



RAPID

Perioperative Care

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WILEY Blackwell

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Preface

This book has been written by C. Paul Wicker and Sara Dalby for perioperative practitioners (students, nurses and ODPs) and junior doctors who work in anaesthetics, surgery and recovery. This *Rapid* series book covers a wide range of subjects related to perioperative practice and perioperative care, and each chapter is relatively short and concise so that practitioners can read the chapter efficiently and effectively, which will encourage them to learn how to undertake tasks and actions within the operating department. This book will provide practitioners with detailed knowledge and understanding of many aspects of perioperative practice which will support them in their work in clinical practice and enable them to deliver the best possible care to all perioperative patients.

This book will use a structured approach to perioperative care, starting with an introduction to the perioperative environment, anaesthetics, surgery and recovery, and critical care for patients who have serious health problems.

The first section is called 'Preoperative Preparation' which covers areas such as roles of theatre practitioners, preoperative assessment checklists, perioperative equipment, medication and several other chapters. This is an important area for junior theatre practitioners so that they know how to prepare the operating room prior to the patient arriving.

The second section is called 'Anaesthesia' and is related to anaesthetic procedures, which are very important to patients because, basically, anaesthesia maintains their homeostasis and physiological status during surgical procedures. Chapters include checking anaesthetic equipment, general and local anaesthesia, rapid sequence induction, airway management and so on. The purpose of anaesthesia is to keep the patient unconscious during the surgical procedure, and maintain oxygenation, blood pressure, pulse, and fluid levels throughout the surgery. The use of anaesthetic drugs also helps to prevent postoperative pain and can help prevent problems such as low blood pressure or malignant hyperthermia.

The next three sections are related to surgery – 'Surgical Specialities', 'Surgical Scrub Skills' and 'Surgical Assisting'. The first two sections cover many areas of surgery, including all aspects of surgery such as vascular, breast, orthopaedics, laparoscopic and colorectal surgery, as well as skin preparation, electrosurgery, wound healing, dressings, haemostasis and so on. These two sections cover most surgical specialities and also all aspects of actions taken during surgery by both the surgeons and the scrub practitioner. The final section on surgery covers the actions taken by surgical assistants, including legal issues, suture materials, wound closure, camera holding, retraction and so on. This chapter will provide you with detailed information about the role of the surgical assistant, which will help you to understand fully the ability to assist surgeons, for those practitioners who have undertaken appropriate first assistant training.

The sixth section is called 'Recovery' and is related to recovery care of patients. Chapters include recovery room design, patient handover, monitoring, assessment, medications, bleeding problems and so on. When the patient enters the recovery room, he or she recovers from the anaesthesia and surgery. Recovery practitioners monitor patients carefully to ensure they don't suffer side effects and do recover from their anaesthesia and surgery safely. Monitoring includes respiration, breathing, blood loss, temperature, blood pressure, pulse and so on. Patients may also need supervising in case of postoperative problems caused by anaesthetic drugs, for example anxiety or delirium.

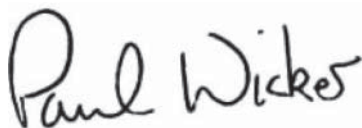
Postoperative problems include many areas such as postoperative pain, nausea and vomiting, electrolyte imbalance, low fluid balance, low blood pressure, malignant hyperthermia and so on. These problems may be resolved by recovery staff or may need an anaesthetist's or surgeon's actions. The 13 chapters regarding recovery should provide you with a good level of knowledge and skills in regards to caring for postoperative patients.

The final section is about 'Perioperative Critical Care' which covers areas such as management of critically ill patients, hypothermia, hyperthermia, deep vein thrombosis, latex allergies, pressure ulcers, diabetes, anaemia, morbidly obese patients and others. Critical

care of patients is important and urgent when they are suffering from serious illnesses or conditions, and so these 13 chapters cover many areas which will be of interest to you when you need to deal with these patient conditions.

This *Rapid* series book on perioperative care will provide theatre practitioners with short, detailed and concise information about many aspects of their role. This will be useful for trained staff and for students and will help to ensure patient safety and effective working.

Enjoy this book and we hope that you like it!

A handwritten signature in black ink that reads "Paul Wicker". The script is fluid and cursive.

Paul Wicker

A handwritten signature in black ink that reads "S. J. Dalby". The script is cursive and somewhat stylized.

Sara Dalby



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Paul Wicker
Sara Dalby

Abbreviations

AAA	abdominal aortic aneurysm
AAGBI	Association of Anaesthetists of Great Britain and Ireland
ABG	arterial blood gas
ACL	anterior cruciate ligament (knee)
ACS	acute coronary syndrome
AF	atrial fibrillation
ARDS	adult respiratory distress syndrome
ARF	acute renal failure, acute rheumatic fever
AV	arteriovenous or arterial-venous
AVR	aortic valve replacement
BMD	bone mass density
BMI	body mass index
BMR	basic metabolic rate
BNF	British National Formulary
BP	blood pressure
C	centigrade, Celsius
C/S	caesarean section
CABG	coronary artery bypass graft
CAD	coronary artery disease
CBD	common bile duct
CBF	cerebral blood flow
CEA	carotid endarterectomy (vascular surgery)
CF	cystic fibrosis
CHD	congenital heart disease
CHF	chronic heart failure
CNS	central nervous system
CO ₂	carbon dioxide
COPD	chronic obstructive pulmonary disease
CPAP	continuous positive airway pressure
CPR	cardiopulmonary resuscitation
CT	computed tomography
CV	cardiovascular
CVC	central venous catheter
CVD	cardiovascular disease
CXR	chest x-ray
DCU	Day Case Unit
DoH	Department of Health
DIC	disseminated intravascular coagulation

