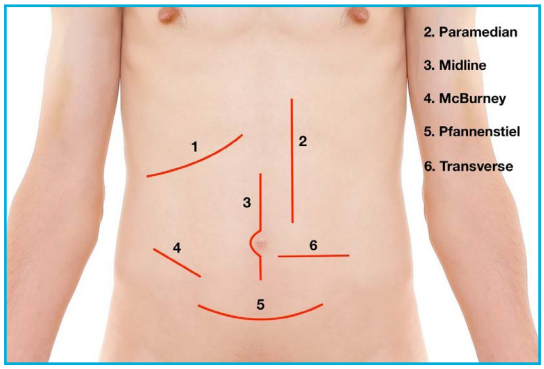
- Draping creates an area called an aseptic field.
- Sterile drapes arranged in a certain position maintains the sterility of surfaces on which sterile instruments and gloved hands may be placed.
- Objects draped may include instrument tables, 'splash' bowls and Mayo stands, and some surgical equipment.
- The patient is draped in a way that exposes the prepared incision site.
- Handle drapes a little as possible to avoid air currents and dispersing dust particles.
- Hold drapes above the waist to comply with aseptic principles.
- Once drapes are placed, they should not be moved.
- 'Cuff' drape with hands to reduce risk of touching unsterile equipment whilst draping.
- Drapes are placed from the incision site to the periphery.
- Use disposable, moisture resistant drapes: more efficient microbial barrier. (Hamlin et al., 2016)

Incisions and wound healing

There are a number of abdominal incisions that are used to access internal organs and structures (see figure 4-12). The surgeon will select an incision that will provide the best access to the organs/ structures to be operated on. Other considerations when planning a surgical incision include:

- Can the incision be extended if required?
- Will the incision provide rapid access to the abdomen in an emergency?
- Will the incision minimise damage to local nerves and blood vessels?
- Can a strong wound closure be achieved, minimising risk of wound dehiscence?
- Will the incision provide a good cosmetic result for the patient?

Figure 4-12. Incision site for right open inguinal hernia repair



Source: © Medical Exam Prep

READ

Hamlin et al (2016) Chapter 11, pp 306-309, Surgical incisions.
In particular, note the muscles of the anterior abdominal wall in Figure 11-4. Also note the large incision shown in Figure 11-3. Many of these are not in common use, but Mr Rubin's incision is listed as 'V – inguinal'.

ACTIVITY

4-6 Skin incision
Using the information from the above reading, describe the incision used for Mr Rubin's surgery. Complete your answer in the Activity section.

Wound management

Wound healing is a complex physiological process, requiring understanding of anatomy, physiology and factors that assist in tissue repair. The following reading provides a description of wound healing and the classification of wounds, commonly seen in the OR.

READ

Hamlin et al. (2016) Chapter 5, p 114, Manual Handling; also Chapter 9, pp 233-236, Patient transfer.
These readings review manual handling and the needs of bariatric patients (Feature Box 9-1).

ACORN (2018) Position statement on safe manual handling.

ACTIVITY

Hamlin et al. (2016) Chapter 11, pp 304-305 and pp 309-315 on wounds, their classification and factors affecting wound healing

Sydney Children's Hospital Network (2014) Practice Guidelines for Wound Assessment and Management, Section 1.1 – 1.3 on the stages of wound healing, wound repair management and general principles.
https://www.aci.health.nsw.gov.au/__data/assets/pdf_file/0003/304167/2014_Wound_assessment_and_management_CHW.pdf

Perioperative nurses require a sound understanding of wound healing, wound closure devices and dressings, as the initial management of the patient's wound commences on the operating table.

Sutures

The goal of wound closure is to approximate the wound edges, eliminate dead space (which can be a focus for haematoma formation) and evenly distribute tension along the wound edges: this results in a strong closure (Hamlin et al, 2016). A large variety of suture materials are used in surgery and building knowledge of all products takes time and experience.

Suture material is made of synthetic or natural materials; is mono filament or multi filament; absorbable or non-absorbable. Their use depends on the tissue to be sutured, the surgeon's preference, and product availability.

The following two readings provide descriptions of sutures used in surgery and wound closure, together with other methods of wound closure.

READ

Hamlin et al (2016) Chapter 11, pp 319-321 on Wound closure. Chapter 10, pp 281-291 on Sutures and Needles.
You will note an extensive table of suture materials and Figure 10-15 (p 285) which shows the suture material gauge.

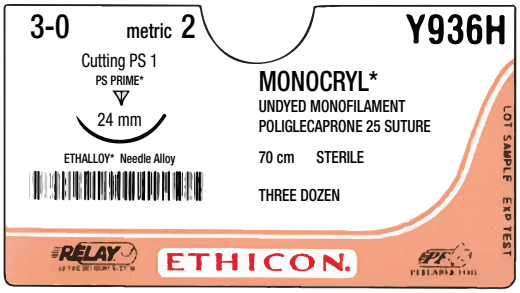
Ethicon, Chart of sutures and their properties
http://slideplayer.com/slide/5383717/17/images/44/The following+charts+explain+the +range+of+suture+products+and +the+product+attributes+forETHICON+Products+and its+competitors.jpg

ACTIVITY

4-7 Sutures
Select six types of suture in common use within your OS and complete the table in the Activity section. Work with your facilitator on this activity.

Both circulating and instrument nurses require a thorough knowledge of suture materials, their use and handling techniques. Circulating nurses must be able to locate and open the correct suture when requested by the instrument nurse. It takes practise to understand the request e.g. '3-0 Monocryl on 24mm cutting needle', and locate the suture (see Figure 4-13). Review the packaging below and local examples to locate the relevant information on the suture box.

Figure 4-13. '3-0 Monocryl on 24 mm cutting needle' and suture rack



Source: Hamlin et al. 2016, NSW Health 2017

KEY POINTS: SUTURE BASICS 3-0 Monocryl on 24mm cutting needle

- '3-0' refers to the size of the suture (the thickness).
- 'Monocryl' is the brand name of the synthetic, monofilament suture material.
- '24 mm cutting needle' refers to the size and type of needle attached to the suture. The cutting needle is shown as the diamond shaped symbol (this suture is an accountable item and requires documentation on the count sheet).
- The suture boxes containing the suture packets are colour coded to aid recognition.

Due to the variety of sutures used, education should be obtained from your facilitator, senior staff and the company representative for the brands of suture material available in your facility.

Intraoperative progress

Mr Rubin has been prepped and draped, and the instrument nurse now moves the instrument table into position. Suction tubing, diathermy leads and surgical plume evacuation tubing are handed off to you for connection to the equipment which are then activated. Settings for the diathermy are confirmed in accordance with surgeon's preferences: you make adjustments as necessary to the diathermy machine and verbalise same, confirming that the request has been carried out.

The start of a procedure is a crucial period and you, as the circulating nurse, must focus on ensuring all equipment is attached correctly and functioning. You must also be alert for any requests from the surgical team for additional sterile items or changes in equipment settings.

The surgeon asks the instrument nurse for 0.5% bupivacaine local anaesthetic to infiltrate Mr Rubin's wound at the conclusion of the procedure as part of post-operative pain management. The instrument nurse asks you to open the medication.

The following readings provide a detailed description of the management of medications in the perioperative environment and provide examples of labelling used on medications and other solutions.

READ

Hamlin et al. (2016) Chapter 3, pp 63-65, Medication Management.
Note Figure 3-5 for examples of labels

ACSQHC (2015) National Standard for User-applied Labelling of Injectable Medicines, Fluids and Lines Section 6, pp 25–30 Labelling in Perioperative Areas
https://www.safetyandquality.gov.au/wp-content/uploads/2015/09/National-Standard-for-User-Applied-Labelling-Aug-2015.pdf

ACTIVITY

4-8 Managing medication
How will you manage the instrument nurse's request?

- Identify at least four items you will need to open for the instrument nurse to complete preparation and administration of the medications.
- Describe the labelling requirements for medications opened onto the aseptic field.
- Describe how you will ensure the safe transfer of a medication from an unsterile ampoule.

Record your answers in the Activity section. You may wish to review this topic covered in Component 2.

Closing count

The procedure has gone to plan and the surgical team are ready to close Mr Rubin's wound using sutures to promote healing by primary intention. The instrument nurse asks you to prepare to undertake a closing count.

ACTIVITY

4-9 Managing accountable items
Describe how you will prepare for and carry out the counting procedure with instrument nurse. Complete your answer in the Activity section.

Procedure completion

The instrument nurse removes their gown and gloves, checks and signs the count sheet and other documentation as per local policy. They then accompany Mr Rubin and the anaesthetist into PACU, where both will provide their individual clinical handovers.

Re-establishing the environment between patients

After Mr Rubin has left the OR, there are a number of tasks for you, as circulating nurse, to complete in readiness for the next patient, Ms Maria Diaz. The changeover time between patients is generally only a few minutes and good communication and teamwork between you and the anaesthetic team is vital to ensure Ms Diaz does not enter the OR until the environment is ready.

KEY POINTS: RE-ESTABLISHING THE ENVIRONMENT BETWEEN PATIENTS

- Ensure all waste/recycling are removed from the OR (ancillary staff may assist depending on local policy).
- All documentation (paper and computer) relating to Mr Rubin are removed or closed: this will avoid any confusion with subsequent patients.
- Any equipment not required for the next patient is removed. The floors are mopped (managed by the ancillary staff as per local policy).
- Spot cleaning of surfaces as per local policy – remember to wear PPE.
- Empty the suction and replace with new liners.

Minimally Invasive Surgery (MIS)

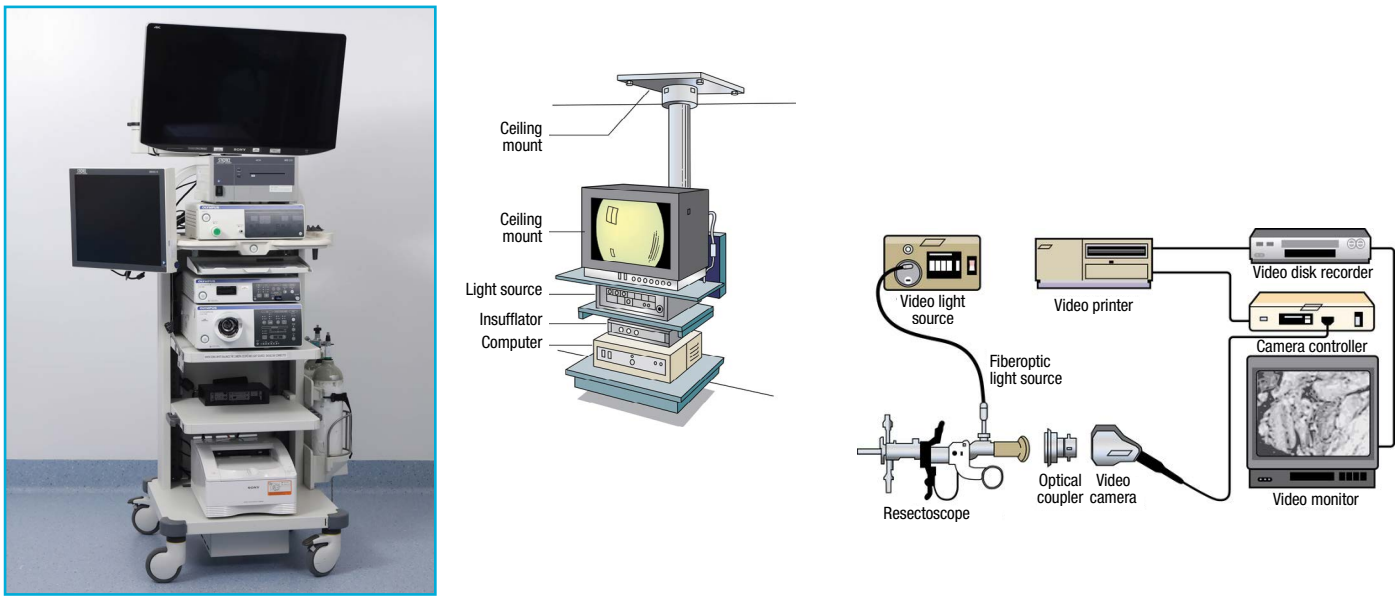
The next patient on the operating list is Ms Maria Diaz, 46, who is to undergo a laparoscopic cholecystectomy. This is termed 'minimally invasive surgery', a technique that has advanced surgery, allowing surgeons to access most areas of the body using small 'keyhole' incisions and perform surgery using specialised equipment. The advantages to the patient are many and include:

- smaller incisions – several small ‘keyholes’ as opposed to large skin incisions
- less trauma to tissue, and strong wound closure
- shorter recovery times and return to normal activities
- decreased post-operative pain (Hamlin et al, 2016).

For the perioperative team, additional equipment will be required for Ms Diaz’s surgery in order to carry out her procedure laparoscopically. Figure 4-14 shows the endoscopic equipment ‘tower’ containing:

- monitor (for surgical team to view operative site via camera)
- light source (to attach to endoscope and camera for visualisation)
- insufflator (to produce a pneumoperitoneum)
- computer to record and document procedure.

Figure 4-14. Endoscopic equipment ‘tower’ and set up



Source: NSW Health 2017; Phillips 2013

MIS instrumentation

Access to Ms Diaz’s abdomen will be via a series of small incisions (3 – 5), strategically placed to allow the insertion of cannulae through which cannulated instruments (graspers, scissors, telescopes, light source/camera) will be introduced. The surgeon will first insert an insufflation needle into Ms Diaz’s abdomen and create a pneumoperitoneum using carbon dioxide gas delivered via sterile tubing from the insufflator on the laparoscopic tower. Creating a pneumoperitoneum ensures that internal abdominal organs are not damaged when the laparoscopic instruments are introduced into the abdomen and also enables the surgeon to visualise the operative site.

As circulating nurse, you are responsible for attaching the insufflation tubing and activating the carbon dioxide gas. As additional incisions are made and instruments inserted into Ms Diaz’s abdomen, you will also connect the camera and light leads to the tower. Diathermy and suction will be connected as required. The instrument nurse is responsible for ensuring all the cannulated instruments are ready for use and checks the insulation on each. Any cracks in the insulation have the potential to cause patient burns internally and externally when diathermy is activated and should not be used.

The following reading provides a detailed description of the instruments an equipment used in laparoscopic surgery.

READ

Hamlin et al. (2016) Chapter 10, pp 291-300
Note Figure 10-37 (pp 299) showing a typical OR set up for MIS. This may vary between ORs depending on the extent of surgery.

ACTIVITY

4-10 MIS equipment
Work with your facilitator to locate the endoscopic equipment used within your OS. Familiarise yourself with the components of the ‘tower’.

Intraoperative progress

Ms Diaz has been transferred to the operating table and anaesthetised. The surgeon has requested she be placed in the reverse Trendelenburg position.

Ms Diaz's surgery is progressing well and the surgeon has removed the gall bladder. The instrument nurse asks you to prepare to receive the gall bladder as a specimen for transport to pathology department.

READ

Hamlin et al. (2016) Chapter 9, pp 244-245, Patient Positioning.

ACTIVITY

4-11 Patient positioning
Why has the surgeon requested reverse Trendelenburg position for Ms Diaz? What specific safety measures will be taken for Ms Diaz? Complete your answers in the Activity section.

Management of specimens

The correct handling of surgical specimens is a responsibility shared by the surgeon, instrument and circulating nurses. The surgeon must identify the specimen and indicate how it is managed. Some specimens will require placing in a formalin fixative solution, some will be placed in a dry container and sent immediately to pathology or microbiology and some specimens will be placed in saline (see Figure 4-15 for specimen jars).

Errors in the handling or mislabelling specimens can result in harm to the patient, misdiagnosis, and may necessitate further surgery (ACORN, 2018; Hamlin et al., 2016).

Figure 4-15. Specimen jars

Source: NSW Health 2017

READ

Hamlin et al. (2016) Chapter 9, pp 263-264, Collection of specimens.

ACORN (2018) Standard on Specimen identification, collection and handling

KEY POINTS: HANDLING SPECIMENS

Instrument nurse

- Confirm name of specimen and fixative solution with surgeon.
- Communicate information to circulating nurse.
- Verbalise patient identification and details of specimen with circulating nurse prior to handing off specimen.
- Manage specimens one at a time.

Circulating nurse

- Receive details of specimen name and fixative solution from instrument nurse.
- Obtain container appropriate to size of specimen and fixative solution required.
- Prepare patient identification label.
- Affix label to container prior to receiving specimen.
- Verbalise identification details with instrument nurse.
- Don PPE and receive specimen from instrument nurse without contaminating aseptic field.
- Seal container.
- Complete documentation according to local policy – this will require a pathology request (paper or computer) prepared by the surgeon.
- Transport specimen to collection area in OS and complete documentation according to local policy.

ACTIVITY

4-12 Specimen management
In the Activity section:

- List the identification checks you and the instrument nurse will carry out prior to the specimen being placed in the container?
- Why is it important to label the specimen container prior to receiving the specimen from the instrument nurse?

Ms Diaz's surgery has been completed successfully and she is now in PACU.

Following the completion of Ms Diaz's procedure, the team leader informs you that you will be working in the role of instrument nurse for the cases on the following theatre list.

Virtual Operating List – OR 2

Patient	Age	MRN	Surgical procedure	Comments
Jill SIMPKIN	85	95420714	Carpal tunnel release on right hand	Tourniquet required
Sanjay KUMAR	56	92348761	Excision of melanoma from left thigh	Weighs 180kgs BMI 35

Instrument nurse actions

Setting up the OR environment

The circulating nurse reviews the operating list with you, noting that Mrs Simpkin will require a tourniquet for her procedure. You also note the second patient, Mr Kumar, weighs 180kg.

This information alerts you to ensure that specialised equipment will be required:

- A tourniquet cuff for Mrs Simpkin's tourniquet: locate and check this prior to use
- Bariatric equipment: check the operating table is appropriate for a bariatric patient (see Figure 4-16) and consider the manual handling aids required for Mr Kumar to ensure safe transfer and positioning. The most commonly used is an air assisted lateral transfer device (brand name HoverMatt™). You ask the operating theatre assistant to ensure a transfer device is available prior to Mr Kumar's arrival in the OR.

You have noted that Mrs Simpkin is 85. The ageing process produces numerous physiological changes which affect all body systems. Thorough pre-operative patient assessment is required to plan the perioperative management of the patient. The following reading provides an overview of the perioperative considerations for elderly patients.

Figure 4-16. Operating table weight rating

Source: NSW Health 2017

READ

Hamlin et al. (2016) Chapter 8, p 227, Table 8-7, Patient care considerations and the ageing process.

Oster, K. & Oster, C. (2015) Special Needs Population: Care of the Geriatric Patient Population in the Perioperative Setting.

AORN Journal. http://onlinelibrary.wiley.com/doi/10.1016/j.aorn.2014.10.022/full

Preparing for and meeting the patient

You visit Mrs Simpkin in the anaesthetic bay. She is talking with the anaesthetic team and is asking questions about the anaesthetic procedure. Due to chronic emphysema, she will undergo her procedure under a regional block, which involves infiltration of the axillary nerves with local anaesthetic. This will numb her forearm and hand allowing painless surgery whilst Mrs Simpkin remains awake during the procedure.

You introduce yourself to Mrs Simpkin and check her identification. You note the site marking is present on her right wrist. In doing so, you see that she is thin and her skin may be prone to tearing. This alerts you to ensure extra pressure relieving aids are present for positioning Mrs Simpkin on the operating table, and to place extra padding under the tourniquet.

You return to the OR to check your set up and ensure all additional equipment is present.

The circulating nurse commences opening the sterile supplies, whilst you start your surgical scrub.

Mrs Simpkin is carefully transferred and positioned on the operating table with the team avoiding shearing forces which may lead to skin tears. All potential pressure points are padded and extra padding is placed around her upper right arm prior to the applying the tourniquet. You ask the circulating nurse to document these actions.

The anaesthetic team are monitoring Mrs Simpkin and talking to her about the actions that are taking place around her.

Checking the instrument set up

The instrument nurse is responsible for ensuring that all items required for surgery have been located and assembled. This task may initially be carried out by ancillary staff working in the sterile stockroom (depending on local policy), however, as instrument nurse, you need to ensure that the set ups for Mrs Simpkin and Mr Kumar are correct prior to scrubbing, gowning and gloving. If items are missing this may lead to a delay in surgery and compromise patient safety.

All instruments and equipment are correct and the circulating nurse begins to establish the OR environment ready for Mrs Simpkin. The operating theatre assistant delivers the tourniquet into the OR as requested and the circulating nurse is checking to ensure it is working correctly.

Surgical scrub

Prior to surgery and entering the aseptic field, you and the surgical team must perform surgical hand antisepsis and don sterile gown and gloves. The surgical scrub is performed using either a fast acting broad spectrum antimicrobial solution e.g. povidone-iodine, or aqueous chlorhexidine, or an alcohol based scrub solution (see Figure 4-17). The scrub procedure differs for each solution and you will need to become familiar with each of them.

There are several basic principles related to each surgical scrub and the following readings provide these points.

Figure 4-17. Surgical scrubs

Source: NSW Health 2017

READ

Hamlin et al. (2016) Chapter 6, pp 146-149, The surgical scrub.

ACORN (2018) Standard on Surgical hand antisepsis, gowning and gloving.
In particular, note Appendices A, B and C for scrub procedures.

ACORN *Asepsis, Gowning and Gloving*. www.acorn.org.au
Access to the video is for NSW OTA members: check with your facilitator.

ACTIVITY

4-13 Surgical hand antisepsis
In the Activity section, list six actions you will take to prepare yourself prior to commencing the surgical hand antisepsis procedure.

Gowning

Sterile disposable gowns provide the most effective barrier against the transfer of microorganisms to the patient, ensuring the integrity of the aseptic field. The gowns also provide protection for the wearer against blood and body fluids (ACORN, 2018). A variety of sterile gowns are available: the range in your OS will depend on local policy and purchasing. Reusable linen and reusable microfibre products are also available.

Figure 4-18. Opening a sterile gown pack

Source: NSW Health (2017)

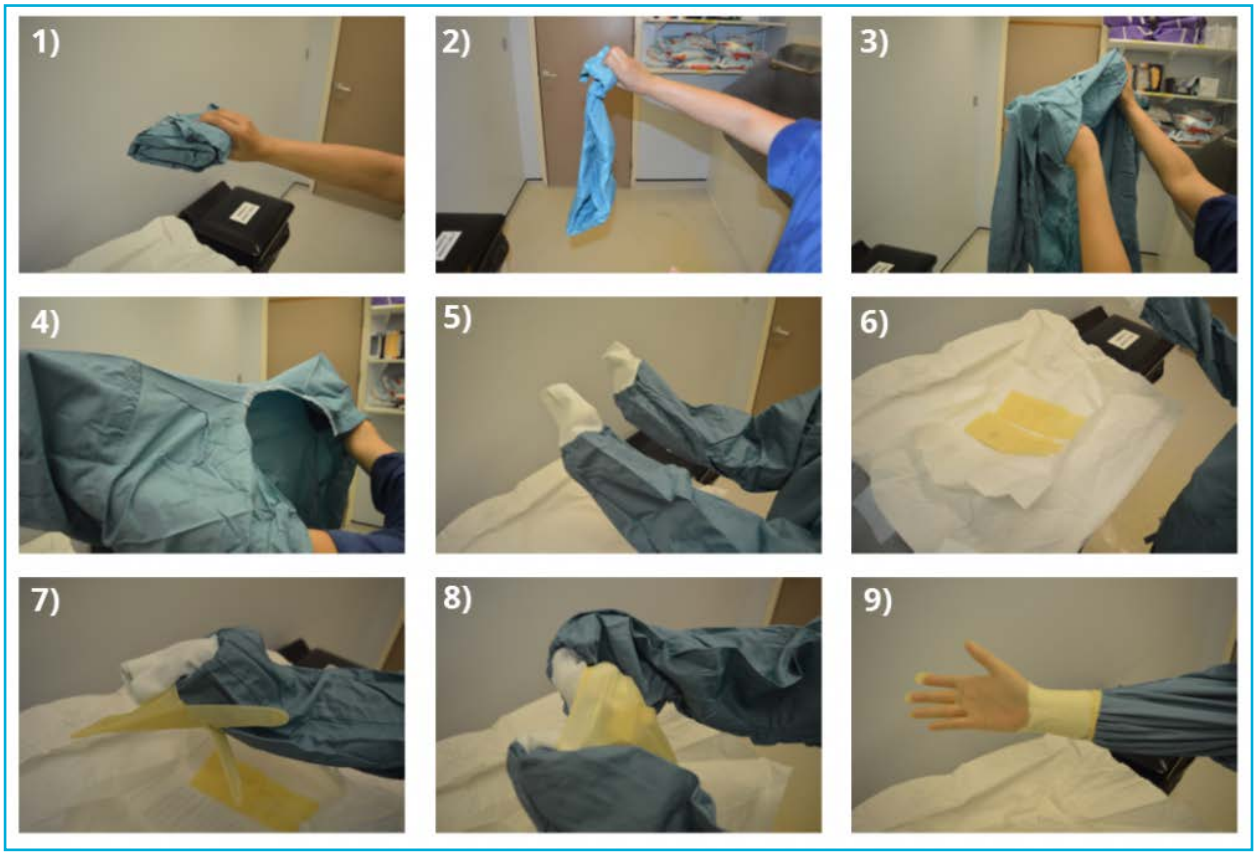
Gowns are folded to allow the inside surface to be handled during the donning procedure (see Figure 4-18). Tapes or grip fasteners at the back of the gown allow an unscrubbed person to fasten without compromising the sterility of the gown. As soon as possible after donning gown and gloves, the gown should be 'turned' and secured by the side tape to ensure the back of the gown is closed. The gown is considered aseptic from the chest/nipple level to the operative field (or table level) in the front and from below the elbow crease to gloved fingertips. Care should be taken when moving around the aseptic field to avoid contamination and if any doubt exists as to the integrity of the gown, both gown and gloves must be changed (see Figure 4-19).

Gloving

The closed method for donning sterile gloves is recommended and it is important that the cuff of the gown is covered by the glove at all times (ACORN, 2018; see Figure 4-19).

The practice of double gloving for procedures is recommended to reduce perforation injuries (by needles, drills etc.) and the risk to healthcare staff of exposure to blood-borne pathogens. Double gloving may also reduce the patient's risk of surgical site infection (ACORN, 2018).

Figure 4-19. Donning gown and closed gloving



Source: © TeachMeSurgery

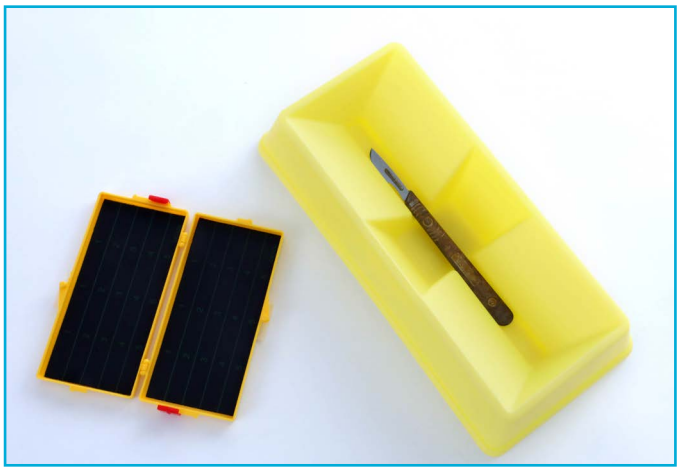
Setting up instruments and equipment

Once gowned and gloved, you can now begin setting up your aseptic field in preparation for surgery. Setting up the aseptic field (the instrument table for a procedure) depends on the complexity of the surgery and the types of instruments and additional equipment required. Your facilitator and experienced perioperative nurses will provide guidance for setting up for different procedures. Each OS has standardised procedures for setting up the instrument table. Standardising the set-up procedure assists staff in knowing where commonly used instruments are at all times. This is important in an emergency when instruments need to be located quickly, or if another instrument nurse takes over the procedure, and is ergonomically efficient.

Designating an area where all sharps are segregated from other instruments and equipment will minimise the risk of injury.

The most common instruments used to commence a procedure are the scalpel (placed in a puncture proof container, see Figure 4-20), a pair of forceps, and scissors, commonly known in the perioperative environment as the 'knife, fork and spoon'. These may be placed on a Mayo stand for ease of access (see Figure 4-21).

Figure 4-20. Puncture proof containers



Source: NSW Health 2017

Figure 4-21. Mayo stand

Source: © Medline Industries Inc.

In addition to the local procedures for setting up the instrument table, there are several key principles to consider which can be used for most types of surgery.

KEY PRINCIPLES: SETTING UP FOR A PROCEDURE

- Understand the procedure including the anatomy of the operative site and the sequence of surgery: this will enable you to anticipate the surgeon's requirements for instruments, sutures etc.
- Know the name and use of the instruments for a procedure.
- Check the instruments are working prior to their use.
- Handle sharps carefully, when loading and unloading scalpel blades and sutures.
- Set up instruments in the order in which they will be used .
- Decide which side of the patient you will position your instrument table: this will determine how you will set up the instruments.
- Know how to pass the instruments correctly: the instrument needs to be placed directly into the surgeon's hand without their need to re orientate the instrument prior to use. This allows the surgeon to focus on the surgical site.

Hamlin et al. (2016)

Instruments

Instruments can be broadly categorised according to their functions:

- cutting and dissecting
- grasping or holding
- clamps
- retractors
- other: accessory instruments.

Individual instruments from each category are grouped into trays designed for specific surgical procedures, e.g. general, Caesarean section, plastics, eyes, orthopaedic, paediatric etc. (see Figure 4-22). Instruments are often named after the surgeon who invented them, for example, Halstead forceps, Metzenbaum scissor, Langebeck retractor. It may be hard to remember the instruments initially, so invest time with your facilitator to increase familiarity with the instruments and their purpose: this is as important as knowing the name.

Figure 4-22. Instrument tray

Source: NSW Health 2017

One of the best way to learn the names, the uses, and the correct way to pass the instruments is to work with your facilitator using a tray of instruments, the tray list and instrument catalogues. A tray list identifying all instruments accompanies each tray and is located within the tray. The tray list is used by the instrument and circulating nurses to check the tray contents for completeness at the beginning and end of surgery.

The patient's surgical outcome depends on the instruments working correctly and effectively every time they are used by the surgeon. Surgical instruments are precision crafted and caring for them correctly helps to ensure safe patient care. Whilst the reprocessing of the instruments takes place in the Sterilising Services Department by specially trained personnel, the instrument nurse plays a vital role in the care of the instruments during and immediately after the surgical procedure.

The following reading provides a comprehensive description on the layout of the instrument table, classification of instruments, how to pass them, and instrument care.

READ

Hamlin et al. (2016) Chapter 10 pp 270-281, Surgical intervention.
Figures 10-12 and 10-13 provide an example of how instruments can be set up on the instrument table. This is a lengthy reading: work with your facilitator to obtain the instruments mentioned. Practice handling and passing them.

ACTIVITY

4-14 Instrument categories
Complete the table in the Activity section on categories of instruments.

Tourniquet

A tourniquet is a constricting device used to control blood flow to part of an extremity for a period of time. Pressure is applied circumferentially via a cuff and is maintained by a tourniquet machine (see Figure 4-23) for the required period to provide a bloodless operative field. Tourniquets require care to ensure patient safety, as complications can occur. The following reading provides a detailed description on safe use of tourniquet, correct pressures and possible complications.

READ

Hamlin et al. (2016) Chapter 9, pp 259-260, Tourniquets.

ACORN (2018) Guideline on the use of pneumatic tourniquet.

ACTIVITY

4-15 Tourniquet

Locate the tourniquet equipment used in your OS. Review its use with your facilitator to ensure you are familiar with its functions.

Observe the placement of a limb tourniquet, then answer the following questions in the Activity section:

- identify the specific steps taken in applying the tourniquet
- identify four risks specific to the use of a tourniquet and explain how you will prevent these risks from occurring.

KEY POINTS: USING A TOURNIQUET

- Check equipment is functioning prior to surgery, including alert alarms.
- Select tourniquet cuff appropriate to the size of the patient's limb
- Apply tourniquet correctly: according to manufacturer's instruction and local policy.
- Ensure the correct amount of pressure is used appropriate to the patient and surgical procedure.
- Monitor maximum inflation time.
- Document the location of the tourniquet, and the time applied and removed.
- Observe patient's skin integrity on removal of tourniquet cuff.

Figure 4-23. Tourniquet machine

Source NSW Health 2017

Haemostasis

The tourniquet is one method of haemostasis used in surgery. Securing haemostasis and preventing bleeding during surgery is important to ensure the patient does not suffer the physiological effects of blood loss, and to allow the surgeon to visualise the surgical field. Surgical haemostasis is the 'deliberate halting of blood flow' (Hamlin et al, 2016) and there are a number of methods used to achieve this including:

- mechanical
- adjuncts to mechanical haemostasis
- chemical
- energy-based.

The following reading provides an overview of the above methods of haemostasis.

READ

Hamlin et al. (2016) Chapter 11, pp 315-319, Surgical haemostasis.

ACTIVITY

4-16 Haemostasis

Consider examples of mechanical, chemical and energy based methods of haemostasis and complete the table in the Activity section.

'Time Out' has been completed by the team. The tourniquet has been applied and Mrs Simpkin's arm is resting on a special arm table attached to the OR table to facilitate access to her right hand and arm.

The surgeon has requested alcohol skin antiseptic solution to 'prep' Mrs Simpkin's surgical site.

Alcohol based skin antisepsis

Preoperative skin antisepsis ('prepping') with alcohol based skin antisepsis solutions has been shown to be more effective in reducing the risk of SSI and are used in many OS. Whilst the principles of prepping do not change when using an alcohol based skin antiseptic solution, there are some important safety points to note. Read the following Safety Information Sheet.

READ

NSW Health (2011) NSW Health Safety Information Sheet 001/11, Safe use of alcohol based skin preparations for surgical and anaesthetic procedures.
http://www.health.nsw.gov.au/sabs/Documents/2011-si-001.pdf
You will note there are very strict protocols which the OS and surgeons must comply with when using alcohol based antiseptic solutions.

ACTIVITY

4-17 Alcohol based skin antisepsis
What alcohol based antiseptic solutions are used in your OS? How are they stored and what safety precautions are followed when using the solutions? Record your answers in the Activity section.

Completion of procedure

Mrs Simpkin's procedure has been successfully completed. You and the circulating nurse have undertaken the count, which was correct. You have assisted to dress Mrs Simpkin's wound and the tourniquet has been released. You and the circulating nurse carefully check the skin under the tourniquet and as she is transferred onto her bed, you also check her sacral area and other potential pressure points. There is some redness on her upper arm which you will document and handover to PACU for observation. All other pressure points are intact.

Whilst the team prepares Mrs Simpkin for transfer to PACU, there are actions that you as an instrument nurse need to take in managing the waste and the instrument trays and equipment.

As instrument nurse, you should remain gowned and gloved until the drapes, other waste and the used instruments have been disposed. This will ensure you are not exposed to any blood or body fluids on these items. Local policy will guide you on the management of used instruments and their transfer to the SSD.

Removal of gown and gloves

The removal and disposal of your gown and gloves following the procedure takes place within the OR to avoid contamination of surrounding areas. The gown should be removed first to avoid contamination of the hands on the used gown, which may be heavily contaminated with blood or body fluids. The gloves should be removed in a manner that also avoids contamination. Work with your facilitator to practise the gowning and gloving donning and removal.

ACTIVITY

4-18 Patient handover
Following removal of gown and gloves, what are your responsibilities as instrument nurse in completing documentation and handover of Mrs Simpkin to PACU using ISBAR? Complete your answers in the Activity section.

Preparing for the next patient

Following your handover of Mrs Simpkin to PACU, you return to the OR to prepare for the final patient of the day. Mr Kumar is undergoing removal of melanoma from his left thigh. You note from the operating list that Mr Kumar weighs 180kg and has a Body Mass Index (BMI) of 35, placing him in the obese category. Mr Kumar's weight increases his risk of a number of conditions which need to be considered when planning surgery. The following reading provides an overview of the effects of obesity on the surgical patient.

READ

Hamlin et al. (2016) Chapter 7, p 176, Obesity; Chapter 8, p 228, Figure 8-8 on Conditions associated with the pathophysiology of obesity; Chapter 9, p 234, Feature Box 9-1, Transferring and positioning the bariatric patient

Monash University (2014) 'Surgery in the obese patients – a modern plague'
https://www.surgeons.org/media/23935890/2016-02-23_pre_w_brown_obese.pdf
This provides a good overview of the perioperative issues when caring for morbidly obese patients.

A full physical assessment was carried out with Mr Kumar during his pre-admission consultation. Any co-morbidities likely to affect his perioperative care will have been noted by the anaesthetist, who will plan the anaesthetic management accordingly.

From a surgical perspective, one of the main issues will be to ensure Mr Kumar is positioned safely on the operating table. You liaise with the operating theatre assistant to ensure that the operating table is suitable for Mr Kumar's weight and request that positioning aids, e.g. side extensions to widen the table, pressure relieving devices and manual handling aids, such as a HoverMatt™ are available to ensure safe care of Mr Kumar.

You visit Mr Kumar in the anaesthetic bay to introduce yourself, check his identification, and the site marking on his left thigh. Fortunately, the surgical site is anterior surface which will mean Mr Kumar can be positioned supine. Mr Kumar appears very anxious and keeps apologising for his weight, 'I know it makes it harder for you to look after me'.

ACTIVITY

4-19 Patient communication
How will you respond to Mr Kumar's comment? Complete your answer in the Activity section.

Intraoperative patient care

Mr Kumar has been transferred to the operating table using a HoverMatt™. Side extensions have been placed to ensure his body is completely supported on the operating table. An intermittent pneumatic compression device has been placed on his right (non-operative) leg to reduce risk of VTE and he will receive anticoagulant therapy post operatively.

You set up your instruments and carry out your initial count and instrument check with the circulating nurse.

'Time Out' has been attended and the procedure commences. Mr Kumar's melanoma is removed and the specimen has been placed in formalin ready for transfer to pathology. The surgeon requests a vacuum drain to prevent haematoma formation and proceeds to close the wound using sutures.

You and the circulating nurse commence your closing count and identify there is a needle missing. You inform the surgeon that a needle is missing and she does not believe you: 'You must have made a mistake, I haven't lost the needle'.

ACTIVITY

4-20 Discrepancy in needle count
What actions will you take on discovering a needle is missing and how will you respond to the surgeon's comment?

The missing needle has been resolved and Mr Kumar is transferred onto his bed using the HoverMatt™ and transported to PACU. You accompany him to provide handover to PACU staff.