DL	direct laryngoscopy
DOB	date of birth
DVT	deep vein thrombosis
ECF	extracellular fluid
ECG	electrocardiogram; electrocardiography
ECT	electroconvulsive therapy
EEG	electroencephalography
ET	endotracheal
ETT	endotracheal tube
F	Fahrenheit
FEF	forced expiratory flow
fem-fem	femoral-to-femoral bypass (vascular surgery)
fem-pop	femoro-popliteal bypass (vascular surgery)
FFP	fresh frozen plasma
GA	general anaesthesia
GU	genitourinary
H&P	history and physical examination
H ₂ O	water
HA	haemolytic anaemia
HAV	hepatitis A virus
Hb	haemoglobin
HBV	hepatitis B virus
HCPC	Health and Care Professions Council
HCV	hepatitis C virus
HR	heart rate
I&D	incision and drainage
ICF	intracellular fluid
ICP	intracranial pressure
IHD	ischaemic heart disease
IM	intramuscular
IP	inpatient
IPPV	intermittent positive pressure ventilation
ISF	interstitial fluid
IV	intravenous
IVC	inferior vena cava
IVF	in vitro fertilization
IVIG	intravenous immune globulin
K	potassium
kg	kilogram
L	litre
LIH	left inguinal hernia
LMA	laryngeal mask airway

LV	left ventricular
MD	muscular dystrophy
MH	malignant hyperthermia
MI	myocardial infarction
ML	millilitre
mol	mole
MS	multiple sclerosis
MVR	mitral valve replacement
NG	nasogastric
NICE	National Institute for Health and Care Excellence
NM	neuromuscular
NPSA	National Patient Safety Agency
NSAID	nonsteroidal anti-inflammatory drug
O ₂	oxygen
ODP	operating department practice, operating department practitioner
OPD	outpatient department
P	pulse
Pa	Pascal
PaCO ₂	arterial carbon dioxide partial pressure (measured from a blood gas sample)
PACU	post-anaesthesia care unit
PAH	pulmonary arterial hypertension
PaO ₂	arterial oxygen partial pressure (measured from a blood gas sample)
PAP	pulmonary artery pressure
PAWCP	pulmonary artery wedge capillary pressure
pCO ₂	partial pressure of carbon dioxide
PE	pulmonary embolism
PEEP	positive end expiratory pressure
PKD	polycystic kidney disease
PNS	peripheral nervous system
pO ₂	partial pressure of oxygen
PONV	postoperative nausea and vomiting
RA	right atrium
RBC	red blood cell
RCT	randomised controlled trial
RHD	rheumatic heart disease
RSI	rapid sequence induction
SaO ₂	saturation level of arterial oxyhaemoglobin
SBO	small bowel obstruction
SIRS	systemic inflammatory response syndrome
SOB	shortness of breath
SpO ₂	oxygen saturation measured by a pulse oximeter

SVA	supraventricular arrhythmia
SVT	supraventricular tachycardia
T	temperature
TAH	total abdominal hysterectomy
TB	tuberculosis
TBI	traumatic brain injury
TGA	transient global amnesia
TIA	transient ischaemic attack
TIMI	thrombolysis in myocardial infarction
TIVA	total intravenous anaesthesia
TURP	transurethral resection of prostate
TVR	tricuspid valve replacement
TVV	tricuspid valve valvuloplasty (valve repair)
UA	urinalysis
UE	upper extremity
UFH	unfractionated heparin
UO	urine output
URI	upper respiratory infection
UTI	urinary tract infection
VCO ₂	carbon dioxide production
VF	ventricular fibrillation
VHD	valvular heart disease
VO ₂	oxygen consumption
VS	vital signs
VT	ventricular tachycardia
WB	whole blood
WBC	white blood cell

SECTION 1

Preoperative Preparation

Paul Wicker

1 The Role of the Anaesthetic Practitioner

An anaesthetic practitioner is an essential member of the operating department team working alongside anaesthetists, surgeons, practitioners and healthcare support workers to ensure that anaesthesia for the patient is as safe and effective as possible. Anaesthetic practitioners provide high standards of patient care and skilled support alongside the other members of the perioperative team during the perioperative phases before, during and after surgery (Fynes *et al.* 2014). It is also essential that they continue with updates and attend current in-house training to maintain their skills and knowledge.

The role of the anaesthetic practitioner has nationally agreed standards and levels of practice, implemented by the Royal College of Anaesthetists (RCA 2006). An anaesthetic practitioner's roles are also covered by the College of Operating Department Practitioners and the Health Care Professions Council. Hospital regulations manage these standards appropriately and are implemented within a nationally recognised framework (Fynes *et al.* 2014).

The roles and responsibilities of anaesthetic practitioners include working by themselves to prepare equipment and providing care for the patient, as well as offering support to the anaesthetist during all stages of anaesthesia (Fynes *et al.* 2014). The main roles and responsibilities of the anaesthetic practitioner include:

- To deliver psychological and emotional support to the patient
- To check the anaesthetic machine
- To prepare the anaesthetic equipment
- To support the patient throughout the stages of anaesthesia
- To support the anaesthetist during anaesthesia
- To understand responsibility and accountability for the patient during anaesthesia, including patient documentation, for example the consent form and the World Health Organization (WHO) Surgical Safety Checklist.