Re-establishing the environment
Following handover to PACU you return to the OR to assist the circulating nurse clean the OR. As Mr Kumar was the final patient of the day, the OR will need to be terminally cleaned and restocked ready for the next list. This is an important task and local policy will guide the process for terminal cleaning, but consists of all furniture and equipment wiped over, floors cleaned and all stock not required is removed. Although these tasks may be carried out by ancillary staff (see Figure 4-24), it is the responsibility of the nursing staff to ensure that supplies in general use e.g. dressings, swabs, sponges, sutures etc. are restocked, the correct furniture is in the OR, suction liners are emptied and replaced. The OR must be left in anticipation of the next patient, particularly for emergency surgery. (Hamlin et al, 2016)

Dressings and drains

Drains are used in surgery either for therapeutic purposes, e.g. drainage of pus, or as a prophylactic measure to prevent the build-up of exudate in a wound and formation of haematoma which can affect wound healing and increase risk of SSI. Although, the prophylactic use of drains may increase the incidence of SSI.

Drains are inserted at the end of the procedure close to the incision site and may be sutured in place. There are a variety of drains available, all with specific mechanisms (passive or active) and uses. All drains must be documented as per local policy, including type, size, modification to length (especially if cut from original length), location, and whether it is sutured in place.

Dressings are used to protect the wound and are not opened until near the end of surgery to prevent contamination by blood or body fluids. The choice of dressing is influenced by many factors (see Figure 4-25 for an example). Dressings are discussed in the following reading, which also describes drains in common use.

READ

Hamlin et al. (2016) Chapter 11, pp 321-324, Wound care, and pp 324-328, Drains and the technological advances in wound management.

ACTIVITY

4-21 Drains and dressings
Explore the different types of drains and dressings in your OS and complete your answers in the Activity section.

Paediatric perioperative considerations

Paediatric surgery is an area of perioperative nursing often carried out in specific paediatric surgical units. Due to its specialised nature, the topic will not be explored in detail within this Component. Those working in OS that provide a paediatric surgical service will undergo additional local paediatric education and training. Work with your facilitator to access the additional training.

The following resources are an introduction to specific considerations related to the care of paediatric patients, particularly in anaesthesia.

READ

Hamlin et al. (2016) Chapter 7, p 171, Paediatric patients.

VIEW

Association for the Wellbeing of Children in Healthcare (AWCH), *Comfort positions for medical procedures*. http://www.awch.org.au/information-for-health-professionals.php *This is helpful when caring for a paediatric patient and their carer in the perioperative environment.*

Figure 4-24. Terminal cleaning

Source: Diversy http://solutionsdesignedforhealthcare.com/solutions/area-of-care/acute-care/operating-room-cleaning-solutions

Figure 4-25. Vacuum dressing

Source: NSW Health 2017

Conclusion

This Component has provided a description of the role and responsibilities of the circulating and instrument nurses and the pivotal function and duty they have in ensuring safe patient care throughout the intraoperative period.

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Victorian Institute of Forensic Medicine (2017) *Clinical Communique 1* (4), 1-6 http://vifmcommuniques.org/wp-content/uploads/2017/03/Clinical-Communique-Vol-4-Issue-1.pdf

Further resources

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COMPONENT 4 – ACTIVITIES

Activity 4-1: Setting up the OR

Draw a diagram of your OR and identify where the fixed equipment and mobile equipment, trolleys and staff are best placed for Mr Rubin's procedure.

Activity 4-2: Electrical equipment

Answer the questions below for the electrosurgery unit and 3 additional pieces of OS equipment from the following: pneumatic compression devices, suction, laparoscopic towers, tourniquet, surgical plume evacuation:

1. Explain the checking process
2. What is the machine/equipment used for?
3. What are the associated risks?
4. Explain the safety requirements/processes
5. Are manufacturer instructions available?
6. What are the documentation requirements, if any?

Piece of machinery/ equipment	Answers

Activity 4-3: Suction

Look around your OS and identify the types of suction used. Do they have regulators? If so, how are these checked and regulated to deliver the correct amount of pressure?

Work with your facilitator to practice the procedure for changing and disposing of suction liners. Identify the PPE required for this procedure and why.

Activity 4-4: Asepsis

To flip or not to flip? Discuss this issue with your facilitator. Are there occasions within your OR when 'flipping' is carried out?

Whilst opening a wrapped steam sterilised item, you notice the chemical indicator has not changed colour. What does this mean? How will you manage this situation?

Activity 4-5: Patient positioning

Revisit the section on patient positioning in *Component 2*. How will Mr Rubin be positioned for his surgery? Identify four main safety issues to consider and why.

Safety considerations in positioning	
1.	
2.	
3.	
4.	

Activity 4-6: Skin incision

Describe the incision used for Mr Rubin's repair of inguinal hernia surgery.

Activity 4-7: Sutures

Select six sutures in common use within your OS and complete the table. Work with your facilitator on this activity.

Name of suture	Natural or synthetic	Absorbable or non-absorbable	Monofilament or multifilament	Uses in surgery

Activity 4-8: Managing medication

How will you manage the instrument nurse's request for medication? You may wish to review this topic in Component 2.

- Identify at least four items you will need to open for the instrument nurse to complete preparation and administration of the medications
- Describe the labelling requirements for medications opened onto the aseptic field
- Describe how will you ensure the safe transfer of a medication from an unsterile ampoule

Activity 4-9: Managing accountable items

Describe how you will prepare for and carry out the counting procedure with the instrument nurse.

Activity 4-10: MIS equipment

Work with your facilitator to locate the endoscopic equipment used within your OS. Familiarise yourself with the components of the 'tower'.

Activity 4-11: Patient positioning

Why has the surgeon requested reverse Trendelenburg position for Ms Diaz? What specific safety measures will be taken for Ms Diaz?

Activity 4-12: Specimen management

List the identification checks you and the instrument nurse will carry out prior to the specimen being placed in the container.

Why is it important to label the specimen container prior to receiving the specimen from the instrument nurse?

Why is it important to wear PPE when handling a specimen?

Activity 4-13: Surgical hand antisepsis

List six (6) actions you will take to prepare yourself prior to commencing the surgical hand antisepsis procedure.

1.
2.
3.
4.
5.
6.

Activity 4-14: Instrument categories

Complete the table on categories of instruments.

Category	Example of instrument/s	Specific purpose
Cutting and dissecting		
Grasping and holding		
Retractors		
Clamps		

Activity 4-15: Tourniquet

Locate the tourniquet equipment used in your OS. Review its use with your facilitator to ensure you are familiar with its functions.

Observe the placement of a limb tourniquet, then answer the following questions:

- identify the specific steps taken in applying the tourniquet
- identify four risks specific to the use of a tourniquet and describe how you will prevent these risks from occurring.

Risks	Actions to prevent harm to patient
1	
2	
3	
4	

Activity 4-16: Haemostasis

Complete the table on methods of haemostasis:

Method	Examples	Where is this used?
Mechanical		
Chemical		
Energy-based		

Activity 4-17: Alcohol based skin antisepsis

What alcohol based antiseptic solutions are used in your OS? How are they stored and what safety precautions are followed when using the solutions?

Activity 4-18: Patient handover

Identify your responsibilities as instrument nurse in completing documentation and handover of Mrs Simpkin to PACU, using ISBAR.

Complete the table using ISBAR to provide your handover of Mrs Simpkin to PACU.

ISBAR	Handover information on Mrs Simpkin
Identification	
Situation	
Background	
Assessment and actions	
Recommendations (responsibility)	

Activity 4-19: Patient communication

How will you respond to Mr Kumar's comment?

Activity 4-20: Discrepancy in needle count

What actions will you take on discovering a needle is missing and how will you respond to the surgeon's comment?

Activity 4-21: Drains and dressings

Identify four types of drains used in your OS. Identify why each type is used, how they function and explain the patient care considerations for each.

Type of drain	Why is it used?	How does it work?	Patient care considerations

Name the commonly used dressings in your unit for each specialty listed below and explain why they are used:

Type of surgery	Dressing used	Advantages	Disadvantages
Orthopaedics			
Gynaecological			
General surgery			
Eye surgery			

— End of Component 4 —

COMPONENT 5

POST-ANAESTHESIA CARE UNIT (PACU) NURSE

Aim

The aim of *Component 5* is to describe the responsibilities, knowledge, skills, and patient care requirements of the post-anaesthetic care unit (PACU) nurse in providing patient care in the immediate post-operative period.

Depending on the facility and model of care, PACU may provide:

- **Stage 1 recovery only:** intensive supervision
- Stage 1 and stage 2 recovery: preparing the patient for discharge home or to an extended care environment.

Note: Component 5 of T2PP pertains to PACU nursing during **Stage 1 recovery only**.

Learning outcomes

1. Discuss the purpose and design features of PACU and how these features contribute to patient care.
2. Demonstrate an understanding of the PACU nurse's role as a member of a multidisciplinary team.
3. Demonstrate an understanding of the PACU nurse responsibilities in caring for a range of post-operative patients.
4. Understand the legislative requirements of the role, including medication administration, documentation, discharge criteria and clinical handover of care.
5. Describe and demonstrate initial assessment, monitoring, and ongoing nursing care interventions in the post-anaesthetic patient.
6. Demonstrate the assessment and management of post-operative pain.
7. Demonstrate knowledge of the key pharmacological agents used in anaesthesia and the immediate post-operative period.
8. Describe the role of the PACU nurse in managing post-anaesthetic emergencies.
9. Describe the key PACU nursing considerations for special care patient groups.

Working through this component

Some of the topics covered within this component are presented in the format of a 'virtual operating suite'. The virtual PACU will care for a variety of patients of mixed complexity for whom you will provide post anaesthetic care.

The Post-Anaesthetic Care Unit (PACU)

The PACU (also known in some facilities as Recovery Room or the Post Anaesthetic Recovery Unit: PARU) is defined as the area within the perioperative environment that is planned, equipped, staffed, and managed for the safe clinical care of patients in the immediate period following a surgical or other procedure, under general, regional, or local anaesthetic (ACORN, 2018).

PACU is a high acuity specialised care unit where skilled nursing staff safely assess, monitor and manage patients as they recover from anaesthesia, providing physiological and psychological care. Patients are particularly vulnerable in the immediate post-operative period as a result of the effects of anaesthetic medications, the surgical procedure and any comorbidities, which can alter their physiological, psychological and cognitive functions (Hamlin et al., 2016). Patients are at high risk of complications during this period and are reliant on the PACU nurse to identify and treat the early signs of deterioration (ACORN, 2018).

Depending on the facility and the surgical caseload, the patient cohorts you experience in PACU may vary from paediatric to geriatric, and across the full scope from fit and well patients recovering from minor procedures to unstable patients having complex, major surgery.

Role of the PACU nurse

The PACU nurse is responsible for patient care from the patient's arrival in PACU until care of the patient is handed over to the receiving post-operative ward or other destination. This is in collaboration with the anaesthetic and surgical teams as required. PACU patients require varying levels of care according to the surgery/procedure undertaken, the type and duration of anaesthetic administered, and individual patient comorbidities.

Whilst the majority of patients make a swift and uneventful recovery from anaesthesia, patients in the immediate post-operative period can deteriorate rapidly. The PACU nurse must be aware of the possible complications of anaesthesia and surgery, and the comorbidities that may contribute. Direct patient observation is crucial and escalation of care may be required.

General responsibilities of the PACU nurse include:

- **airway** assessment, management, and oxygen administration for patients who have undergone general anaesthesia or sedation
- **patient monitoring**: haemodynamic (heart rate, blood pressure, temperature, and respiratory rate, oxygen saturation), neurological, neurovascular, and others as required
- assessing and managing **postoperative pain**
- preparing and **educating patients** on the use of patient-controlled analgesia (PCA)
- assessing and managing **postoperative nausea and vomiting**
- assessing and maintaining **fluid balance**
- **monitoring surgical sites** for excessive bleeding/swelling and neurovascular observations
- achieving and maintaining **normothermia**
- preparation and **administration of intravenous, epidural, and subcutaneous infusions**
- care and interpretation of **invasive monitoring** (including arterial lines, central venous lines, ICP measurement)
- **escalate issues** as required to the multidisciplinary team
- **clinical handover** on shift change and to the receiving ward
- act as the **patient's advocate**, ensuring safety, dignity, privacy, and comfort
- **communicate** with the patient's carer or family regarding updates to the patient's condition (in some facilities there may be visitor restrictions in PACU)
(ACORN, 2018; Hamlin et al, 2016).

The following readings provide greater detail on the role of the nurse in PACU.

READ

Hamlin et al. (2016) Chapter 12, Role of the nurse and function of PACU, p 332.

ACORN (2018) Position Statement for Nursing roles: Post Anaesthetic Care Unit Nurse.

PACU environment – design and function

The location of PACU within the perioperative environment allows for quick and easy access for both patients and staff to and from the operating rooms. This is particularly important should a patient's condition require a rapid response from the surgical and/or anaesthetic teams, or the PACU staff require access to the team. For this reason, PACU nurses wear perioperative attire which allows them to access restricted areas within OS.

The design of PACU should be large enough to accommodate sufficient patient bays according to the number of ORs, at least 1.5 bays per OR i.e. six bays for an OS with four ORs (ANZCA, 2006). The design must allow for an unobstructed view of all patients, with central staff stations a feature of many PACUs (see Figure 5-1).

Most PACUs are classified as semi-restricted areas to allow ward nurses access to collect patients (depending on local policy) and other healthcare personnel and visitors to access in street attire. Only personnel with legitimate reason to access PACU are permitted, and this includes patients' relatives or support people (according to local policy). This is to comply with infection prevention protocols and to protect patient privacy and confidentiality.

PACUs are busy, high acuity patient care areas and must be well equipped to manage critically ill patients.

Figure 5-1. Example of a PACU with visibility of all bed spaces and a central desk

Source: © Surgery Centre of Viera

The following readings provide details of the essential equipment that must be present in PACU and its standardised location in each bay to allow quick and easy access, particularly in an emergency situation.

READ

Hamlin et al. (2016) Chapter 12, PACU Design Features, pp 332-334.

ACORN (2018) Guidelines on the Management of the PACU.
Note Guideline Statements 1 and 2 which specify design features and equipment requirements.

ANZCA (2006) Recommendations for the post-anaesthesia recovery room , pp 1–6.

ACTIVITY

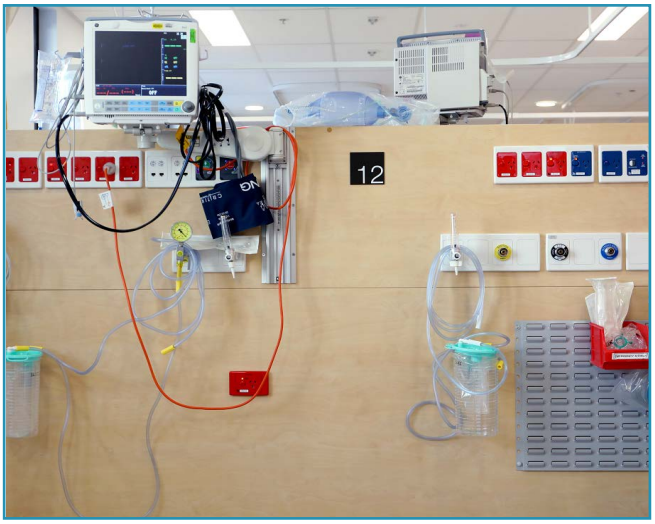
5-1 PACU design
In the Activity section, draw a map of your PACU and identify the location of six items of monitoring and emergency equipment.

Preparation of the environment

At the beginning of the day, the PACU staff check the functionality of emergency and routine equipment in each patient bay and in PACU generally. Many PACUs utilise a checklist for this task. Restocking should be completed as each patient is transferred from PACU to ensure the patient bay is fully equipped to receive the next patient.

Staff should review the operating list and plan the care for each individual patient. Equipment needs will vary and will be dependent on the type of surgery/procedure, the type of anaesthetic, the condition and age of the patients. PACU nurses are required to understand the types of surgery undertaken within the OS in order to provide nursing care appropriate to the surgical procedure and be alert to specific potential complications. Knowledge of anaesthetic drugs is required to care for patients recovering from their effects.

Figure 5-2. Example of patient bay in PACU – note monitoring equipment and display screen, suction, oxygen, and self-inflating bag/mask.



Source: NSW Health 2017

If you have not completed *Component 3 Anaesthetics*, the following readings will provide you with a description of the commonly used anaesthetic agents and drugs. If you have completed Component 3, move on through this component or complete the readings to refresh your knowledge.

READ

Hamlin et al. (2016) Chapter 8, Types of Anaesthesia, pp 196-201.

ANZCA (2017) *PS51 Guidelines for the Safe Management and Use of Medications in Anaesthesia.*

ACTIVITY

5-2 Anaesthetic medications
Consider the anaesthetic and adjunct drugs used in your OS and PACU, and the nursing care considerations for each. Complete the table in the Activity section.

PACU patient care

Virtual PACU

To facilitate the study of post-anaesthesia care and the role of the PACU nurse, an operating list of 'virtual patients' is provided. The guided readings and activities relate to the nursing care of each patient as they progress through PACU.

Virtual PACU Patient List

Patient	Age	Medical record number (MRN)	Surgical procedure	Comments
George RUBIN	66	87459061	Repair right inguinal hernia	VTE risk
Gemma ARMITAGE	46	76594302	Excision of lump left breast	N/A
Jill SIMPKIN	85	95420714	Carpal tunnel release on right hand	Tourniquet required
Sanjay KUMAR	56	92348761	Excision of melanoma left thigh	Weighs 180kg BMI 35

Admission to PACU and clinical handover

The PACU nurse's initial contact with the patient occurs during clinical handover which takes place immediately on the patient's arrival to PACU from OR. The patient is accompanied by the anaesthetist and instrument/circulating/anaesthetic nurse (as per local policy) who provide both a medical and nursing handover of care (see Figure 5-3). If a PACU nurse is unavailable to take handover, the anaesthetist must stay with the patient until a PACU nurse is able to take over the care of the patient.

Handover is a vital time in the care of the patient and should be viewed as an active process by the PACU nurse rather than a passive transfer of information. The receiving PACU nurse must ensure they have all the information to enable patient care to continue seamlessly, asking questions of the anaesthetist and nurse to clarify information as needed. A structured clinical handover should result in the transfer of responsibility and accountability for care (ACSQHC, 2017).

Figure 5-3. Receiving a patient and clinical handover in PACU

Source: NSW Health 2017

The ISBAR/ISOBAR system (depending on local policy) is a systematic approach to the transfer of critical information which should be followed to enhance patient safety and minimise the risk of missing vital information (Street et al., 2015).

ISOBAR Clinical Handover

I	Identification – the identification of the patient will be confirmed utilising the front sheet and patient identification band
S	Situation – anaesthetic type, drugs administered, procedure completed, drains, catheters, dressings
O	Observations – any observational events and actions, documented altered calling criteria, additional observations (e.g. level of block, limb observations), significant events intraoperatively and actions taken
B	Background – past history, comorbidities, allergies
A	Assessment – post operative orders for analgesia, antiemetics, IV lines, Patient Controlled Analgesia (PCA), regional blocks
R	Recommendation – post operative orders and any contact details in the event of an emergency or questions pertaining to patient care.

Source: ANZCA, 2013 ; Hamlin et al. 2016

Neither the anaesthetist nor accompanying nurse should leave PACU until the receiving PACU nurse is satisfied they have all the necessary information, including medication, fluid orders and relevant completed documentation. Unconscious patients are managed 1:1 and cannot be left unattended until the patient regains their protective reflexes and consciousness (ANZCA PS4, 2006).

NB: Experienced PACU nurses will become familiar with individual anaesthetists' practices in areas such as fluid and medication prescribing regimes. Deviations from common prescribing practices should be queried and orders confirmed to ensure no error has occurred.

The following readings provide examples of the use of ISOBAR (developed by anaesthetists to include 'O' for observations) and the nursing ISBAR structured handover tools.