Preanaesthetic phase

The anaesthetic practitioner assists the patient before surgery and provides individualised care. This will include supporting the patient by reducing anxiety, placing blood pressure cuffs, connecting electrocardiograph (ECG) electrodes and pulse oximeters, and preparing IV fluids and anaesthetic drugs (NHS Modernisation Agency 2005). The practitioner will also communicate effectively within the team to pass on problems, issues or any past adverse events, such as when catheterising patients and when preparing and assisting in the safe insertion of invasive physiological monitoring such as central venous pressure (CVP) lines and arterial lines.

The anaesthetic practitioner is also able to support the patient if he or she has any concerns. For example, most patients fear anaesthesia, because of fearing the risk of waking

up too early or not waking up following surgical procedures. Many patients ask, 'Will I wake up alright after surgery?' and then become anxious if they don't receive a reply. One of the main roles is therefore to provide psychological support, which is something that practitioners can do on a face-to-face basis. This may include discussing problems, offering reassurance to the patient to let them know they are monitored safely, ensuring the patient is comfortable, talking to the patient and reassuring the patient throughout their time in theatre (Fynes *et al.* 2014).

The anaesthetic practitioner will also undertake roles which will also involve many clinical skills, such as preparing a wide range of specialist equipment and drugs (Copley 2006). This includes:

- Testing anaesthetic machines
- Preparing anaesthetic equipment (AAGBI 2012)
- Preparing intravenous equipment
- Making devices available to safely secure the patient's airway during anaesthesia
- Ensuring drugs such as propofol, local anaesthetics, anaesthetic gases and so on are available
- Knowledge of the different operating tables, including positioning equipment, clamps and pressure-relieving devices.

Anaesthesia

There are three parts to anaesthesia:

1. *Induction*: This is when the patient goes to sleep using anaesthetic drugs.
2. *Maintenance*: This is maintaining the anaesthetic during surgery.
3. *Reversal*: This is waking the patient up by stopping the administration of drugs and anaesthetic gases, or by using specialist drugs to revive the patient (Goodman & Spry 2014).

Responsibility of the practitioner for the care of the patient throughout the stages of anaesthesia is vitally important (Fynes *et al.* 2014). The practitioner is responsible for ensuring the patient is positioned correctly to maintain safety and comfort, to ensure pressure areas are supported, and also to provide maximum access during the operative procedure. The practitioner also needs to follow legal and ethical considerations, and ensure that they are following the Health and Care Professions Council (HCPC) regulations and guidelines.

Checking the anaesthetic machine

Making sure the anaesthetic machine is working correctly is an essential part of the anaesthetic practitioner's role, in collaboration with the anaesthetist. Knowing 'how' it works is of course equally important (Goodman & Spry 2014). During induction of anaesthesia, the patient is at one of the most vulnerable points in his or her perioperative care. Equipment error can therefore put the patient at high risk of harm, for example through airway obstruction, circulatory problems, reduced blood oxygenation or even death, because of errors such as flow reversal through the back bar on the anaesthetic machine (Smith *et al.* 2007).

Practitioners should check the anaesthetic machines by using the Association of Anaesthetists of Great Britain and Northern Ireland checklist (AAGBI 2012) and the manufacturer's manual as guides to ensure the machine is safe to use. There is a joint responsibility between the anaesthetist and anaesthetic assistant for ensuring the correct functioning of anaesthetic equipment before patient use. Often, the anaesthetic assistant will assemble and check the equipment in preparation for the anaesthetist, who then ensures that he or she has the correct equipment for the anaesthetic procedure. The assistant's role is therefore to

support the anaesthetist, check the equipment and ensure the patient's safety (Wicker & Smith 2008).

Errors during anaesthesia have often been associated with lack of proper equipment checks. However, checking an anaesthetic machine using a checklist can lead to a reduction of incidents. Patient safety can be increased by the use of the checklist for checking new anaesthetic machines which can highlight faults during their manufacture. For example, wrong assembly of the anaesthetic machine can lead to errors such as high dosages of volatile agents. The use of a checklist also needs to be carried out when equipment is returned from servicing – it cannot be guaranteed that a serviced or brand-new anaesthetic machine is working perfectly. A thorough check will therefore ensure the equipment has been returned in a working condition and is ready for use. However, it is not the ultimate responsibility of the anaesthetic practitioner to ensure the anaesthetic machine is in perfect working order; it is the anaesthetist who carries the main responsibility. Nonetheless, practitioners have a duty of care to identify and report any faults and are also responsible for their actions, including recordkeeping of anaesthetic machine checks (Fynes *et al.* 2014).

Monitoring responsibilities

The anaesthetic practitioner's responsibility is to attach two ECG electrodes to the patient's upper left and right-sided chest, and one ECG electrode to the lower left side of the chest, before anaesthesia so heart rate and rhythm are monitored by the ECG monitor during induction of anaesthesia. There are many other areas to monitor, and three of the most important are blood pressure, oxygen saturation and temperature.

Non-invasive blood pressure (NIBP) measurement

NIBP is measured by using a blood pressure cuff which is fastened around the arm or leg. The air tube is then attached to the monitor which inflates and deflates the cuff according to the time settings. The blood pressure reading is displayed on the monitor and registers the systolic, mean and diastolic pressures. Normally, the monitor records all measurements over time and provides a trend to indicate when the blood pressure has risen or fallen. Invasive blood pressure monitoring equipment is also used to provide a continuous record of blood pressure. This normally works by connecting a monitor to a transducer which in turn is connected to an intra-arterial line (O'Neill 2010).

Attaching the blood pressure cuff around the patient's arm monitors blood pressure and will ensure that blood pressure is maintained at the correct level. Anaesthetic drugs can reduce or increase blood pressure because of vasoconstriction, vasodilation or effects on the heart, so it is important that blood pressure is constantly monitored.

Pulse oximeters

A pulse oximeter measures the patient's oxygen saturation in their blood. Normal oxygen saturation is between 95 and 100%; anything less than 95% is seen as causing problems for the patient. Patients with chronic obstructive pulmonary disease (COPD) may also suffer from hypoxia. The pulse oximeter is normally attached to a finger, but it can also be attached to an earlobe or toe. The light source in the probe passes through the tissue, and the patient's oxygen concentration is measured via the absorption of the light, then recorded on the monitoring screen (O'Neill 2010). The light is detected by light sensors and is altered by the levels of oxyhaemoglobin and deoxyhaemoglobin. The pulse oximeter should be regularly checked to ensure that it is correctly placed on the extremity and also that circulation at that point is not impaired. Constantly observing the patient's oxygen levels is essential during anaesthesia, and using a pulse oximeter is one of the most important monitors used during anaesthesia as it can help to identify patient problems associated with low oxygen levels (Valdez-Lowe *et al.* 2009).

Conclusion

Anaesthetic practitioners have the potential to contribute to team working, and this results in enhancing patient care and patient access, improving operating room capacity and reducing cancellations and waiting times. Practitioners can also enhance the learning experiences of anaesthetic trainees and other junior anaesthetic practitioners.

2 The Role of the Surgical Practitioner

The surgical practitioner role includes preparing the operating room, scrubbing and circulating as well as contributing to the WHO checklist (see Chapter 7). Scrubbing involves working within the sterile field to assist the surgeon and being responsible for delivery of instruments and equipment. The circulator, or runner, provides the link between the scrub nurse and the non-sterile areas outside the surgical field. Circulators are also able to provide equipment needed for the surgical team such as sutures, swabs or prostheses. Circulating staff also assist in preparing the patient for surgery. This includes moving the patient onto the operating table, exposing the surgical site and connecting the patient to equipment that is necessary for surgery, such as the electrosurgery machine or suction machine. As the surgical team are unable to leave the operating table during surgery, the circulator provides communication between the surgical team and the rest of the theatre department, wards or laboratories (Conway *et al.* 2014).

Scrub practitioners are operating department practitioners (ODPs) or post registration nurses. ODPs are now more common in the operating room because the BSc (Hons) ODP programmes educate and train practitioners in all three roles in the operating department – anaesthetics, surgery and recovery. Preregistration nurses often observe in operating departments as they may not have the skills and knowledge needed to work in anaesthesia or surgery. Following their qualification, nurses may undertake CPD modules in anaesthesia, surgery and recovery to gain the necessary perioperative skills and knowledge.

Scrub practitioners need an understanding of operating room procedures, including the instruments and equipment needed for surgery, and must remain calm and clear-headed, even when under pressure because of, for example, urgent surgery. Practitioners communicate well when working with surgeons and aiding them during the surgery (Wicker & Nightingale 2010).

Surgical practitioners provide patient care before, during and after surgical procedures. Surgical practitioners must therefore be registered by the HCPC or Nursing & Midwifery Council (NMC), and have the necessary surgical expertise. When scrub practitioners assist the surgeon, it can be demanding, challenging and sometimes exciting, but circulating practitioners are also essential to provide support to the surgical team.

Scrub practitioners

The role of scrub practitioners is to ensure the best, safest and most effective care for the patient by supporting and aiding surgeons during the surgical procedure (Smith 2005). To undertake this role, they must have knowledge and skills related to patient care, anatomy and physiology, surgery, and the instruments and equipment needed for the procedure. Experienced scrub practitioners prepare equipment and instruments before the start of surgery and support the surgeon throughout the procedure. Inexperienced

scrub practitioners, however, need support from mentors or colleagues during surgery as inefficiency may lead to delays or serious errors with instrument handling and use.

Before surgery

Surgical practitioners clean and prepare the operating room before surgery, including organising instruments and equipment for surgery. Scrub practitioners preserve the sterile environment by scrubbing hands and arms with betadine or chlorhexidine, and putting on suitable sterile surgical garments which include a gown, mask and gloves (Gruendemann & Fernsebner 1995). The scrub practitioner will prepare, check the function of and count the instruments and equipment before the patient arrives in the operating room to ensure everything is ready for the surgeon to commence surgery. The surgical practitioner will ask the circulator to show them the consent form with the correct procedure and patient identification number. The circulator will also identify any patient allergies and the correct equipment, for example if they are operating on a specific limb that needs left or right-sided tools.

When the surgeons arrive and start surgical scrubbing, the circulating practitioners may help them don their gown and gloves before exposing the patient for the surgical procedure.

During surgery

The main role of the scrub practitioner during surgery is to provide a quick, safe and effective procedure by selecting and passing instruments and swabs ready for the surgeon to receive. The practitioner may also support the surgeon during surgery by cutting sutures or other minor tasks (Smith 2005). Scrub practitioners must have knowledge and understanding of the surgical procedure, the patient's anatomy and the instruments which are required for specific procedures so they can quickly pass them over to the surgeon (Conway 2014). The scrub practitioner also needs to watch the procedure carefully to prepare instruments in advance. The practitioner should also retrieve instruments that the surgeon has stopped using, as these can sometimes fall off the operating table onto the floor. Also important is the need to keep track of any samples of tissues, as the surgeon can hand out many samples from different parts of the surgical site in quick succession, which must be kept separate. The scrub practitioner will then clean the instruments after use and place each instrument back in its place on the instrument trolley. If required, the scrub practitioner will ask for other instruments or items from the circulating practitioners.