READ

Hamlin et al. (2016) Chapter 12, pp 334-336.
Note Figure 12-4 (p 335) and Figure 12-5 (p 336).

ANZCA (2013) PS53 Statement on the handover responsibilities of the anaesthetist, http://www.anzca.edu.au/documents/ps53-2013-statement-on-the-handover-responsibiliti.pdf

Sydney Morning Herald (2018) 'Paul Lau died after hospital medication mix-up following routine surgery'; https://www.smh.com.au/national/nsw/paul-lau-died-after-hospital-medication-mix-up-following-routine-surgery-20180329-p4z6wg.html
This case highlights the need for confirming post-operative medication orders and for PACU nurses to critically consider and question medication orders. For the full report on the Coroner's findings, follow the link:

NSW Coroner (2018) Inquest into the death of Paul Lau
http://www.coroners.justice.nsw.gov.au/Documents/Findings%20Paul%20Lau%20Final.pdf

First patient into PACU

Mr George Rubin, aged 66 years, is your first patient of the day. He has had an open repair of a right inguinal hernia under general anaesthesia. He arrives in PACU accompanied by the anaesthetist and the instrument nurse. You receive a clinical handover from both.

ACTIVITY

5-3 Clinical handover
Consider the information you require from both the anaesthetist and the instrument nurse during handover of care. Complete the table in the Activity section.

Physical assessment

On arrival in PACU, the patient will be receiving supplementary oxygen and may have an artificial airway insitu, e.g. a Guedel's airway. Some PACUs receive patients with LMA or ETT insitu: local policy will guide the management of intubated patients and those with LMAs.

Ensure PPE is worn to protect against splash injury caused by fluids the patient may expectorate or vomit. A face mask may also be indicated, depending on risk assessment of the patient.

During handover, many activities are occurring simultaneously and the patient must be constantly observed throughout. Key activities include:

- PACU nurse listens to the handover
- oxygen supply is transferred from the portable oxygen cylinder to the wall outlet to ensure continuous administration of oxygen to the patient
- initial rapid assessment of the patient including assessing ABC (airway, breathing, circulation) and level of consciousness
- monitoring equipment (BP cuff, pulse oximetry) is applied to the patient and a set of observations is attended.

Depending on availability of staff and the acuity of the patient, a second PACU nurse may assist in the initial assessment and care of the patient.

Following handover and the initial assessment, a more detailed assessment is actioned and documented.

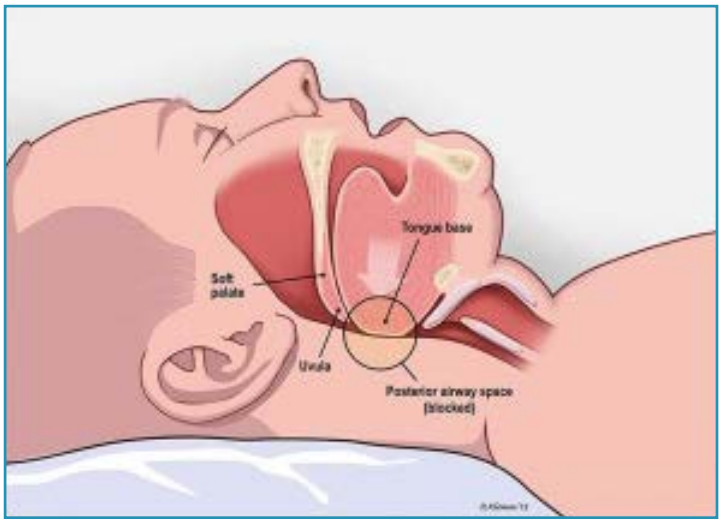
Airway – check patency of the airway, audible airway sounds (or silence if completely obstructed), patient positioning, and presence of an artificial airway.
Breathing – look, listen and feel to assess respiratory function including rate, rhythm and depth of breathing, noisy breathing (or silence if no breathing), accessory muscles in use, respiratory effort, patient colour.
Circulation – rate of pulse, BP, oxygen saturation, colour, peripheral perfusion, ECG if indicated, observe for reportable blood loss from wound or drain.
Level of consciousness – awareness, response to stimuli, neurological assessment if relevant to patient (GCS) (Hamlin et al., 2016).
Other assessments – temperature, IV fluids, urine output (IDC)/fluid balance, assessment of pain, assessment of wound site and drains, circulation checks, and specific checks as required.

Airway assessment and recognising obstruction

Airway assessment and management is the critical first step in the care of all post-operative patients. An inadequately maintained (obstructed) airway and respiratory complications can lead to adverse outcomes, including hypoxaemia, hypoxia, cardiac arrest, brain damage and death (Drain, 2013). Airway and respiratory complications are the most common major problem in the immediate postoperative period, and are the second most common problem requiring treatment (after post-operative nausea and vomiting) (Bittner, 2018).

The PACU nurse applies knowledge of the anatomy and physiology of the upper airway to assess and manage a patient's airway. Airway assessment involves the steps outlined in Figure 5-5.

Figure 5-4. Tongue falling back causing airway obstruction



Source: © Habib M'henni/Wikimedia Commons

Figure 5-5. Airway assessment overview

AIRWAY ASSESSMENT BASICS	
Assess patient responsiveness	• An awake and talking patient is a good initial indication that they are able to maintain their airway (may be seen as crying in a paediatric patient) • If a patient has a decreased level of consciousness, their ability to maintain their airway may be compromised. This is associated with the most common cause of airway obstruction, where the tongue relaxes posteriorly into the oropharynx (see Figure 5-4) • Generally, a patient with a Glasgow Coma Scale of 8 and below is considered unable to protect their airway and will require airway management such as intubation
Look	• Are the patient's respirations slow or fast, deep or shallow? Watch for fogging of the oxygen mask on exhalation and observe for periods of apnoea • Is the patient using accessory muscles to breathe i.e. is there evidence of tracheal tug or paroxysmal breathing (see-saw chest movements) indicating upper airway obstruction (Bevan, 2012)? • Observe the patient's colour, noting that cyanosis is a late sign • If required, inspect the patient's airway for signs of obstruction (e.g. blood, vomitus, loose dentures or other foreign bodies) • Observe how the patient is positioned – are they lying flat on their back? Lateral positioning or elevating the bed head can assist in airway management
Listen	• Are breath sounds present? Note the rate, rhythm and depth of ventilation • Is the patient's breathing noisy, and if so, what is the nature of the noise? Airway sounds indicate a degree of obstruction that may arise from different causes and conditions: snoring, gurgling, stridor, grunting, wheezing. NB: complete obstruction is silent
Feel	• Feel at the mouth and nose for expired air • Feel the patient's chest for rise and fall, rate, depth, and equal movements. (Scott, 2012; Hamlin et al., 2016)

Airway complications and management

Post-operative airway complications vary and may be due to abnormalities in the upper airway, lower airway, lung parenchyma, or the peripheral nerves and muscles that control breathing (Bittner, 2018) (see Figure 5-5). Airway obstruction can result in hypoventilation, increased work of breathing and impaired gas exchange, with development of hypercarbia and ultimately hypoxaemia if left untreated (McPherson & Stephens, 2012). Monitoring, early diagnosis and timely management by the PACU nurse are crucial in reducing morbidity and mortality.

Figure 5-6. Causes of airway obstruction in PACU

CAUSES OF AIRWAY OBSTRUCTION IN PACU	
Central drive	Reduced level of consciousness related to anaesthetic drugs (opioids, hypnotics, benzodiazepines); low GCS related to neurosurgery or other comorbidities
Residual paralysis	Incomplete recovery of muscle function after administration of muscle relaxant drugs: also known as 'fish out of water' due to appearance of affected patient
Direct trauma or irritant	Laryngeal spasm or oedema
Intraluminal contents	Blood, vomit, foreign body (e.g. loose dentures), secretions: may cause mechanical obstruction or laryngeal spasm
External compression	Haematoma, surgical oedema
Artificial airway factors	Blockage or displacement of ETT, LMA, tracheostomy tube

Adapted from McPherson & Stephens, 2012

The airway is divided into upper and lower: the upper airway is from the nares and lips to the larynx, and the lower airway contains the trachea and bronchial tree (McPherson & Stephens, 2012).

Upper airway obstruction and management

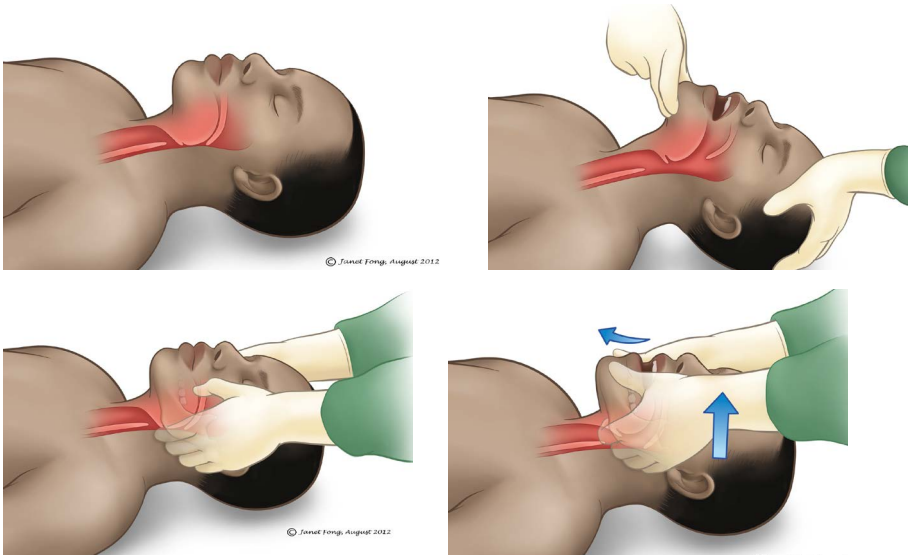
If close monitoring of the patient's respiratory function detects an abnormality in respiratory rate or depth, airway noises, the use of accessory muscles, or decreasing SpO_2 values, intervention is immediately required. When assessing patients, look carefully for these signs and symptoms and always call for help early from a senior nurse or anaesthetist if you suspect airway compromise.

Oxygen therapy is required urgently in a compromised airway. An oxygen mask with reservoir bag (partial rebreather or non-rebreather mask) used with a flow rate of 12-15litres/minute can provide a high inspired fraction of oxygen and blood oxygen to restore blood oxygen levels (McPherson & Stephens, 2012).

For mild obstruction, it may be adequate to rouse the patient with voice and gentle touch, and give firm instructions ('e.g. take some deep breaths Mr Kumar: your surgery is finished'). If rousing the patient results in a clear airway and effective breathing, note that close monitoring and repeated prompting is required until the patient's level of consciousness increases and their airway stabilises. Repositioning the patient into the lateral recovery position can assist if not contraindicated: gravity pushes the tongue and jaw forward and improves the airway.

In many cases, simple airway opening manoeuvres used in Basic Life Support (BLS) such as *head tilt/chin lift* and *jaw thrust* will relieve an airway obstruction (see Figure 5-7). The jaw thrust manoeuvre is used with caution in patients with a suspected spinal injury as the cervical spine should not be hyper-extended (do not use head tilt/chin lift) (ARC, 2010).

Figure 5-7. Head tilt/chin lift opening an obstructed airway (top row); jaw thrust manoeuvre opening an obstructed airway (bottom row)



Source: Anaesthesia and Intensive Care, Chinese University Hong Kong

If obstruction persists, the airway should be cleared using a wide-bore rigid (Yankauer) suction catheter to gently suction as indicated. To remove secretions lower than the pharynx, a y-suction catheter inserted down an airway adjunct (e.g. oropharyngeal/ nasopharyngeal airways) is required. Remove any foreign bodies from the oral cavity using Magill's forceps: fingers must never be used.

Once a clear airway has been established, maintaining the airway may require the use of airway adjuncts, for example, oropharyngeal (Guedel's) or nasopharyngeal airways (NPA). Both of these devices prevent the tongue from occluding the airway.

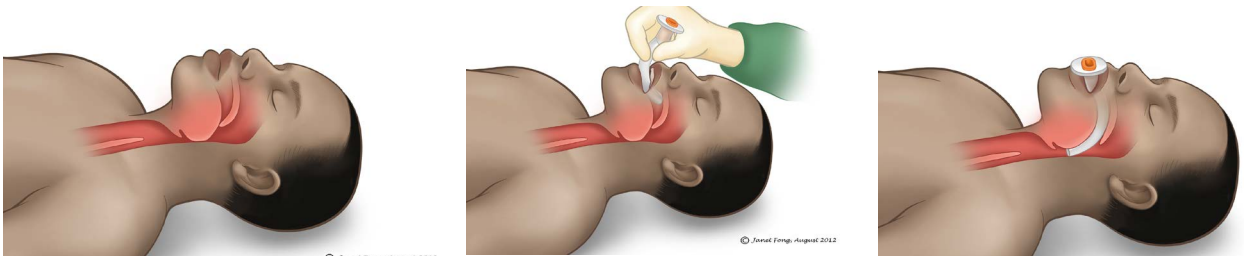
Oral and nasal airways may be used for:

- airway maintenance for an unconscious patient
- to open the airway for bag/mask ventilation (BMV)
- suctioning
- as a bite block (Guedel's).

Oropharyngeal airway (Guedel's airway)

- Guedel's airways are hard, curved plastic tubes with a reinforced bite section and flange to prevent over-insertion
- When using an oropharyngeal (Guedel's) airway:
  - exercise caution when inserting to avoid soft tissue trauma, gagging, vomiting, and aspiration
  - measure for sizing: from corner of mouth to the angle of the jaw (multiple sizes are available from newborn to large adult; see Figure 5-9)
  - in adults insert concave up then rotate 180° (see Figure 5-8)
- Remember: Guedel's airways sit in the oropharynx (Figure 5-8) and can induce a gag reflex by touching the soft palate; NPAs do not induce the gag reflex (Elliot et al, 2012).

Figure 5-8. Obstructed airway: insertion and positioning of Guedel's airway



Source: Anaesthesia and Intensive Care, Chinese University Hong Kong

Figure 5-9. Examples of Guedel's airways (L) and nasopharyngeal airways (R)

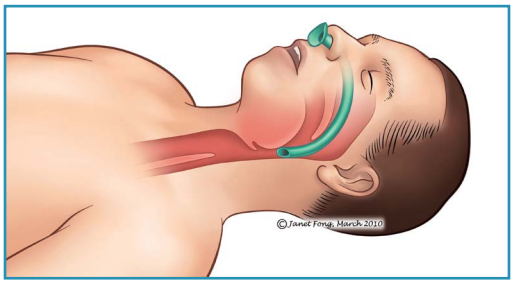
Source: NSW Health 2017; Medistock https://www.medistock.co.uk/products/nasal-airway-size-8-box-10

Nasopharyngeal airway (NPA)

- NPA is a soft, flexible, anatomically designed airway adjunct with a smooth angled tip, a curved body, and a flanged end (to prevent over-insertion)
- Sized by measuring from the tip of the patient's nose to their earlobe. The sizes reflect the internal diameter: range from 2mm - 9mm
- NPAs may be used in patients with seizure activity, intact gag, and following dental or oral surgery
- Considerations of NPA use:
  - may cause epistaxis
  - do not use in patients with facial trauma, base of skull fractures, or coagulopathy
  - to insert: lubricate well, bevel facing septum, direct posteriorly and rotate slightly. Inserting an NPA is a skill that requires practice and supervision until mastered

    ALERT: incorrect direction can lead to insertion through cribriform plate into brain
  - less likely to induce gag or vomiting: better tolerated in patients who have a gag reflex. (Elliot et al, 2012)

Figure 5-10. Nasopharyngeal airway



Source: Anaesthesia and Intensive Care, Chinese University Hong Kong

Patients with an artificial airway (e.g. tracheostomy) who display features of respiratory distress require urgent and skilled airway assistance. Do not delay in requesting immediate help from a senior nurse and anaesthetist: the device may be blocked or displaced (McPherson & Stephens, 2012).

Lower airway obstruction and management

Lower airway obstruction may be caused by:

- airway oedema – due to surgery, airway trauma, inflammation or allergy
- laryngeal spasm (laryngospasm) – due to a foreign body, airway stimulation or secretions/blood in the airway
- tracheobronchial obstruction – due to secretions, inhaled gastric contents, pulmonary oedema fluid or bronchospasm.

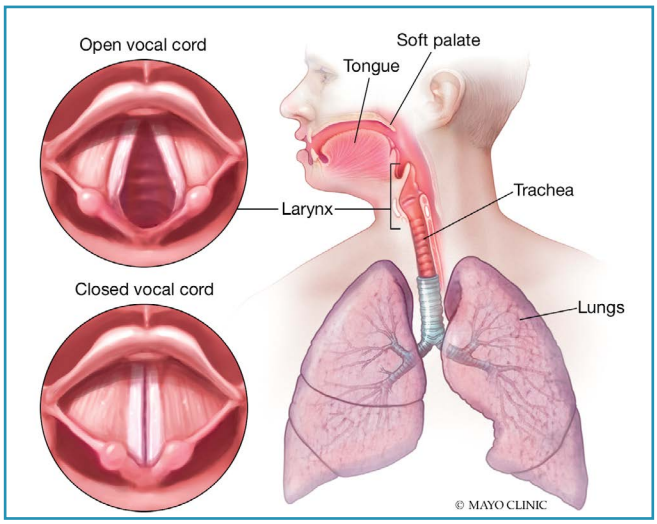
These conditions can lead to partial or complete airway obstruction and constitute a life-threatening emergency requiring immediate treatment.

Laryngospasm

Laryngospasm occurs when there is an irritation of the vocal cords leading to an involuntary spasm of the superior laryngeal nerve. This can result in complete or partial closure of the cords and subsequent airway obstruction (see Figure 5-11). When an airway is partially obstructed, noises can be heard which indicate the level of obstruction: partial laryngospasm is associated with a high pitched inspiratory stridor making a characteristic 'crowing' noise.

When the vocal cords are totally shut, there are no breath sounds at the nose or mouth, as air is unable to move past the obstruction. A 'rocking' movement of the patient's chest can be seen indicating an obstructed breathing pattern. Prompt recognition of laryngospasm is essential for early correction.

Figure 5-11. Airway anatomy and laryngospasm



Source: Used with permission of Mayo Foundation for Medical Education and Research. All rights reserved.

Management of laryngospasm requires advanced airway management. Patients may require positive pressure ventilation via a bag valve mask and/or anaesthetic drugs to overcome the spasm. Effective team communication is essential in managing this emergency situation.

Management of laryngospasm includes:

- Prompt recognition of the obstructed airway. Stay with the patient and notify the anaesthetist and senior nursing staff immediately: if the patient is conscious, reassure them you will help them with their breathing
- Removal of any irritant by gentle suctioning of the oropharynx
- A jaw thrust will lift the tongue off the pharyngeal wall and potentially help lift the supraglottic tissues. If the patient is unconscious, placement of a Guedel's airway will help ensure patency of the supraglottic airway. If the patient's mouth does not open, a nasopharyngeal airway can be inserted (Gavel & Walker, 2013)
- Application of a face mask and delivery of 15 litres oxygen per minute, using two hands if necessary to create a seal (see *bag mask valve* ventilation), and apply continuous positive airway pressure (CPAP). Vigorous attempts at ventilation must be avoided as this can inflate the stomach and cause diaphragmatic splinting (Gavel & Walker, 2013)
- Depending on the patient and degree of laryngospasm, the anaesthetist may opt to wait for the spasm to resolve spontaneously while giving CPAP. If the laryngospasm does not settle rapidly, the treatment is to anaesthetise the patient with propofol +/- paralyse with suxamethonium (Gavel & Walker, 2013). Intubation may be required. Laryngospasm commonly resolves with apnoea and the patient will require ventilation via the face mask until spontaneous respirations return
- When the laryngospasm has resolved, the patient should be administered high flow oxygen and positioned head-up (if not contra-indicated) to support ventilation
- Monitor the patient closely as laryngospasm may recur.

Bag/valve mask ventilation (BMV) is achieved in PACU using a self-inflating resuscitation system (e.g. Ambu bag and mask) or a t-piece circuit with mask (see Figure 5-12). BMV is used to deliver oxygen to a spontaneously breathing patient, or to manually ventilate a patient via the face mask or ETT. BMV requires a good seal and a patent airway. To create a seal while maintaining the airway, use the thumb and index finger to apply downward pressure on the mask then use 3rd, 4th and 5th fingers to pull patient's jaw up and open the airway. Take care to avoid compressing the great vessels located in the neck, placing fingers instead on the mandible. Airway adjuncts can assist the operator maintain a seal. Obtaining a good seal with the mask while maintaining the airway to allow for ventilation is a skill that takes practice to master.

The reservoir bag is used to deliver high flow oxygen via positive pressure ventilation to a spontaneously

breathing patient or in complete obstruction, the bag is compressed to manually ventilate the patient via the mask. High flow oxygen (e.g. 12–15 L/min) is required.

If a seal is difficult to achieve, 2 handed BMV is used: one person uses both hands to hold the face mask on the patient, lifting the jaw and achieving a seal, the second person uses the self-inflating or reservoir bag to maintain the positive pressure or to give breaths ('bags' the patient).

NB: If you have completed Component 3, Anaesthetics, you will have observed BMV and may have had the opportunity to practice the skill. If not, work with your facilitator to practice BMV on a mannequin.

If the obstruction is asthma or bronchospasm, oxygen and bronchodilators will be used (Hamlin et al, 2016).

Bronchospasm

Bronchospasm is the sudden constriction of bronchial smooth muscle resulting in spasm, and is a hyper-reactive airway response to mechanical or chemical irritants. Bronchospasm during anaesthesia is characterised by an expiratory wheeze (heard in the breathing circuit), prolonged expiration, and in intubated patients ventilation will become difficult. Perioperative causes of bronchospasm include:

- secretions
- airway equipment
- pulmonary aspiration
- anaesthetic drugs including volatile anaesthetic agents.

Patients with a history of smoking, asthma or respiratory infection are more susceptible to bronchospasm (Hamlin et al., 2016). Anticipating potential airway issues can be achieved by reviewing the patient's medical history.

Treatment involves removal of the identified cause (anaphylaxis should be considered as a cause), and administration of inhaled or IV bronchodilators (e.g. salbutamol) (Hamlin et al., 2016).

Pulmonary oedema

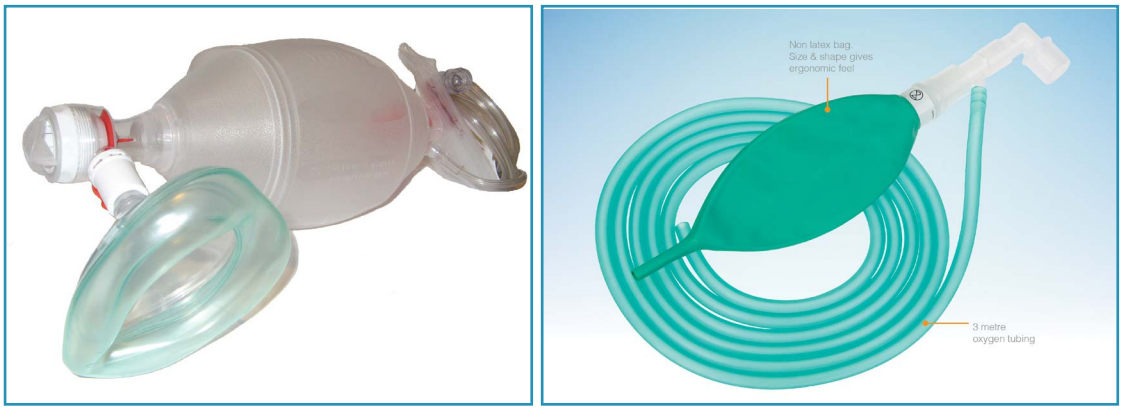
Pulmonary oedema is an increase in lung fluid due to leakage from the pulmonary capillaries into the alveoli of the lungs. This leads to an impairment in gas exchange and can cause respiratory failure. The cause may be:

- fluid overload
- congestive cardiac failure
- pulmonary injury.

Patients will be hypoxaemic, 'crackles' will be heard on auscultation of the chest and there will be noted decrease in pulmonary compliance.

Treatment involves identifying the cause, the use of diuretics, and decreasing IV fluid administration. In severe cases where patients are unable to maintain oxygenation or adequate ventilation, intubation and artificial ventilation may be required (Odom-Forren, 2018).

Figure 5-12. Bag/valve mask ventilation with self-inflating system, and 't-piece' circuit



Source: © Mike 6271/Wikimedia Commons; © Fairmont Medical

Patients suffering partial airway obstruction may be very anxious and frightened: reassurance must be provided in a calm manner.

In a deteriorating or complete obstruction, re-intubation (or insertion of an LMA) may be necessary. PACU staff must be familiar with intubation sequence and have airway equipment and anaesthetic medications readily available.

If you have not completed *Component 3 Anaesthetics*, the following reading describes the rapid sequence induction (RSI) procedure.

READ

Hamlin et al. (2016) Chapter 8, p 207, Rapid Sequence Induction.

Inadequate reversal of muscle relaxants (curarisation or recurarisation)

The initial assessment of a patient's airway may reveal inadequate respiratory effort with a shallow and weak breathing pattern. If the patient has been intubated during their procedure, drugs (neostigmine and atropine) to reverse the action of the muscle relaxant drugs are administered by the anaesthetist at the end of the anaesthetic. Some patients may have an inadequate response, or may receive an inadequate dose which results in residual neuromuscular blockade (paralysis). This presents as shallow uncoordinated breathing or an obstructed airway, poor tidal volume, a rise in CO_2 levels and a decrease in O_2 saturation levels. The patient may appear 'floppy' and unable to coordinate limb movements (this is often referred to colloquially as 'fish out of water').

If conscious, the incomplete recovery from neuromuscular blockade is a distressing experience for the patient. The PACU nurse must provide reassurance to the patient and take immediate action so adequate respiratory function is restored (Hamlin et al., 2016).

Management depends on the severity of the symptoms. Alert the senior nursing staff and inform the anaesthetist. If symptoms are severe, the anaesthetist will urgently review the patient. Sitting the patient up (if not contraindicated), monitoring $ETCO_2$ and SpO_2 levels, and providing oxygen may be sufficient. Further doses of reversal agents may be necessary.

Oxygen delivery

A variety of oxygen delivery equipment is used in PACU (see Figure 5-13). Selection and use depends on the patient's requirements and any surgical restrictions e.g. nasal surgery may prevent use of nasal prongs.

Figure 5-13. Oxygen delivery methods

OXYGEN DELIVERY METHODS

Nasal cannula/prongs
Low flow oxygen delivery via the nose: allows supplemental oxygen to be given whilst the patient is eating or talking.

High flow nasal prongs
An alternative to low flow mask oxygen therapy in respiratory failure.

Simple oxygen mask (Hudson mask)
Delivers concentrations of 35–65%, depending on the patient's respiratory rate and tidal volume.

Venturi mask
Face mask for patients who require precise O_2 concentrations between 24–50%.

Oxygen reservoir mask (non-rebreather mask)
A precise method of delivering high O_2 concentration. Delivers 90–100% O_2 (provided there is no leak in the system) via a face mask with reservoir bag. The reservoir bag must remain inflated.

Oxygen enhancement device (OED)
Sometimes known as a t-bag, the OED may be applied to an ETT or LMA in situ to deliver higher concentrations of oxygen (e.g. approximately 70% at 6L/min). It also serves as a visual confirmation of respiration.

Humidification
Humidified oxygen is delivered to some post-operative patient groups (e.g. those with new tracheostomies, post maxillofacial surgery etc.) via a humidifier to avoid mucosal drying, reduce viscosity of secretions, and decrease the work of breathing.

Ventilator
A high flow method of oxygen delivery. Few PACUs manage ventilated patients: generally patients requiring mechanical ventilation are transferred directly to ICU (Rose & Butcher, 2015) (may vary according to local policy).

Note: Caring for ventilated patients and those with tracheostomy are advanced skills that will require additional education and practice. Work with your facilitator and the PACU staff to learn about the equipment and nursing care.

READ

Hamlin et al. (2016) Chapter 12, pp 341-344, Airway and breathing complications. *Note Table 12-1(p 342) which shows common respiratory complications and their management.*

ACTIVITY

5-4 Airway management
Consult with your facilitator and practice the skills required for insertion of artificial airways and single and/or two person BMV. Complete the table on airway complications in the Activity section.

KEY POINTS: AIRWAY MANAGEMENT

- Be aware of the features of airway compromise: identify and treat patients with airway obstruction early
- Call for help early (senior nurse, anaesthetist) and anticipate deterioration in patients with airway compromise
- Use of simple airway manoeuvres, with basic adjuncts (as required), will often achieve a patent airway
- Remember, oxygenation is paramount: make every attempt to provide high oxygen concentration to patients where airway compromise is suspected
- Practice airway skills in a simulated environment and then under supervision to improve your skills in recognising, managing and treating patients with airway compromise.

Initial PACU assessment

Mr Rubin is breathing oxygen through a Hudson mask without the need for additional airway support. His observations:

- Oxygen saturation = 98% and his colour is good
- Respiratory rate = 12 breaths per minute
- BP within normal limits 140/80 (you compare against his baseline pre-operative BP: 154/80)
- Pulse = 85 beats per minute
- Temperature = 36.0°C

You speak with Mr Rubin whilst attaching the monitoring equipment. Communicating with the patient is important during this initial period to provide reassurance and reorientation. It is also an opportunity to assess Mr Rubin's ability to respond to verbal commands. Following completion of your initial assessment, you will carry out a 'head to toe' assessment.

Ongoing patient assessment and care

Using a 'head to toe' approach, the PACU nurse assesses the patient and develops a plan of care. As well as the ongoing assessment of airway, breathing, circulation and level of consciousness, depending on the specific surgery, the following should be assessed:

- pain
- observation of wound dressings and drains to ascertain status of blood loss and any active bleeding, including checking perineal pads
- patency and placement of drains and catheters, ensuring tubing is not kinked and the drains are not under tension
- IV access is patent, secured, not under tension, labelled, and IV fluids have been documented
- fluid balance
- nausea and vomiting
- neurological and neurovascular assessments
- skin integrity and signs of any pressure injuries
- alignment of limbs especially for patients who have had a regional block
- sensory and motor function in patients who have received central neural blockade
- uterine tone in Caesarean patients to assess for postpartum haemorrhage (covered in *Component 5*)
- surgery or patient comorbidity specific observations – spinal, neurological status, circulation observations, flap observations, blood sugar levels etc.
- patient safety and comfort: bed rails up, clean, dry bed linen and patient gown, ice to suck or water to sip (if not contraindicated), lip/mouth care.

Head to toe assessment

On assessing Mr Rubin, you note:

- IV Hartmann's solution running @ 125ml/hr with a second litre ordered by the anaesthetist
- Wound dressings: dry with no visible ooze
- Graduated compression stockings in situ: you check to ensure they are fitted correctly and do not have a 'tourniquet' effect just below the knees which could compromise circulation.

You document Mr Rubin's observations on the PACU observation chart.

Monitoring

Haemodynamic monitoring plays an important role in the management of the post-operative patient, allowing early detection and pre-emptive actions to be performed. An example is monitoring of a post-operative patient for hypovolaemia and taking immediate action to manage the issue before any deterioration in the patient's condition occurs. If a problem with the patient has been recognised, monitoring can assist in identifying underlying pathophysiological processes so that appropriate forms of therapy can be selected (Vincent et al, 2011).

Continuous monitoring of pulse oximetry and non-invasive blood pressure are the minimum standard of observation carried out on every post-operative patient (ANZCA PS18) and are visualised on the bedside monitor. Although it is not mandatory, many PACUs use ECG monitoring for all patients (check local policy). Patients with cardiac co-morbidities or who have displayed intraoperative dysrhythmias should have ECG monitoring during the immediate post-operative period.

Pulse oximetry provides an estimate of a patient's capillary oxyhaemoglobin saturation (SpO_2) and consists of a light-emitting diode (LED), a photo detector probe and a sensor. The probe is attached to the patient's finger, toe, ear lobe or forehead, which is linked to a computerised unit and works by emitting beams of red and infrared light that pass through the pulsating arteriolar bed. The display shows the percentage of Hb saturated with oxygen together with an audible signal for each pulse beat, and calculated heart rate. Normal values of SpO_2 are 95–100%. However, in certain patients, e.g. patients with CAL (chronic airways limitation) lower saturation levels are acceptable (Nagelhout, 2014).

Respiratory rate is normally 12-20 breaths per minute for an adult patient. Assessing the rate and quality of respirations for a full minute ensures accuracy. The chest should be observed for equal expansion bilaterally, and respirations should be quiet and regular in rate and rhythm.

NiBP provides information on the condition of the patient's circulatory system. Changes in the systolic BP correlate with changes in oxygen requirements of the myocardium, whilst changes in the diastolic BP reflect coronary perfusion pressure. Post-operative hypotension may indicate a deterioration in the patient's condition: the reasons must be investigated and appropriate action taken. It is important to know the patient's pre-operative BP to enable comparison. Ensuring the correct sized cuff is used will ensure accurate readings. Although automatic sphygmomanometers are generally used, in some cases a manual BP reading on a sphygmomanometer will be required.

Basic ECG/rhythm interpretation is an essential nursing skill for PACU staff. Many PACUs use a 3 lead ECG that is integrated into the bedside monitor. A 12 lead ECG must be readily available for use if required. The ability to identify abnormal rhythms and escalate findings appropriately will reduce the risk of adverse events.

NB: Interpreting ECG is a learned skill. If you require education in this area, work with your facilitator. Refer to the Further Resources section at the end of the Component for online ECG resources.

Temperature must be monitored in PACU to enable detection and treatment of inadvertent perioperative hypothermia. Inadvertent hypothermia is when the body temperature falls below 36°C, and in the surgical patient can result in:

- increased blood loss
- arrhythmias, prolonged recovery
- reduced immunity
- delayed healing
- increased oxygen requirements
- increased risk of wound infection (Hart, et al., 2011; Wu, 2013).

Body temperature is most commonly measured by non-invasive methods such as a skin or tympanic thermometer (axilla for paediatric patients). Some degree of hypothermia after a surgical procedure is common due to a combination of the administration of anaesthesia, exposure to the low ambient temperature in the OR, duration of the procedure and inadequate temperature regulation before and during surgery (Wu, 2013).

Hypothermia can be treated in PACU by using warmed blankets, reflective blankets, forced-air warming devices (FAWD), and warmed intravenous and irrigation fluids. The patient's temperature must be checked regularly when using active warming devices.

Paediatric and elderly patients are particularly susceptible to hypothermia, therefore close monitoring and instigating active measures to ensure normothermia is imperative in the immediate post-operative period.

Invasive forms of monitoring include arterial lines, central venous pressure and pulmonary artery catheterisation (Swan Ganz). Invasive monitoring gives a clearer picture of cardiac output which is represented as a wave form and measurement of pressure on the monitoring screen.

Central venous pressure (CVP) reflects the filling pressure in the right atrium or the vena cava. CVP gives information about intravascular blood volume, right ventricular end-diastolic pressure and right ventricular function (Morton et al, 2012). Central venous catheters can be inserted into the jugular, subclavian, axillary and cephalic veins, and have multiple lumens to enable medication administration and CVP monitoring simultaneously. CVP monitoring may be used in patients undergoing major surgery, in those at risk of hypovolaemia, or with cardiovascular disease.

Arterial BP monitoring (iBP) allows for continuous monitoring of systemic arterial blood pressure and provides vascular access for obtaining blood samples. In the anaesthetic context, arterial lines are indicated in patients undergoing major neurosurgery and cardiothoracic surgery, trauma patients, and patients with particular comorbidities. An arterial catheter can be inserted into radial, brachial, femoral, or dorsalis pedis arteries, however the radial artery is the preferred site due to accessibility and lower risk of infection (Hamlin et al, 2016).

NB: Working with invasive monitoring is an advanced skill that will require additional education and practice. Work with your facilitator and the PACU staff to learn about the equipment and nursing care.

Direct patient observation is paramount even though the patient is continuously monitored by automatic means. Visualising the patient at all times assists in the early detection of any deterioration in the patient's condition and enables immediate interventions to rectify deviations. Nursing the patient (not the monitor) and using a combination of vital signs and visual/physical assessment will assist you to interpret the condition of the patient.

If you have not yet completed *Component 3, Anaesthetics*, the following reading provides details of haemodynamic monitoring and inadvertent perioperative hypothermia.

READ

Hamlin et al. (2016) Chapter 8, pp 218-221, Haemodynamic Monitoring. Chapter 12, p 345, Inadvertent Perioperative Hypothermia.

Duff, J., Walker, K., Edward, K., Williams, R. & Sutherland-Fraser, S. (2014) Incidence of perioperative inadvertent hypothermia and compliance with evidence-based recommendations at four Australian hospitals: A retrospective chart audit. ACORN: *The Journal of Perioperative Nursing in Australia 27*(3), 16-23.

Hamlin et al. (2016) Chapter 12, pp 337-341, Patient Observations and Monitoring

ACORN (2018). Standard on Management of hypothermia in the perioperative environment.

ACTIVITY

5-5 Haemodynamic monitoring
Identify the haemodynamic monitoring used in your PACU. Work with your facilitator to ensure you become familiar with how the equipment works and associated patient care. Complete the table in the Activity section.

Documentation

Chronological documentation of observations must be completed electronically or on paper records (or both, according to local policy). Documenting observations enables you to assess the progress and trajectory of your patient's recovery and alerts you to any complications or deterioration. This allows management measures to be quickly mobilised, for example, contacting the anaesthetist to review the patient or commencing resuscitative actions.

Paediatric and adult observations in NSW public hospitals are documented utilising SurgiNet (electronic medical record or eMR.) Care must be taken when using electronic documentation to ensure the correct patient's records are being completed. Staff members must enter information under their own unique login details. If another staff member enters information whilst you are logged in, this will be attributed to you which could be detrimental if the information is found to be inaccurate.

Paper based documentation is recorded on the NSW Health Standard Adult General Observation (SAGO) chart or the Standard Paediatric Observation Chart (SPOC) chart accordingly. It is important to recognise that a number of patients will be outside the 'Between the Flags' parameters shown on the observation charts due to spinal/epidural blocks, medication and effects of anaesthesia. Any variances to vital sign parameters must be documented by the anaesthetist before the patient is admitted to PACU and reviewed again prior to discharge.

Deteriorating patient

Patients who show signs and symptoms of deterioration are managed by seeking a review by the anaesthetist rather than calling on the hospital's rapid response team (RRT). Whilst a patient is in PACU, a medical officer must be immediately available or readily accessible (ACORN, 2018). However, if a situation occurs where no anaesthetic staff are available within the OS, the RRT must be contacted for assistance (or follow local protocol).

The following reading provides information about the RRT.