After surgery

Scrub practitioners count all instruments, sponges, swabs and other tools and verbally communicate to the surgeon in regards to the count once surgery is completed. It is essential that swabs are counted so that they are not left inside the patient (D'Lima 2014). Scrub practitioners then remove instruments and equipment from the operating area, assist the surgeon in applying a dressing to the surgical site and accompany the patient to the recovery area to inform recovery staff of the procedure, dressings, suction drains and so on (Wicker & Nightingale 2010). Scrub practitioners also complete necessary documentation about the surgery in the surgical record book and input relevant information into the computer.

Circulating practitioners

Circulating practitioners create and preserve a clean and sterile operating room environment in preparation for treating patients before surgery. Having a clean and safe environment will promote health for staff and prevent patients from acquiring infections following surgery (Goodman & Spry 2014). Perioperative practitioners may also undertake pre and



Photo 1 Carrying out the WHO checklist. Courtesy of Aintree Hospital, Liverpool

postoperative assessments of patients, and it is also important that they support, care and educate patients about their surgical treatment before and after surgery.

The circulating practitioner is also responsible for setting up the operating room before a surgical procedure gets underway (Goodman & Spry 2014). This role includes checking disposables, such as pads, swabs and sutures; laying out instrument trays; preparing equipment, such as diathermy and suction machines; and preparing any other equipment needed. The circulating practitioner also checks all equipment needed during the procedure to verify that it is functioning properly. When the patient arrives in the OR, the circulating practitioner usually verifies the patient's identity and necessary consent forms. This includes showing the consent to the surgical practitioner, and then reviewing the site and nature of the procedure with the surgeon (Goodman & Spry 2014).

Theatre practitioners clean and maintain the operating room and inform the surgical team of anything that may be contaminated before the start of surgery. They are also responsible for opening sterile packages, so the surgical team may easily access the sterile equipment without becoming contaminated (Goodman & Spry 2014). However, they must always avoid touching the sterile field, for example the instrument trolley or the drapes covering the patient, because they do not scrub or wear sterile gloves or a gown. The circulating practitioners and other members of the surgical team also position the patient correctly and safely on the operating table. The circulating practitioner connects any necessary equipment, such as suction and diathermy, and liaises with the surgeon about his or her needs. During the operation, the circulating practitioner provides the surgical team with sterile fluids and medications as required and renews the surgical team's supplies if they need more sterile drapes or instruments. Each member of the surgical team has specific personal responsibilities, including maintaining an overview of the patient's condition. For example, if an arm or leg accidentally falls off the operating table, then this is one of the circulating

practitioner's responsibilities to prevent it from happening, or to replace the arm or leg in a safe position (Wicker & Nightingale 2010).

Outside of surgery, perioperative practitioners also play a role in patient care before and after procedures, including the initiation of the WHO checklist (Photo 1). Before surgery, a practitioner draws up the patient's plan of care and spends time to document and record any allergies or other health-related issues. After surgery, theatre practitioners complete the WHO checklist and patient care plan, and the circulating practitioner helps the scrub practitioner and other staff to clean the room and prepare it for the next surgical procedure (Wicker & Nightingale 2010).

3 The Role of the Recovery Practitioner

The three perioperative roles in the operating department are anaesthetic, surgery and recovery practitioners. The recovery practitioner is seen as an autonomous practitioner because anaesthetic and surgical practitioners assist medical staff, but recovery practitioners work mostly on their own initiative and with each other. Hospitals have a clear separation between the recovery unit and the operating room because the patient has completed anaesthesia and surgery on entry to the recovery room, or PACU (post-anaesthesia care unit). Although the recovery room is still seen to be part of the patient's perioperative experience, theatre and recovery practitioners remain two separate groups of staff. While recovery practitioners do understand anaesthesia and surgery, they are more focussed on the postoperative care of patients and their recovery from their anaesthetic and surgical procedures. In some situations, however, theatre practitioners may be asked to work in all areas of the operating department.

The role of practitioners in recovery

The role of recovery practitioners involves one-to-one care of patients who have undergone a procedure under general, regional or local anaesthetic (Hatfield & Tronson 2009). Patients in recovery range from small elective cases to complicated emergency procedures, and post-operative care varies in individuality and depth of skills, knowledge and experience needed to afford the best possible care (Alfaro 2013).

The skills undertaken by postoperative practitioners in the recovery area are complex and include the following:

- Managing the patient's airway (Alfaro 2013)
- Pain management
- High-quality patient care
- Knowledge of anatomy and physiology, as well as recognising symptoms such as shock or internal bleeding
- Monitoring pulse rate, respiratory rate, oxygen saturation, temperature and blood pressure (Hatfield & Tronson 2009)
- Care of wounds and dressings
- Helping with mobility
- Adequate blood circulation
- Fluid and electrolyte maintenance
- Treating nausea and vomiting
- Providing verbal support and reassurance to patients
- Documenting observations, consciousness, drugs, pain levels and so on
- Providing information to ward staff during handover of patient.

Admission to recovery

In some hospitals, the recovery practitioner will enter the operating room and escort the patient to recovery alongside the anaesthetist and the scrub practitioner. The recovery practitioner must ensure the correct equipment is available for the patient, including an oxygen cylinder attached to the trolley and connected to the patient using a Hudson mask, and an anaesthetic circuit for an intubated patient (AAGBI 2013). There should also be a suction unit in case the patient vomits during the transfer to the recovery area.