READ

NSW Health (2013) NSW Health 2013. PD2013_049. Recognition and management of patients who are clinically deteriorating. *Section 4, p 10, Clinical Emergency Response System*

Post-operative nausea and vomiting

Mr Rubin has been in PACU for 20 minutes. His observations are stable, but he is complaining of nausea: a common complication in the post-operative period. You check Mr Rubin's medication chart and note he is prescribed ondansetron, a commonly used antiemetic agent. You reassure Mr Rubin, sit him up slightly which makes him more comfortable, and provide him with an emesis bowl. You check that suction is connected and turned on, and tuck the Yankauer sucker under his pillow for rapid access if needed. You inform him that you will prepare an antiemetic for him to treat his nausea.

Post-operative nausea and vomiting

Post-operative nausea and vomiting (PONV) is a common and distressing complication, with many patients fearing PONV more than post-operative pain (Mathews, 2017). Vomiting can be harmful to the patient from a surgical perspective as retching can cause suture tension and may result in wound disruption (Matthews, 2017), and may also contribute to fluid and electrolyte imbalances, airway compromise, oesophageal tears, wound dehiscence, bleeding, venous hypertension, and increased intracranial pressure (Collins, 2011).

Although patients are risk assessed for PONV pre-operatively and treated prophylactically intraoperatively, nausea and vomiting should be generally anticipated across all PACU patients and PACU nurses should have suction and emesis bags/bowls readily available.

In patients who have not regained full consciousness or control of their airway, vomiting can lead to aspiration: a life threatening situation. If a semi- or unconscious patient retches or vomits, the patient should be immediately placed in a lateral position (if not contraindicated) and suction used to remove vomit or secretions. Antiemetics are administered as a priority. A vomiting conscious patient should be positioned in a semi-sitting or lateral position. A y-suction catheter (see Figure 5-14) should be used in infants to gently suction the mouth and nose as they are obligate nose breathers. A patient who is vomiting should never be left alone due to the dangers of aspiration and their need for support and reassurance. Due to the seriousness of aspiration, treatment when a patient initially complains of nausea is preferable.

Figure 5-14. Y-suction catheter

Source: http://www.mcfarlanemedical.com.au/30046TE/CATHETER-Y-SUCTION-8FG-43CM-%28AN042002%29----EACH/pd.php

Patients at greatest risk of nausea and vomiting include:

- non smokers
- female
- previous history of PONV
- history of motion sickness
- children – usually over the age of three (Matthews, 2017).

Patients undergoing certain types of surgical procedures are more likely to suffer PONV including:

- Laparoscopic procedures: the $C0_2$ used to distend the abdomen may stimulate the vagus nerve
- Gynaecological procedures: disturbance of gastrointestinal tract
- ENT procedures: patient may have swallowed blood
- Strabismus correction: visual axis disturbed. (Matthews, 2017)

Other risk factors include the use of opioids, use of inhalational anaesthetic agents, manipulation of organs, hydration status (relative hypovolaemia and dehydration), and the position of the body during long procedures (Collins, 2011).

READ

Hamlin et al. (2016) Chapter 12, pp 344-345, Post-operative nausea and vomiting; Aspiration pneumonitis.

Rother, C. (2012). Post-operative nausea & vomiting: use of antiemetic agents in anaesthesia http://sumj.dundee.ac.uk/data/uploads/volume1/SUMJVol1-p89-97.pdf
This reading uses a case study approach to discuss PONV and treatment

Assessment for discharge from PACU

Mr Rubin's nausea has been relieved by the administration of ondansetron. He is reporting very little pain: this is due to the intraoperative infiltration of local anaesthetic into his wound. He has met the discharge criteria and is ready for transfer to the surgical ward.

You accompany Mr Rubin to the ward and provide clinical handover to the ward RN.

Discharge from PACU

The length of time a patient remains in PACU prior to transfer to the ward or other department depends on when the patient has recovered from the effects of the anaesthetic and has met the 'discharge criteria' relevant for your facility. The minimum requirements are reflected in several discharge scoring systems available e.g. Aldrete, with scores reflecting the physical status of the patient in regards to:

- airway
- breathing
- circulation
- consciousness and muscle strength
- pain
- vital signs (BP, oxygen saturation).

It is also necessary to ensure the patient is stable; IV lines, catheters, and drains are patent; urine output is appropriate (for patients with IDC); and the condition of the wound/dressing is satisfactory. The patient should be in the normal range on the SAGO chart prior to discharge, unless an altered review criteria has been set and documented.

Prior to discharging the patient from PACU, the ward is notified by PACU that the patient is ready for discharge. The ward nurse determines if they are able to accept the patient at that time. If the ward is particularly busy or there is a change of shift or if an emergency, the ward may request a short delay before accepting the patient.

The following reading provides a detailed description of PACU discharge criteria.

READ

Hamlin et al. (2016) Chapter 12, pp 352-353, Box 12-1: A patient focussed discharge criteria system

ACORN (2018). Guideline for the Management of the PACU. Guideline statement 5.
This reading details the discharge criteria recommended by ACORN.

ACTIVITY

5-6 Documentation
Review the documentation requirements within your PACU.
What discharge criteria system is used in your PACU to assess patient readiness for discharge? Complete your answers in the Activity section.

Ready to receive subsequent patients

On return to PACU, you clean the patient bay, restock equipment and prepare for the next patient. Ms Armitage, 46, has had an excision of a lump from her left breast. She arrives in PACU with an LMA in situ. You receive handover from the anaesthetist and from the instrument nurse which includes the following information:

- general anaesthetic
- IV Hartmanns solution is running
- hypotension of 90/55 noted at completion of procedure (pre-operative BP was 110/60. Anaesthetist requests that Hartmanns be infused rapidly with a further litre ordered
- pulse 76 bpm
- oxygen is connected to LMA which remains in situ
- the instrument nurse informs you that Ms Armitage had a lump removed from her left breast and has a small closed wound drain in situ.

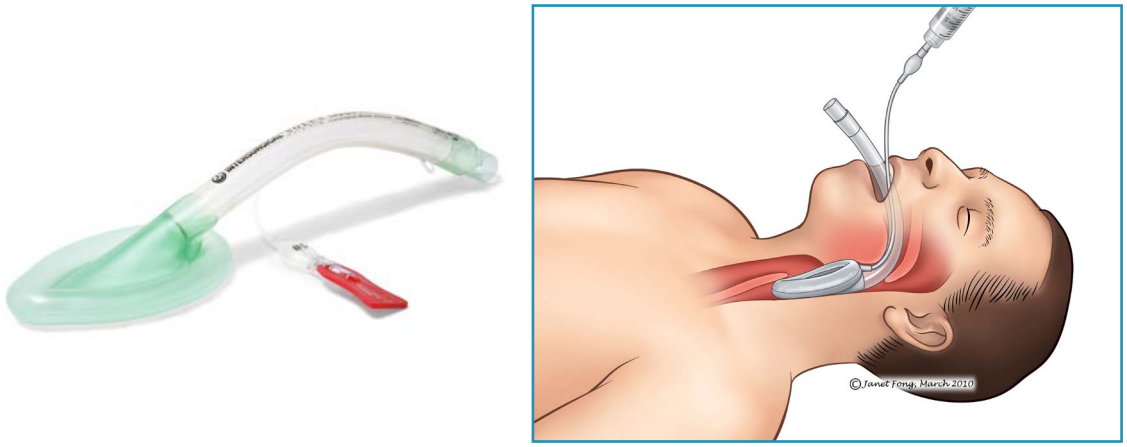
Laryngeal mask airway

A laryngeal mask airway (LMA) is a supraglottic airway i.e. it sits above the trachea and is not inserted through the vocal cords. LMAs are available in a variety of sizes to suit paediatrics and adults. [Review *Component 3 Anaesthetics* for further information on LMAs]

LMA consists of a silicone or PVC tube with an elliptical cuffed mask at the distal end and provides a relatively airtight seal around the larynx (see Figure 5-15). The cuff is lubricated for insertion and the LMA is inserted by hand without the use of a laryngoscope. Once inserted, the cuff is inflated, the LMA is secured in place with tape and attached to the breathing circuit.

The LMA is removed at the end of the surgical procedure either while the person remains anaesthetised (referred to as 'early removal' or while the patient is 'deep') or after the person is fully awake (referred to as 'late removal', usually occurs in PACU) (Mathew & Mathew, 2015).

Figure 5-15. Example of an LMA; LMA in situ



Source: © Anaesthesia and Intensive care, Chinese University of Hong Kong.

In PACU, LMAs are removed (from adults) once the patient regains consciousness and responds to verbal commands. LMAs can be removed by PACU RNs who have undergone additional education and practical assessment. This practice may vary from facility to facility and the local policy should be checked.

Note: *If you have completed Component 3 Anaesthetics, you will have observed the insertion and removal of LMA. If not, read the following information and follow the link to the Sunshine Coast University video.*

READ

Hamlin et al. (2016) Chapter 8, pp 203-205 Laryngeal Mask Airway
Note Figure 8-8 (pp 205) which shows the insertion and placement of LMA

VIEW

Sunshine Coast University LMA insertion and removal
https://www.youtube.com/watch?v=Py57T8o-4A8

Removal of LMA

Following completion of the clinical handover, Mrs Armitage begins to rouse and you prepare to remove Ms Armitage's LMA. You have a Yankauer sucker available to remove secretions from Ms Armitage's mouth, and you gently undo the tape securing the LMA.

Ms Armitage is regaining consciousness: her eyes are opening and she responds to verbal commands to take a deep breath. You remove the LMA, leaving the cuff inflated so any secretions on the cuff or in the oropharynx are also removed. The LMA is disposed of according to local policy. A Hudson mask delivering 6L oxygen per minute is placed on Ms Armitage's mouth and nose. You rapidly assess Ms Armitage's airway and breathing: airway is clear, RR = 14, SpO_2 = 99%.

You continue with your initial and 'head to toe' assessments. You are speaking with Ms Armitage, reassuring her and asking her to take deep breaths. Her BP has responded to the IV fluid blous and is now 100/55 and pulse 80 bpm.

Your head to toe assessment reveals the closed suction drain with a small amount of blood. The dressing is intact with no ooze noted.

Hypotension and shock

Hypotension is not uncommon in the immediate post-operative period. Common causes include hypovolaemia (secondary to blood loss and/or inadequate fluid replacement) and vasodilation (secondary to anaesthetic drugs). Less common causes in the post-operative context include cardiac failure, anaphylaxis, and sepsis (Peetz & Crandall, 2017).

It is important to consult the patient's notes for their pre-operative baseline BP as a low BP may be 'normal' for the patient: the difference between the patient's current and baseline BP is the most critical factor (Peetz & Crandall, 2017).

If continued hypotension persists it can lead to the patient suffering shock and requiring active measures to restore perfusion to vital organs.

Management of hypotension

Evaluation of the hypotensive patient starts with immediately ruling out haemorrhage as a cause (Peetz & Crandall, 2017). Checking dressings, drains, perineal pads (post gynaecological or obstetric surgery), urinary catheters, and overall fluid balance are central to assessing the patient.

If there is no evidence of active bleeding or suspicion of cardiac aetiology, sepsis, or anaphylaxis, hypotension may be secondary to the anaesthetic medications and the patient's BP may recover fairly quickly with minimal treatment. Initial treatment includes increasing IV fluids and providing oxygen (if not already being administered). Stay in regular contact with senior nurses and the anaesthetist to inform them of the patient's response to IV fluids: further treatment will be required for sustained or symptomatic hypotension (nausea, vomiting, light headedness, diaphoresis). This may include further IV fluids and sympathomimetic drugs prescribed to increase BP (Foran & Marshall, 2015), while other potential causes for hypotension are investigated (Peetz and Crandall, 2017).

If active bleeding is the source of the hypotension, the surgeon is informed and requested to review the patient. Further surgical intervention may be required in addition to blood and fluid replacement.

This can be a distressing time for the patient and calm explanations must be provided by the PACU nurse.

Fluid management

Perioperative fluid management can be affected by many factors:

- pre-operative fasting
- blood and other fluid loss during surgery
- nausea and vomiting pre-operatively and post operatively.

Fluid management requires careful assessment and monitoring during the surgical procedure. Blood loss is measured by assessing loss in suction containers (minus irrigation quantities), swabs and sponges, and urinary output.

The anaesthetist will calculate the fluid and electrolyte replacement requirements for each patient to ensure adequate hydration occurs (see Figure 5-16). Accurate documentation of fluid balance by the anaesthetic team is important and must be included in the clinical handover to PACU staff.

Ongoing monitoring of the patency of intravenous access, fluid replacement administered, and outputs (urinary, vomiting, and wound drains/dressings) must be documented in PACU for the ongoing assessment of hydration status and to determine fluid requirements (Hamlin et al., 2016).

The following tables provide a summary of the most common crystalloids and colloid solutions used and the related nursing considerations.

Figure 5-16. IV fluids and their applications

Common crystalloids			
Solution	**Type**	**Uses**	**Nursing considerations**
Dextrose 5% in water (D5W)	**Isotonic**	Fluid loss Dehydration Hypernatraemia	Use cautiously in renal and cardiac patients Can cause fluid overload May cause hyperglycaemia or osmotic diuresis
0.9% Sodium Chloride (Normal Saline-NaCl)	**Isotonic**	Shock Hyponatraemia Blood transfusions Resuscitation Fluid challenges Diabetic Keto Acidosis (DKA)	Can lead to overload Use with caution in patients with heart failure or oedema Can cause hyponatraemia, hypernatraemia, hyperchloraemia or calorie depletion
Lactated Ringer's (Hartmanns)	**Isotonic**	Dehydration Burns Lower GI fluid loss Acute blood loss Hypovolaemia due to third spacing	Contains potassium; don't use with renal failure patients Don't use with liver disease; can't metabolise lactate
0.45% Sodium Chloride (½ Normal Saline)	**Hypotonic**	Water replacement DKA Gastric fluid loss from NG or vomiting	Use with caution May cause cardiovascular collapse or increased intracranial pressure Don't use with liver disease, trauma or burns
Dextrose 5% in ½ normal saline	**Hypertonic**	Later in DKA	Use only when blood sugar falls below 250mg/dl
Dextrose 5% in normal saline	**Hypertonic**	Temporary treatment from shock if plasma expanders aren't available	Contra-indicated for cardiac or renal patients

Common colloids		
Colloid	**Action/use**	**Nursing considerations**
Albumen (plasma protein) 4% or 20%	Keeps fluids in vessels Maintains volume Primarily used to replace protein and treat shock	May cause anaphylaxis (a severe, often rapidly progressive allergic reaction that is potentially life threatening) – watch for/report wheeze, persistent caught, difficulty breathing/ talking, throat tightness, swelling of the lips, eyes, tongue, face, loss of consciousness May cause fluid overload and pulmonary oedema
Dextran (Polysaccharide) 40 or 70	Shifts fluids into vessels Vascular expansion Prolongs haemodynamic response when given with HES	Can cause fluid overload and hypersensitivity Increased risk of bleeding Contraindicated in bleeding disorders, chronic heart failure and renal failure
Hetastarch (HES) (synthetic starch) 6% or 10%	Shifts fluids into vessels Vascular expansion	May cause fluid overload and hypersensitivity Increased risk of bleeding Contraindicated in bleeding disorders, chronic heart failure and renal failure
Mannitol (alcohol sugar) 5% or 10%	Oliguric diuresis Reduces cerebral oedema Eliminates toxins	May cause fluid overload May cause electrolyte imbalances Cellular dehydration Extravasation may cause necrosis

Source: Hills, 2013

All IV and arterial lines, epidural catheters, IV fluids, syringes and any other line in use must be clearly labelled, according to the *National Standard for User-applied Labelling of Injectable Medicines, Fluids and Lines* (ACSQHC, 2015).

READ

Hamlin et al. (2016) Chapter 12, p 346, Hypotension and Shock
If you have not completed Component 3 Anaesthetics, also read Chapter 8, pp 222, Electrolyte balance and Fluid and blood loss.

Hamlin et al. (2016) Chapter 3, pp 63-65, Medication Management
Note Figure 3-5 for examples of labels

ACSQHC (2015) National Standard for User-applied Labelling of Injectable Medicines, Fluids and Lines, Sections 5 (Labelling Medicine Conduits, Lines and Catheters) & Section 6 (Labelling in Perioperative Areas)
https://www.safetyandquality.gov.au/wp-content/uploads/2015/09/National-Standard-for-User-Applied-Labelling-Aug-2015.pdf

Assessing and managing pain

Ms Armitage is awake and complaining of wound pain. You assess her pain using the numerical pain rating scale. Ms Armitage rates her pain at 8 out of 10 (10 being worst pain possible). She is moaning, frowning, and restless. You check her medication chart for pain protocol ordered by the anaesthetist. You inform Ms Armitage that you will organise administration of analgesia.

You note she is ordered IV bolus doses of morphine (pain protocol) and you locate the nursing colleague who is carrying the drug keys to check Ms Armitage's morphine.

Pain assessment

Postoperative pain is one of the most undesirable experiences for a patient undergoing surgery. Deliberate action to prophylactically and post-operatively treat pain is part of the anaesthetic plan. If postoperative pain develops in PACU, it should be managed early. Apart from the unacceptable suffering from pain and the delay in discharge from PACU, poor post-operative pain relief has been associated with an increased incidence of nausea and vomiting, cardiovascular instability, disturbance of sleep, and delays in post-operative patient mobilisation (Tharakan & Faber, 2014). Pain that is not managed effectively post-operatively can have detrimental effects on the ability of the patient to recover (Madenski, 2014).

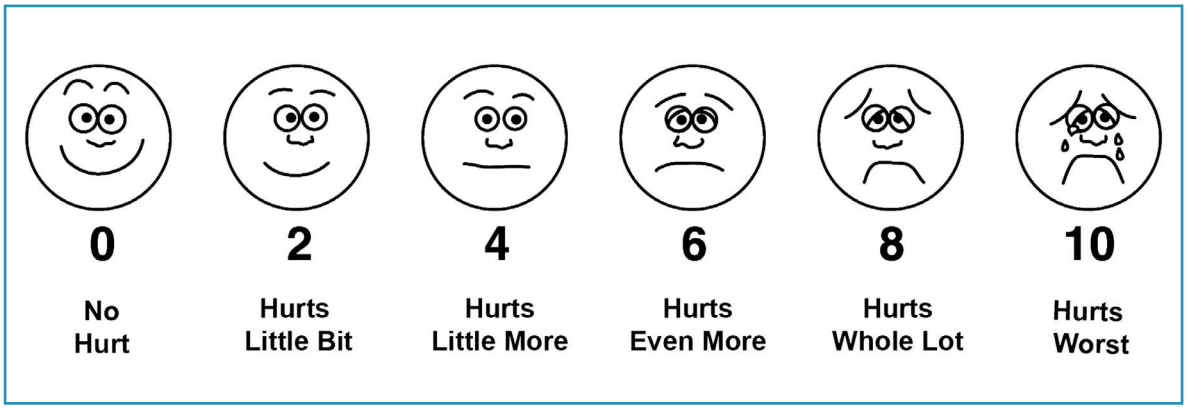
Post-operative pain is the most commonly expressed fear of patients (Hamlin et al, 2016). Pain is subjective, individualised and dependant on perception, previous experiences, tolerance and means of expression (Madenski, 2014). Some patients such as young paediatric, cognitively impaired or those from culturally and linguistically diverse backgrounds, may have difficulty communicating their pain verbally. Other cues and specific pain assessment tools may need to be considered including consultation with the carer/parent/support person.