On admission to recovery, the recovery practitioner will receive information from the scrub practitioner about surgery and the anaesthetist about the patient's status following anaesthesia and the medicines which have been administered, as well as further medication which may be required (Hatfield & Tronson 2009). Examples of the scrub practitioner's handover include:

- The surgical procedure
- The wound closure, dressings and surgical drains
- Confirmation of the presence (or not) of a urinary catheter
- Issues about pressure sores, pain, disabilities and so on
- Allergies
- Local anaesthetic drugs that have been in use.

The anaesthetist will also cover all areas including:

- The patient's name and the type of anaesthesia used
- Any relevant medical history, for example diabetes or dementia
- Analgesia administered during surgery and the patient's needs post anaesthesia
- Fluid and electrolyte balance and any need for further IV fluids.

The anaesthetist will also support the recovery practitioner for a short time in recovery. This will include assessing the patient to ensure he or she is breathing regularly, airways are intact, oxygen saturation is stable, circulation is stable (blood pressure and pulse) and the patient is recovering safely (Alfaro 2013). The anaesthetist will also stay with the patient if there are any continuing problems.

Initial assessment of a patient

On arrival in recovery, the oxygen tube is transferred to the oxygen supply attached to the wall. The oxygen delivered will depend on the patient's level of consciousness at the discretion of the anaesthetist (AAGBI 2013). O_2 flow is monitored using the flow meter which is attached to the wall. The fraction of inspired oxygen (FiO_2) inhaled by the patient is lower than the flow rate. For example, a flow rate of 5 L per minute normally delivers approximately 0.4 L per minute to the patient, depending on the methods of delivery, including different masks or nasal cannula.

Once the patient is receiving an acceptable quantity of oxygen, he or she will then be connected to monitors, including:

- *ECG monitor*: monitors pulse, rate and rhythm
- *Blood pressure*: automatic blood pressure cuff attached to upper arm
- *Oxygen saturation*: pulse oximeter
- *Respiratory rate*: normally, a maximum of 12–20 breaths per minute
- *Temperature*: These measurements should be recorded regularly.

Other monitors may also be required depending on the surgery undertaken and the physiological status of the patient.

Sometimes, a patient is admitted to recovery with an endotracheal tube (ET) tube still in place. If this is the case, the anaesthetist will need equipment to remove the ET tube once

the patient wakes up, for example by using suction, a face mask and a syringe to remove air from the cuff of the ET tube. This is also undertaken by recovery staff in some hospitals where training has been undertaken.

Under most circumstances, an ABCDE approach is used to assess patients during their recovery (Hatfield & Tronson 2009). This assessment consists of:

- A = Airway
- B = Breathing
- C = Circulation
- D = Disability
- E = Exposure.

Practitioners use this method of assessment continuously while the patient is in the recovery room to ensure safe patient care. Care for patients, however, depends upon the needs of the patient and the procedures they have undergone, and so care is individualised depending on their needs (AAGBI 2013). For example, surgery on limbs will need consistent monitoring of circulation, sensations felt by the patient, and their ability to move fingers or toes.

Documentation needs to be completed and recorded clearly, accurately and concisely to ensure that records are kept of the patient's recovery period. Recovery charts differ between hospitals, but most contain the following basic items:

- The time the patient entered the unit
- Vital signs
- Drugs given, including dose and route
- Unexpected events, such as vomiting or sudden onset of pain
- Specific postoperative instructions (e.g. oxygen therapy for the ward)
- Records are signed and dated by the recovery practitioner.

Discharge of patient

Normally following an hour in the recovery room, if the patient has recovered fully then they are discharged (Hatfield & Tronson 2009). Sometimes patients may be discharged within 20 min, especially those undergoing day surgery or minor surgery. However, they must meet the minimum criteria, dependent on their state of health and the hospital regulations:

- Maintaining the patient's airway
- Stable blood pressure, pulse and rhythm
- Conscious and able to uphold a 5-sec head lift
- Oxygen saturation greater than 95%
- No pain, nausea or vomiting
- Clean, dry and warm
- All documentation is completed and signed.

The recovery practitioner prepares the patient for returning to the ward and contacts ward staff to come and collect the patient. In some circumstances, however, the recovery practitioner may return the patient to their ward if ward staff are not available. Once the ward nurse arrives, the recovery practitioner will hand over all the relevant documentation and verbally communicate to the ward nurse of the anaesthetic and surgical procedures. Also the practitioner will hand over postoperative instructions given by the anaesthetist, the analgesia which the patient has received and the vital sign recordings taken in the recovery room. The ward nurse will then accept that the patient is ready to be handed over, sign the form and escort the patient safely back to the ward.

4 Preoperative Assessment of Perioperative Patients

Introduction

Pre-assessment of perioperative patients is essential to prepare patients for anaesthesia, surgery and recovery, and to ensure that they understand the anaesthetic and surgical procedures, as well as their postoperative recovery period. This role can be carried out by operating department practitioners and nurses. Practitioners also need to understand the physiological status of the patient so they can communicate this information to perioperative staff (including anaesthetists, surgeons and perioperative practitioners) and inform them of any patient issues. This chapter covers preoperative assessment, planning and education, and reducing intraoperative and postoperative complications.

Ensuring that surgical patients are prepared prior to surgery increases their safety and improves their surgical outcomes. Practitioners become involved in preoperative patient care because of their capacity to assess the individual needs of a patient before anaesthesia and surgery (Holmes 2005).