Pain can be expressed by verbal and non-verbal means. If the patient is able to verbalise pain, it is important to clarify with the patient the location and characteristics of the pain, as it cannot be assumed that the pain is a result of the surgery. A patient may have pain from injuries or chronic conditions such as arthritis, autoimmune diseases, chronic pain syndromes, psychological pain, or pain resulting from intraoperative positioning. It is essential to explore the nature of the patient's pain to select the most appropriate method/s of relief.

On emergence from anaesthesia when the patient may not be able to express their pain verbally, other behavioural and physiological cues are assessed, such as tachycardia, hypertension, moaning, restlessness, aggression or grimacing.

As pain is subjective and influenced by a number of factors, it is essential to utilise an assessment tool to measure a patient's pain. There are a variety of pain assessment tools available. Commonly a scale system is used (verbal or pictorial, see Figure 5-17) and is graded from 0 to 10, with 0 being no pain and 10 being the worse pain possible. Scoring and documenting the patient's pain is helpful in tracking the efficacy of analgesic measures.

Figure 5-17. Pain scale example



Source: Wong -Baker FACES Foundation 2018

Pain management

Effective pain management is a fundamental aspect of quality patient care. PACU staff play a vital role in the assessment and management of pain in the immediate post-operative period. Timely and effective pain relief must be provided, and the effectiveness assessed. Unrelieved or ongoing pain can be a sign of more serious complications and the patient will require review.

In the immediate post-operative period, pain can be managed using pharmacological and non-pharmacological methods. Due to the complex nature of pain, a combination of pain relief measures, known as *multimodal,* may be more appropriate. The PACU nurse must have a thorough understanding of the types of pain management measures available, the indications, complications, onset, duration and peak effect, as well as methods of administration and monitoring requirements for each. If required, patient controlled analgesia (PCA, see Figure 5-18) or nurse controlled analgesia (NCA) will be initiated.

It is important to review the anaesthetic chart to note any medication given to the patient intra-operatively, when it was given and by which route before administering further medication in PACU.

It is imperative that the patient's pain is under control before they are discharged from PACU (Hamlin et al, 2016).

Figure 5-18. Example of PCA device

Sources: NSW Health 2017

Analgesia

Pharmacological

Analgesic medications used in PACU include opioids, opioid-like medications, non-steroidal anti-inflammatory medications, and simple analgesia (see Figure 5-19). Local anaesthetics are often infiltrated into the wound intra-operatively or used to support ongoing regional anaesthesia post operatively. Medication may be given as single doses, pain protocol (multiple small doses), patient controlled (PCA), nurse controlled (NCA) or continuous infusion. All require ongoing monitoring including respiratory assessment (rate and quality), sedation scores, pain assessment, supplementary oxygen and close observation (Putnam, 2016).

Opioids are potent analgesics and are commonly prescribed for acute post-operative pain. A range of side effects are associated with opioids and are frequently seen in PACU, including respiratory depression, sedation, confusion, nausea and vomiting. Side effects largely become apparent as the dose is increased, so careful titration to the patient's analgesic response is required. If side effects become intolerable and pain control remains inadequate, the anaesthetist may order an alternative opioid.

Naloxone is a temporary reversal agent for opioids and in PACU may be used to treat severe respiratory and CNS depression side effects. The duration of action of naloxone is shorter than that of many opioids, and the effect of the opioid may return as the naloxone dissipates. Vigilant monitoring is required.

Figure 5-19. Properties of commonly used analgesia in PACU

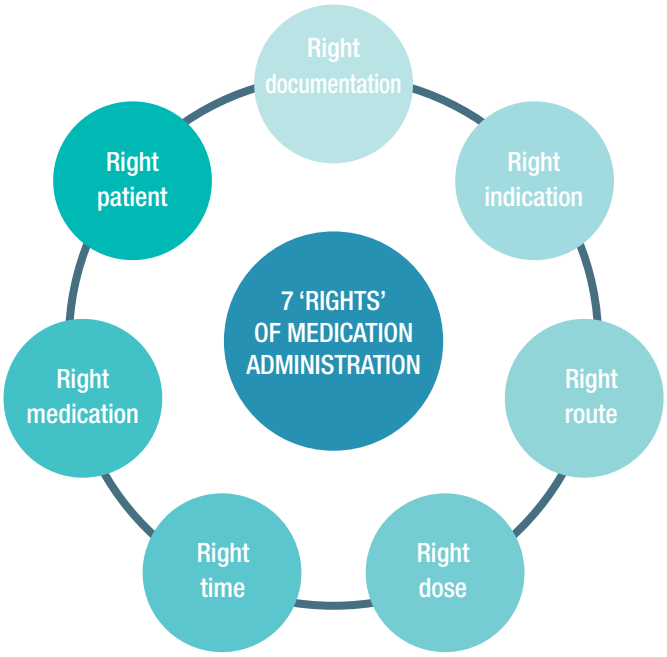
Drug administered	Onset (mins)	Peak effect (mins)	Duration (hours)	Comments
Opioid analgesia				
IV morphine	5–10	15–30	3–4	Considered the 'gold standard' of analgesia
IV fentanyl	3-5	10 - 15	2	More potent and rapid onset compared to morphine: patients require immediate post administration monitoring
IV oxycodone	5	5– 10	2–3	Use with caution in post abdominal surgery – can impair intestinal motility
Non-opioid analgesia (may reduce need for opioids)				
IV tramadol	5	10– 15	4–6	Structurally not an opiate, but exhibits many characteristics of opioids. May not respond to opioid reversal agents e.g. naloxone
IV ibuprofen	5– 10	30	6	Non-steroidal anti-inflammatory drug (NSAID)
IV paracetamol	5–10	15	4–6	Effective as short term IV post-operative analgesia
IV parecoxib	7–15	120	6–24	NSAID: approved for single perioperative injection

Multimodal pain management

Multimodal pain management is often utilised in PACU, and entails simultaneously administering two or more analgesic agents with different mechanisms of action to improve the analgesic effect, while reducing adverse effects (Pasero & Stannard, 2012). Multimodal management may include the use of opioid and non-opioid agents in combination with continuous peripheral neural blocks. Careful monitoring of sedation and respiratory status is required.

ACORN's 7 'rights' of medication administration (see Figure 5-20) must be adhered to at all times, regardless of type of analgesia used or route of administration. Note that other resources e.g. PD2013_043 Medication Handling in NSW Public Health Facilities state '5 Rights'.

Figure 5-20. 7 'rights' of medication administration



Source: ACORN, 2018

The following readings provide detail of the range of pharmacological interventions available to manage post-operative pain.

READ

Hamlin et al. (2016) Chapter 12, pp 347-351, Management of pain in the PACU

Luo, J. & Min, S. (2017) Postoperative pain management in the postanesthesia care unit: an update *Journal of Pain Research* 10: 2687–2698. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5695271/

ANZCA (2013) Guidelines on acute pain management http://www.anzca.edu.au/documents/ps41-2013-guidelines-on-acute-pain-management.pdf

Observations for analgesia

During and immediately following administration of analgesia the patient must be closely monitored to assess the effectiveness of the analgesia in relieving their pain, and to observe for adverse effects of the medication. In particular, observation for respiratory depression and sedation must be attended. Medical assistance should be summoned if the patient exhibits signs of side effects.

Patients who have received analgesia generally remain in PACU for a minimum of 30 minutes following the last dose of analgesia administered to monitor for adverse effects (this may vary according to local policy).

Patients receiving PCA or continuous opioid infusions require frequent observations which are entered on specific charts.

READ

ACI (2016) NSW Standardised Pain Charts (adult and paediatric)
View a range of pain charts and work with your facilitator or PACU staff to become familiar with those used in your PACU.

CEC (2013) Patient controlled analgesia: clinical focus report
http://www.cec.health.nsw.gov.au/__data/assets/pdf_file/0009/259209/patient-safety-report-pca-web.pdf
Details risks related to PCA use

Non-pharmacological

Physical comfort measures can alleviate pain and can be used in combination with pharmacological treatments or alone to reduce pain and discomfort. Measures include, but are not limited to the following:

- positioning: extra pillows, elevation, pressure relieving mattresses
- ensuring the patient is clean, warm and dry
- ensuring patient is not lying on wrinkled sheets or objects inadvertently left in the bed e.g. syringes or anaesthetic equipment
- breathing exercises: can be a relaxation technique whilst promoting lung expansion
- adjusting environmental conditions such as reducing noise and lighting
- utilising warm or cold packs (unless contraindicated)
- for children, having a parent/carer and a favourite toy
- gentle limb exercises
- reducing bladder volume: this can reduce pain associated with pressure on suture lines and internal organs.

ACTIVITY

5-7 Administration of S8 medications
Describe the procedure for checking and administering Ms Armitage's morphine, including the legal requirements when handling S8 drugs. Identify the 7 rights (as per ACORN, 2018) associated with medication administration. Complete your answer in the Activity section.

You have just administered Ms Armitage's IV morphine and as you are making her comfortable, she becomes tearful. She asks you if the lump removed was cancer.

Psychological support of the post-operative patient

Whilst most of the immediate post-operative period is concentrated on monitoring physical parameters, the patient's emotional and psychological well-being must also be considered. Patients are often anxious in the pre-operative period for a variety of reasons, including fear of the unknown, anaesthesia, nausea and vomiting, pain, diagnosis. These anxieties can often manifest themselves in the immediate post-operative period with patients becoming restless, tearful and distressed.

As hearing is the first sense to return post operatively, the PACU nurse should speak to the patient in a calm, quiet, confident voice as this will do much to allay patient anxiety. The PACU nurse should reassure and reorientate the patient to time and place. Patients may not realise that their surgery has been completed and they are in the recovery area, therefore repeating simple factual statements can be effective (Odem-Forren, 2018).

In Ms Armitage's situation, her anxiety relates to whether a diagnosis of cancer has been made during surgery. Consider how you will respond in the next activity.

ACTIVITY

5-8 Communicating with the patient
How will you respond to Ms Armitage? Complete your answer in the Activity section.

Ms Armitage's pain was relieved following several doses of morphine and she was eventually discharged to the ward.

Your next patient is Mrs Simpkin, who is 85 years old and has had carpal tunnel release surgery on her right hand. Mrs Simpkin was given an axillary block due to a long history of emphysema making her unsuitable for a GA. She arrives in PACU and you receive handover from the anaesthetist and instrument nurse. You note that she has had midazolam for sedation during surgery and is still quite drowsy on arrival in PACU, but responding to verbal commands.

Her vital signs are within normal limits, except her temperature is 35.4°C: she has inadvertent perioperative hypothermia, defined as the unintentional drop in core body temperature to below 36°C (Duff et al, 2014; Warttig et al, 2014). In addition, you note during your 'head to toe' assessment of Mrs Simpkin that she is very thin and at risk of pressure injury. Both issues are commonly seen in older patients.

PACU and the older patient

The older patient may present with a number of medical comorbidities or physical limitations which may affect care given in the recovery period. The handover from the anaesthetist combined with reviewing the patient's medical history will provide information on comorbidities and alert staff to the additional care required.

The reduction in adipose tissue places older patients at risk of inadvertent perioperative hypothermia. Consideration of pressure care and skin integrity is also important and they may require frequent repositioning or a pressure relieving mattress.

Patients with hearing or sight deficits should have their hearing aid or glasses applied as soon as appropriate: this will assist in their reorientation, communication with staff, and delivery of appropriate care, such as pain management. Unless contraindicated, dentures should be given to the patient as soon as possible to assist with communication and reduce embarrassment some patients may feel without their teeth.

The following readings provide a summary of caring for older patients in PACU. If you have not studied *Component 3 Anaesthetics*, it is recommended you complete these two additional readings.

READ

Hamlin et al. (2016) Chapter 8, p 227, Table 8-7, Patient care considerations and the ageing process. Chapter 12, pp 351-352, Care of the older patient in PACU

Oster, K. & Oster, C. (2015) Special needs population: care of the geriatric patient population in the perioperative setting. *AORN Journa*l, 101(4), pp 443-459. https://aornjournal.onlinelibrary.wiley.com/doi/full/10.1016/j.aorn.2014.10.022

ACTIVITY

5-9 Care of the older patient
Describe how you will manage Mrs Simpkin's inadvertent hypothermia and reduce her risk of pressure injury. Complete your answers in the Activity section.

You are repositioning Mrs Simpkin to improve her comfort and have elevated her right arm on a pillow to protect it from injury. In addition to general observations, neurovascular observations are required on her right arm to assess return of sensory and motor function. You also assess the area on Mrs Simpkin's arm where the tourniquet was applied for skin damage.

As you are attending to Mrs Simpkin, your attention is drawn to screaming coming from a nearby bed bay. A semi-conscious patient is thrashing around in the bed and the PACU nurse caring for him is struggling to prevent the patient getting out of bed. You leave Mrs Simpkin and move to assist your colleague protect and calm the patient. The patient is suffering from emergence delirium.

Emergence delirium

Post-operative delirium is a well-recognised post-operative complication which can occur in any age group, though is more common in children and the older patient (Odem-Forren, 2018; Brooks et al, 2014). In a mild form, the patient may exhibit restlessness, disorientation, repeating questions, and inappropriate conversations. However, some patients will exhibit aggressive or inappropriate behaviour, thrashing of limbs, hallucinations, disorientation, violent behaviour, and removal of tubes and catheters. This behaviour can place both staff and patient at risk of harm and requires urgent treatment.

Preoperative assessment and screening of adults for cognition and delirium risk is required to ascertain a baseline from which to diagnose and be alert to post-operative delirium post operatively (Brooks et al, 2014).

The management of emergence delirium includes:

- remain calm when talking to the patient and provide reassurance (including to any carer/support persons present)
- summon assistance from other staff in PACU
- protect the patient from harm and prevent injury to staff; keep bedrails up and line with pillows to protect head and limbs
- treat the cause e.g. pain, the presence of an artificial airway or gastric tube, anxiety, bladder distension/ urinary retention, or hypoxia
- alert anaesthetic staff to review patient: sedation may be required.

Delirium usually subsides as the patient emerges fully from the anaesthetic and the majority of affected patients have little recollection. However, for some patients, delirium may persist and delay their discharge from PACU.

The following readings provide a summary of emergence delirium, its management, and the care of older patients with delirium.

READ

Hamlin et al. (2016) Chapter 12, pp 346-347, Emergence delirium.

Brooks, P., Spillane, J., Dick, K. & Stuart-Sho, E. (2014) Developing a strategy to identify and treat older patients with postoperative delirium.

The patient exhibiting signs of emergence delirium has been managed without the need for medical intervention. The administration of oxygen and gentle reassurance from nursing staff has calmed the patient.

You return to Mrs Simpkin and prepare her for discharge to the ward.

The next patient to arrive in PACU is Mr Sanjay Kumar, 56, who has had a melanoma excised his anterior thigh under a GA. Mr Kumar weighs 180kgs. He arrives semi-conscious, extubated and sitting upright supported on pillows. 6L oxygen per minute is being delivered through a Hudson mask and his oxygen saturation is 97%. This positioning has assisted in maintaining Mr Kumar's airway and adequate respiratory function.

Bariatric patients

The bariatric patient is at greater risk of respiratory, circulatory and integumentary complications. Positioning the patient in a more upright position in the post-anaesthetic period (unless contraindicated) will reduce the pressure on the chest wall, allowing for greater lung expansion and will assist in reducing sleep apnoea (Hamlin et al, 2016).

Assessing the patient's risk of pressure injury is important. For instance, if your facility uses slim transport trolleys, the patient may not fit comfortably and the trolley rails will require padding to prevent injury. Alternatively, ensuring the patient is placed directly on a ward bed with greater width would reduce this risk. This negates the need to move the patient a second time and reduces the manual handling risks to both staff and patient. When moving the patient, transfer equipment e.g. Hovermatt or slide sheets must be used.

The following reading provides a summary of caring for bariatric patients in PACU. If you have not studied *Component 3 Anaesthetics*, it is recommended you complete the additional reading from Chapter 8.

READ

Hamlin et al. (2016) Chapter 12 p 352, Care of the obese patient; Chapter 8, p 228, Figure 8-8 on Conditions associated with the pathophysiology of obesity.

Mr Kumar has been in PACU for 20 minutes. His BP on admission was 140/55 (pre-operative BP was 145/70) and pulse 88 bpm (pre-operative pulse was 80 bpm). You have been monitoring his vital signs every five minutes and his readings are as follows:

Time	BP	HR
1145	140/55	88
1150	138/50	90
1155	120/60	98
1200	110/55	102

ACTIVITY

5-10 Deteriorating patient
What is your interpretation of Mr Kumar's BP and pulse readings? What action (if any) will you take and why? Complete your answers in the Activity section.

You ask the anaesthetist to review Mr Kumar in view of his emerging hypotension and tachycardia. A 500ml bolus of IV Hartmanns is ordered and administered. Mr Kumar's condition stabilises following the bolus: his BP and pulse return to normal limits. He eventually meets all discharge criteria and is transferred to the ward.

Your next patient is Ms Raikuna who has had an elective Caesarean section under spinal anaesthesia. She was 38 weeks pregnant with her second baby. A healthy baby boy was delivered and has accompanied his mother into PACU. You have placed them both in a side room (or a quiet area of PACU if side rooms are not available). Ms Raikuna's partner Chris has left to phone their families and will return to PACU shortly.

You receive handover from the anaesthetist and instrument nurse.

Obstetric patients

The care of post-operative obstetric patients is specific and is influenced by the type of anaesthetic they have received. In NSW, over 90% of lower segment Caesarean sections (LSCS) were performed under epidural or spinal anaesthetic (or a combined spinal-epidural) from 2011 to 2015 (NSW Health Stats, 2018).

If you have not completed *Component 3 Anaesthesia*, the following reading provides information on the insertion of central neural blockade which will assist your understanding of the post-operative management. The second chapter describes the PACU management of patients with central neural blockade.

READ

Hamlin et al. (2016) Chapter 8 pp 214-217 and Chapter 12 pp 339-340, Central Neural Blockade.

Post-operative care following central neural blockade

Patients who have received a central neural blockade (epidural block, spinal block, or combined spinal-epidural block) will experience loss of sensation in the area below the level of the block. For LSCS patients, the abdomen and legs are usually affected. Care must be taken in positioning the patient's legs to ensure pressure injury does not occur, e.g. pressure from contact with the bed rails. The block will provide post-operative pain relief, however, pain assessment should be carried out as the block will start to wear off. Patients must be warned not to try to get out of bed, even if they believe the block has worn off, as complete motor function may not have returned and injury could result.

High spinal/epidural block

The area of skin that is supplied by a single spinal nerve is known as a dermatome. Regular dermatome testing in PACU detects the extent of the spinal or epidural block, any spread which may interfere with the diaphragm or upper extremities, and to track the descent of the block.

Local anaesthetics (LA) work by blocking nerve impulses on sensory, motor and autonomic nerve fibres. Sensory fibres respond to pain, temperature, touch and pressure, and since pain and temperature nerve fibres are similarly affected by LA, changes in temperature perception indicate the area where the block is working (Royal Children's Hospital, Melbourne, 2015). Ice packs are commonly used to establish which

dermatomes are affected: the patient will report reduced sensation of cold. Both left and right sides need to be assessed as blocks can be uneven or patchy (RCHM, 2015).

If the block is too high, the patient may become dyspnoeic, complain of weakness or numbness in their fingers, complain of nausea and may show signs of bradycardia and hypotension. Immediate assistance from the medical team is required should this occur.

Urinary retention is a potential complication of any anaesthetic, and particularly with central neuraxial anaesthesia. For this reason, many patients having spinal/epidural anaesthesia will have an indwelling urinary catheter inserted. Close monitoring of input and output and ultrasound (if indicated) will assist to detect any retention.