The perioperative patient is subject to many stressors that can induce anxiety, for example:

- Threats to their sense of identity
- Fear of dying or not waking up
- Fear of the surgical procedure
- Delay in surgery or change of anaesthetists.

Practitioners can help the patient during these times because of their knowledge and skills, as well as their work with other professional colleagues within both the ward and the operating department. Practitioners therefore carry out preoperative assessment, education and care as necessary parts of the patient's treatment (Goodman & Spry 2014). Pre-assessment clinics also support the multidisciplinary team in undertaking preoperative medical and patient assessments.

Preoperative preparation

Care plans for patients are a key part of today's care for perioperative patients (Table 4.1, 'Care planning'). Several key elements of care planning may involve:

- *Preoperative education*: Including communication with the patient and information regarding anaesthesia, surgical procedure, pain relief, surgical techniques, preoperative actions, postoperative analgesia, postoperative vomiting and postoperative exercises (Wicker 2010).
- *Preoperative assessment*: Including status of elderly patients, concurrent illnesses, physiological status of the patient and injuries that trauma patients may have suffered.

Table 4.1 Care planning

Hospitals develop individualised care plans which help practitioners deliver the care required in an organised and effective way. The assessment process for preoperative and postoperative care often involves the following stages.

Assessment on entry to the ward

Patient details:

- Name:
- Patient number:
- Surgical procedure:
- Ward:
- Verification of operative site:

Walking to the operating department:

- Has the patient taken sedation on admission:
- Does the patient have a history of instability:
- Does the patient have a history of dizziness:
- Does the patient need a mobility aid to walk:

Baseline observations:

- Pulse:
- Blood pressure:
- Urine output:
- Height:
- Respiration rate:
- Temperature:
- Weight:
- Waterlow Score:
- Hearing aid:
- Skin integrity:

Ward preoperative checklist (immediately before the patient leaves the ward for surgery)

Confirm the following:

Patient details:

Consent form:

Allergies:

Intended surgical site verified and marked:

Blood results are valid and recorded:

ECG recorded:

Fasted as per hospital guidelines:

Pre-medication given:

Anticoagulants given:

Contact lenses and jewellery removed:

Dentures removed:

Caps crowns or bridges present:

Makeup and nail varnish removed:

Pacemaker in situ:

Patient placed on trolley safely:

Pregnancy test:

Signature of ward nurse:

Operating theatre reception confirmations

Blood results are valid and completed:

Ward preop care planning checklist completed:

Confirm patient's details:

Consent form present and completed:

Allergies:

Signature of theatre practitioner:

Further comments:

(continued overleaf)

Table 4.1 (continued)*Postoperative checklist**Care assessment on admission to recovery***Airway support:**

- None
- Oral
- Nasal tube
- Endotracheal tube
- Laryngeal mask
- Tracheostomy

Breathing:

- Respiration rate and quality:
- Oxygen levels:
 - Venti masks
 - Ventilator
 - Nasal specs
 - Breathing circuit
 - Temperature
 - Oxygen saturation

Circulation:

- Arterial line inserted:
- Central venous pressure lines:
- Skin or mucous membrane:
 - Flushed
 - Pale
 - Cyanosis
 - Pink
 - Warm
 - Dry
 - Cool
 - Moist
 - Clammy

Intravenous therapies – specify:**Bladder irrigation – specify:****Other:****Comments:***Recovery Room Observations*

CVP:

Temperature:

SpO₂:

- Litres per minute:

Blood pressure:

Pulse:

Respiration:

Pupil reactions to light:

Muscle tone (ability to move limbs):

Wound condition:

Drains:

Peripheral perfusion:

Other observations:

Perioperative drugs given to the patient:

- Fentanyl plus local anaesthetic:
- Spinal anaesthetic:
- Plain local anaesthetic:
- Other analgesics:
- Anti-emetics:

(continued overleaf)

Table 4.1 (continued)**Recovery room care given:**

Progress and actions taken:

Recovery evaluation and handover information:

All information given to ward nurse on discharge of patient, including:

- Airways
- Respiration
- Cardiovascular status
- Medications given
- Comfort and safety
- Wound management
- Fluid management
- Anaesthetic and surgical procedures
- Time of discharge from recovery.

- *Informed consent:* Including information about the anaesthesia and surgery before completion of the consent form. The consent policies and procedures of the hospital, underpinned by legal practices, help to ensure patient safety and involve the patient in their proposed treatment and care (Wicker 2015).
- *Patient preparation before surgery:* Including confirmation of preoperative fasting guidelines, not smoking, use of DVT (deep venous thrombosis) stockings, use of patient gown and hat, and confirmation of patient details on the wristband (Goodman & Spry 2014).
- *Discharge planning:* This happens either before or after surgery, depending on the length of the patient's stay. Discharge planning should cover such areas as pain relief, mobilisation exercises, dressing changes, postoperative drugs and identifying and managing possible postoperative complications.

Reducing postoperative complications

There are several postoperative complications which can occur following surgery and anaesthesia, and preoperative assessment and planning can help to prevent these complications from happening. Actions also need to be undertaken by recovery practitioners when patients suffer from postoperative complications during recovery.

Respiratory care

Practitioners undertake preoperative airway assessment (Sweitzer 2008) by assessing the patient's airway and breathing patterns and any problems which the patient identifies. Practitioners will also support anaesthetists by reducing the risk of intraoperative airway problems, achieving best airway management and recording information for intraoperative use (Sweitzer 2008).