Spinal headache

Some patients who have received a spinal anaesthetic may complain of a headache in the post-operative period: this is caused by leakage of cerebral spinal fluid (CSF) through the hole made in the dura during insertion of the spinal anaesthetic. Most headaches subside within 24 hours, however, if it persists, the anaesthetist may need to perform a 'blood patch': an injection of 5-20ml of blood into the epidural space to seal the hole.

A headache may also be a symptom of a condition known as pre-eclampsia, a condition unique to pregnant women. Pre-eclampsia is characterised by hypertension, headaches, proteinuria and other physiological changes. It can be a serious condition leading to death if not treated. Although pre-eclampsia occurs during pregnancy and is relieved by the delivery of the baby, it is not uncommon in the postpartum period for women to experience hypertension and headaches. Any changes in BP indicating hypertension, with or without a headache must be investigated. Treatment is usually with antihypertensive agents (Magee, 2013).

Obstetric care and monitoring

In addition to vital signs and block checks carried out by PACU staff, specific postpartum observations must be carried out including a wound check, lochia (post-delivery vaginal discharge) check, and fundal check.

PACU staff and the attending midwife work together to care for both mother and baby during their stay in PACU. The midwife conducts the newborn check on the baby and assists in skin to skin bonding between mother and baby. The post-partum checks may be managed by either the midwife (if available) or an appropriately trained PACU nurse.

The fundal check must be performed with care as it requires palpating near the operative site (midline between umbilicus and symphysis pubis). This can be uncomfortable for the patient, particularly as the block wears off. The fundus (top of the uterus) is palpated and should feel firm and be located centrally. If it feels soft (often termed 'boggy') this could indicate that the uterus has not contracted properly and the patient may be at risk of a post-partum haemorrhage (PPH). PPH is excessive bleeding caused by a failure of the uterus to contract following delivery. Severe PPH is defined as blood loss of 1000mL or more, or any amount of blood loss postpartum that causes haemodynamic compromise (NSW Health, 2017). The patient's perineal pad should be checked for lochia. PV blood loss is normal in the post-partum period but if it appears excessive or if you are unsure, request a senior nurse/midwife to review the patient.

PPH can be a life-threatening emergency and a large volume of blood can be lost rapidly. Early detection is vital to avoid the patient deteriorating. Management of PPH consists of:

- calling for assistance
- treating hypotension/hypovolaemia with fluid replacement +/- blood products
- IV oxytocic medication to contract the uterus
- investigating the cause – a blood clot or retained piece of placenta could be preventing the uterus from contracting. If this is suspected, the tissue may need to be manually expelled or the patient may need to be returned to the OR for a further procedure
- inserting a urinary catheter if not already attended: a full bladder may be preventing the uterus from contracting. (NSW Health, 2017)

NB: Caring for post-partum patients is an advanced skill that will require additional education and practice. Work with your facilitator and the PACU staff to learn about post-partum nursing care.

ACTIVITY

5-11 Patient handover
Using ISOBAR, Identify the information you expect to receive from the anaesthetist and instrument nurse relevant to the care of Ms Raikuna and her baby.

All of Ms Raikuna's observations are within normal limits. Her spinal block is descending: she has some feeling returning to her legs and can move her feet. Her urine output via IDC is satisfactory. She has no nausea or headache and has taken a few sips of water. Ongoing analgesia and IV fluids are ordered.

The midwife has performed the newborn check. Ms Raikuna has her son on her chest, continuing the skin to skin bonding that was commenced after delivery in the OR. This action has been shown to play an important role in the bonding process between mother and baby (NSW Health, 2016). Mrs Raikuna is cautioned not to try to get out of bed as motor function may not have fully returned, even though sensory function is returning. The safety of both mother and baby are paramount and staff must be vigilant in observing both.

Ms Raikuna's partner Chris has arrived in PACU. As Ms Raikuna has met the discharge criteria, she is transferred to the post-natal ward. You accompany her and provide a handover to the ward staff.

Visitors in PACU

Each facility will have a policy to guide staff in relation to visitor access to PACU (ACORN, 2018). PACU is a semi-restricted area and staff should challenge unannounced visitors to ascertain their reason for accessing the area: the safety of both staff and patients remains paramount.

ACORN (2018) states that parents, guardians, spouses and significant others are able to accompany patients in the perioperative environment, supervised by a staff member. PACU is unique because there are multiple patients in an open area and staff must ensure that the privacy of patients is maintained.

Visitors can provide immense psychological support to patients which may also assist PACU staff in communication and managing care. However, visitors are exposed to many sights, sounds and smells in PACU which they may find unpleasant and confronting. PACU staff must provide visitors with support as required.

The following reading provides information to assist in managing visitors to the perioperative environment.

READ

ACORN (2018) Standard for Visitors to the perioperative environment.

ACTIVITY

5-12 Visitors in PACU
What are the benefits and challenges of allowing visitors into the PACU? How will you manage Ms Raikuna's partner when they arrive in PACU? Complete your answer in the Activity section.

Clinical handover

The handover from PACU to the ward must be structured and comprehensive. ISBAR guidelines should be followed.

Each PACU patient is escorted by a nurse to their destination. In some facilities, the PACU nurse escorts the patient to the ward, whilst in others the receiving nurse attends for handover in PACU prior to escorting the patient to the ward.

ACTIVITY

5-13 Clinical handover
Using ISBAR, identify the information you will handover about Ms Raikuna to the post-natal ward.

Additional considerations

Paediatric patients

Paediatric anaesthesia and surgery are specialties in their own right, and not all facilities offer these services. If your unit provides paediatric surgical services, explore this topic further with your facilitator and seek to complete additional education on paediatric anatomy, medications, and special care needs. DETECT Junior (NSW Health, 2013) and Resus4Kids are education programs that all staff working with paediatric patients must complete.

A summary of the post anaesthetic care of paediatric patients is provided in this Component.

Children and young people have special healthcare needs due to their physical and emotional differences from adults, and their need for the constant care and support of their parents/support person. As a priority, the PACU should consider the child's emotional needs and create an environment that minimises fear and distress, whilst still monitoring and providing care for the child. Parents or support people will likely feel anxious and will also require reassurance and information from the PACU nurse (Figure 5-21).

Figure 5-21. Supporting parents/carers in PACU

SUPPORTING THE PATIENT'S PARENT/CARER IN PACU
Key actions of the PACU nurse: • explain what to expect in the PACU including the usual recovery pathway and any interventions you make • explain the parent's/support person's role in the recovery process • explain how they can enter/exit PACU • ensure they understand what to do should they feel unwell or overwhelmed • stay close throughout and offer support as needed.

Paediatric patients differ significantly from adult patients in PACU, and between children of different ages there is further variation in size, anatomy, physiology, and psychology. The key physiological differences are summarised in Figure 5-22.

Figure 5-22. Paediatric physiology

PAEDIATRIC PHYSIOLOGY: KEY DIFFERENCES FROM ADULTS	
Airway	• In children <8 years old, the head is proportionately larger and the neck shorter • The trachea in infants is more malleable, and the large tongue can result in airway obstruction if the head is overextended • Infants <6 months are obligate nasal breathers • The epiglottis is horseshoe-shaped
Breathing	• Small diameters throughout the respiratory system increase the risk of obstruction • Infants have ribs that lie more horizontally and they rely on their diaphragm for breathing • Increased metabolic rate and oxygen consumption contribute to higher respiratory rates
Circulation	• Small stroke volume but a relatively higher cardiac output is facilitated by higher heart rates • Stroke volume increases with age as heart rate falls (<2 years old, ability to increase stroke volume is limited) • The circulating volume per kg of body weight is higher than adults at 80–100 mL/kg but the total circulating volume is low
Other	• Higher surface area results in rapid heat loss • Normal neurological responses change with stages of development: it is essential to involve caregivers in the assessment process. A modified Glasgow Coma or Alert, Verbal, Pain, Unconscious assessment (AVPU) scale can be used to detect decreasing levels of consciousness for pre-verbal children and those with developmental delay (NSW Health, 2011) • Vulnerable to fluid deficits.

Adapted from Yock-Corrales & Starr, 2010

Paediatric pain assessment and management

Assessing pain can be difficult in paediatric patients due to age-related communication constraints and the challenge in identifying pain in the context of emergence agitation or delirium. Observing behaviour and facial expressions combined with physiological parameters will assist in the detection of pain. Involving the parent/carer can be helpful as they are familiar with signs of pain expressed by their child. An age appropriate pain scale should be used to assess and monitor pain in infants and children, including children with developmental disabilities. Medication doses are based on the weight of the child, therefore noting the baseline weight of the child is integral. Absorption, metabolism and excretion of medications will also differ between ages of children.

Figure 5-23. Paediatric PACU patient

Source: Photo by rawpixel.com from Pexels; https://www.pexels.com/photo/baby-birth-born-care-734541/

Emotional support

Emergence from anaesthesia in an unfamiliar environment and with unfamiliar people is stressful for any child: support from their parent or carer is required as soon as possible. Emergence delirium is common in children and can be distressing for both parent/carer and patient. However, the parent/carer can assist with settling an upset child, giving warmth, identifying pain responses and differences in behaviour. The value of the parent/carer's presence cannot be underestimated in the recovery of the paediatric patient.

Patients with diabetes

Patients with diabetes mellitus have increased surgical morbidity and mortality. This is thought to be associated with sustained hyperglycaemia and the glycaemic variability across the patient's surgical episode (Coan, Apsey, Schlinkert, Stearns, & Cook, 2014) amongst other factors. Patients with diabetes mellitus are susceptible to post-operative complications e.g. infection, hypo- and hyperglycaemia. The PACU nurse must be alert to patients with diabetes mellitus and their current blood glucose status. The clinical handover from the anaesthetist should include detail of intraoperative management and ongoing monitoring and treatment requirements.

Regular checks of blood glucose levels (BGL) in the immediate post-operative period will provide the basis for ongoing management. Episodes of hypoglycaemia and hyperglycaemia may be masked by the effects of anaesthesia, therefore monitoring BGL is vital (Drain, 2013). Some patients may require insulin infusions in the post-operative period to control BGLs.

The following readings provide information about the pre and post-operative management of patients with diabetes.

READ

Hamlin et al. (2016) Chapter 7, pp 176-177, Diabetes, and Chapter 12, p 351, Management of patients with diabetes mellitus.

Coan, K., Apsey, H., Schlinkert, R., Stearns, J., & Cook, C. (2014). Managing diabetes mellitus in the surgical patient. https://pdfs.semanticscholar.org/3af0/1e7c122e5eb13d7d220229853da586ae1bcf.pdf
Read practice points and Box 1.

Management of wounds

Assessment of a patient's wound forms part of the 'head to toe' assessment carried out on admission to PACU, and periodically thereafter. The dressing should be viewed and assessed for bleeding or swelling. Any excessive or active bleeding must be noted and managed: initial management of active bleeding requires applying pressure with a sterile pad whilst review from the surgical team is sought.

Active bleeding or swelling noted in the head and neck area e.g. post thyroidectomy or neck dissection etc. may compromise the airway and urgent assistance will be required to stop the bleeding.

If it is necessary to redress a wound in PACU, aseptic technique must be strictly followed.

Management of drains

Drains are inserted during surgery to provide a pathway for blood and other exudate to be removed from the surgical site. There are a variety of drains available and their use will vary between surgeons. Some will be sutured in place. Regardless of the drainage system used, it is important that the drain's patency is checked frequently: any blockage will allow blood and exudate to collect in the wound which can contribute to haematoma formation and surgical site infections.

The amount and type of drainage should be checked and documented as per local policy. Any sudden increase in the amount or type of drainage could be a sign of active bleeding and should be communicated to senior PACU staff and the surgical team for review.

Figure 5-24. Wall suction regulator

Source: Medical Australia Limited

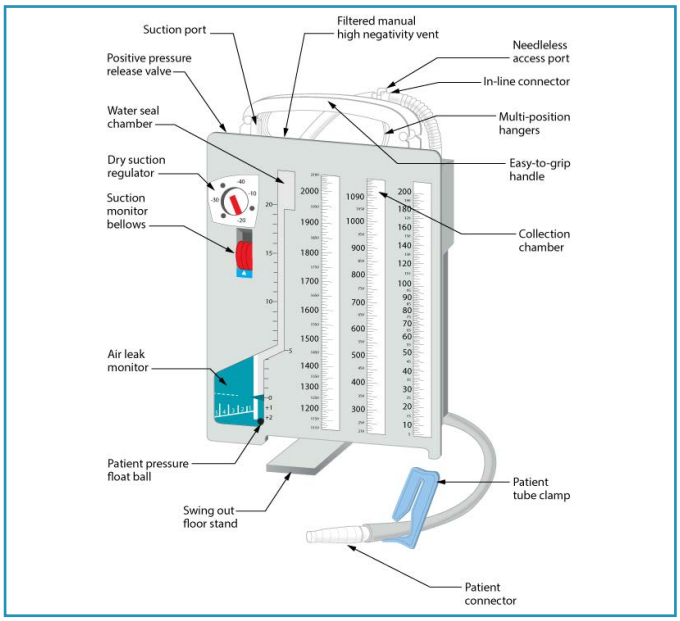
Active drains

Some drains, e.g. closed wound suction systems and chest drains, are 'active' drains and attached to a suction outlet with a regulator where suction is applied. It is important that suction regulators (see Figure 5-24) are checked prior to use to ensure they deliver the prescribed amount of suction for the type of drain and the surgeon's orders, i.e. the minimum amount of suction required to achieve the desired result. Excessive negative pressure can cause tissue damage.

Chest drains

Chest drains (also known as underwater sealed drains – UWSD) (see Figure 5-25) are inserted to drain the pleural cavity of air and/or blood to re-establish normal negative intrathoracic pressures and allow the lungs to re-expand following thoracic or cardiac surgery. One or more drains may be inserted to drain both air and fluid. The drain is attached to regulated wall suction at a prescribed level. Care must be taken when moving the patient to ensure the drain is kept upright and below chest height to prevent back flow into the pleural cavity. According to ACI Guidelines (see reading), pleural drains should only be clamped on medical orders and a set of clamps should be kept at the bedside and accompany the patient when being transported.

Figure 5-25. Example of a chest drain



Source: British Columbia Institute of Technology

Vacuum assisted wound closure (VAC)

Vacuum assisted closure (VAC) is a wound dressing system that uses negative pressure to expedite wound healing. A vacuum at the wound site helps to approximate the wound edges, remove infectious materials, and promote granulation. It is often used in large wounds which cannot be closed by suturing or have been debrided of infected tissue. The VAC system consists of an absorbent dressing, an occlusive adherent dressing to seal the wound, a reservoir to collect exudate, a suction tube, and the portable suction machine (see Figure 5-26). The VAC may be attached to suction intermittently or continuously, depending on the surgeon's orders.

Figure 5-26. VAC dressing

Source: Noles1984/Wikimedia Commons

Passive drains

Passive drains function by gravity and capillary action, emptying blood and exudate from the wound into a dressing or drainage bag. Corrugated silicone drains (e.g. Yeates drain) or tubing (e.g. Penrose drain) may be used. More commonly used are closed wound drainage systems which are self-contained and can be either passive or active, when attached to suction.

External ventricular drains

External ventricular drains (EVD) are inserted to relieve pressure from within the cranial vault by releasing cerebro-spinal fluid. One of their uses is for pressure monitoring or reduction following some neurosurgical procedures. The EVD is placed in the anterior horn of the lateral ventricle of the non-dominant hemisphere (usually the right side). EVDs are attached to a transducer to measure intracranial pressure.

Note: *Caring for complex thoracic and neurosurgical patients and associated drainage and monitoring equipment are advanced skills that require additional education and practice. Work with your facilitator and the PACU staff to learn about the equipment and nursing care.*

The following readings provide further detail on the types of wound drains commonly used.

READ

Hamlin et al. (2016) Chapter 11, pp 321–324, Wound care, and pp 324–328, Drains and the technological advances in wound management.

ACI (2016) Pleural drains in adults.
https://www.aci.health.nsw.gov.au/resources/respiratory/pleural-drains/pleural-drains-in-adults/section-3-management
Read Section 3: Management.

ACTIVITY

5-14 Drainage systems
Identify four different types of drains used in your PACU, give an example of why each type is used, how they function, and explain the patient care considerations for each.

Conclusion

Component 5 has provided a description of the responsibilities of the PACU nurse and the role they play in the patient's physical and psychological recovery from anaesthesia. The importance of monitoring and prompt recognition and management of post-anaesthetic complications in PACU patients has been highlighted.

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Weblinks

Agency for Clinical Innovation: www.aci.health.nsw.gov.au/resources/pain-management/acute-sub-acute-pain/acute-pain-forms

Life in the Fast Lane: ECG online learning https://lifeinthefastlane.com/ecg-library/

COMPONENT 5 – ACTIVITIES

Activity 5-1: PACU Design

Draw a map of your PACU and identify the location of six items of monitoring and emergency equipment.

Activity 5-2: Anaesthetic medications

Consider the anaesthetic and adjunct drugs used in your OS and PACU and outline the nursing care considerations for each. Complete the table:

Anaesthetic drugs used in:	Name of drug	Action	PACU nursing considerations
Induction			
Muscle relaxant			
Analgesia			
Reversal			
Pain management			
Central neural blockade			
PONV			

Activity 5-3: Clinical handover

Consider the information you require from both the anaesthetist and the instrument nurse during handover of care. Complete the table:

ISOBAR	Anaesthetist Handover	Instrument Nurse Handover
Identification		
Situation		
Observations		
Background		
Assessment		
Responsibility		

Activity 5-4: Airway management

Consult with your facilitator and practice the skills required for insertion of artificial airways and single and/or two person IPPV. Complete the table:

Complication	Signs and symptoms	Management
Upper airway obstruction		
Partial laryngospasm		
Complete laryngospasm		
Bronchospasm		

Activity 5-5: Haemodynamic monitoring

Complete the following table based on the haemodynamic monitoring used in your PACU. Identify patient care considerations for each:

Monitoring equipment	Rationale for use	Patient care considerations

Activity 5-6: Documentation

Review the documentation requirements within your PACU. Describe the discharge criteria system used in your PACU to assess patient readiness for discharge.

Activity 5-7: Administration of S8 medications

Describe the procedure for checking and administering morphine, including the legal requirements when handling S8 drugs. Identify the 7 rights associated with medication administration.

Activity 5-8: Communicating with the patient

How will you respond to Ms Armitage?

Activity 5-9: Care of the older patient

Describe how you will manage Mrs Simpkin's inadvertent hypothermia and reduce her risk of pressure injury.

Hypothermia:
Pressure injury:

Activity 5-10: Deteriorating patient

What is your interpretation of Mr Kumar's BP and pulse readings? What action (if any) will you take and why?

Activity 5-11: Patient Handover

Using ISOBAR, identify the information you expect to receive from the anaesthetist and instrument nurse relevant to the care of Ms Raikuna and her baby.

ISOBAR	Anaesthetist Handover	Instrument Nurse Handover
Identification		
Situation		
Observations		
Background		
Assessment		
Responsibility		

Activity 5-12: Visitors in PACU

What are four benefits and four challenges of allowing visitors into the PACU?

Benefits	Challenges

How will you manage Ms Raikuna's partner when they arrive at PACU?

Activity 5-13: Clinical handover

Using ISBAR, identify the information you will handover about Ms Raikuna to the post-natal ward.

ISBAR	Handover information on Ms Raikuna
Identification	
Situation	
Background	
Assessment and actions	
Responsibility	

Activity 5-14: Drainage systems

Identify four different types of drains used in your PACU, give an example of why each type is used, how they function, and explain the patient care considerations for each.

Type of drain	Why is it used?	How does it work?	Patient care considerations

— End of Component 5 —

Notes

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