- Pre-assessment of respiratory function lessens the risk of chest infection following surgery.
- Assess the patient's respiration, for example breathing rate, sputum and secretions, cardiovascular status and pulse oximetry.
- Direct patients should be instructed not to smoke before or after surgery.
- Drug therapy, such as antibiotics or bronchial dilators, may be given preoperatively.
- Teach the patient breathing exercises and good positioning when in bed (Wicker 2015).

Joint stiffness

Patients who have stiff joints may need support during surgery (Wicker 2010); for example, a stiff neck makes intubation difficult. It is also painful for a patient with a stiff hip to be

placed in the lithotomy position, and an arm placed on an arm board, especially if the arm is pushed towards the head, may damage the brachial plexus (Wicker 2010).

- Pre-assessment and understanding of a patient's joints which are stiff or damaged are important before surgery.
- Practitioners who pre-assess patients should inform perioperative staff about patients who have stiff joints to prevent harm during surgery.

Urinary problems

Urinary tract infection can lead to prolonged postoperative recovery due to discomfort and surgical complications (Berger 2005). Education is necessary about the need to maintain good fluid intake and follow medical orders on fluid balance. Maintaining postoperative fluid intake is also important to prevent further urinary and renal problems (Goodman & Spry 2014).

- Preoperatively, catheters need to be inserted carefully, following agreed sterile techniques to prevent colonisation postoperatively.
- Patients require information in regards to maintaining good fluid intake and following medical orders on fluid balance to prevent further urinary and renal problems (Wicker 2015).
- Pre and postoperative assessment and recording of urine output must also be undertaken.

Pressure sores

The presence of pressure sores results in an extended stay in hospital and causes distress to patients (Schultz 2005).

Practitioners can use pressure sore assessment scales, the most common being the updated Waterlow Scale (Waterlow 1985), to assess risk factors for developing pressure sores. If the patient receives a high score, then this is an indication of the potential for skin damage and ward nurses need to carry out suitable preventive measures to protect the patient (Wicker 2015).

- Pre-assessment of the patient's likelihood of developing pressure sores is important to prevent patient harm.
- Pressure sores occur because of excessive pressure leading to reduced blood supply and tissue hypoxia.
- Patients at risk include the elderly, patients undergoing long surgical procedures, patients with concurrent illness and poor health, and those with reduced mobility.
- Risk factors in assessment scales include age, gender, smoking history, nutritional status, mobility, build, medication, incontinence, existing vascular diseases and proposed duration of the surgical procedure.
- Pressure-relieving devices and techniques include a low-pressure mattress and frequent changes of position while on the ward.
- The perioperative team should be informed of the need for the patient to be protected during surgery by using gel pads and careful positioning.

Deep venous thrombosis

DVT can affect between 15 and 40% of perioperative patients undergoing general surgery (Mood & Tang 2009). Pre-assessment of the risk of DVT will provide the patient with suitable treatment before and during surgery (Nelson *et al.* 2008) (Table 4.2).

DVT assessment tools often contain several risk factors, including age, body mass, mobility, trauma risk, disease and type of surgical intervention (Wicker 2015). Patients at risk of DVTs are identified in low, medium or high-risk categories, and treatment given may

Table 4.2 Deep venous thrombosis

Practitioners can pre-assess factors contributing to DVT development and minimise the risks to the patient during surgery. Reduce the likelihood of DVT by:

- Pre-assessing the patient for the possibility of developing DVT
 - Encouraging the patient to wear GCS before surgery
 - Avoiding abnormal leg positioning
 - Avoiding extreme degrees of leg rotation
 - Performing passive limb exercises if required
 - Encouraging movement if the patient is confined to a bed
 - Encouraging walking if the patient is fit to do so
 - Placing a patient susceptible to DVT in a leg-up position to encourage venous drainage
 - Avoiding placing the patient in a limb-down position to reduce the risk of lower limb oedema leading to venous stagnation and vascular damage
 - Ensuring the patient at risk of DVT receives heparin and warfarin, aspirin, dextran or other anticoagulants.
-

include graduated compression stockings (GCS), heparin or intermittent pneumatic compression therapy (IPCT) (Nelson *et al.* 2008, Mood & Tang 2009). Most wards now have protocols in place for DVT prophylaxis to help protect patients from this condition.

- Preoperative assessment of blood circulation can help to reduce the incidence of DVT and pulmonary embolism.
- Reasons leading to DVT include endothelial damage to blood vessels, long periods of immobility leading to venous stagnation; medication which affects clotting mechanisms (e.g. contraceptive pills), dehydration, pregnancy and nephritic syndrome.
- Treatment to prevent DVT can include:
 - *Low risk:* GCS
 - *Moderate risk:* GCS plus low-dose heparin
 - *High risk:* GCS, adjusted dose of heparin and IPCT.

Nausea and vomiting

Preoperative assessment of patients can identify patients who are susceptible to PONV (post-operative nausea and vomiting), since PONV occurs in many surgical patients (Wicker & Cox 2010). PONV is treated with anti-emetics which antagonise the various neurotransmitter systems which cause nausea and vomiting. Careful pre-assessment of the likelihood of nausea and vomiting occurring will also help ensure the patient receives effective treatment (Wicker & Cox 2010). For example, a previous episode of PONV can highlight the need to include a preoperative anti-emetic.

- Preoperative assessment of patients can identify patients who are susceptible to PONV.
- Patient education is important as many patients believe that nausea and vomiting are caused by anaesthesia.
- Risk factors that can cause PONV include extreme anxiety, faulty preoperative fasting and a history of seasickness or motion sickness.
- PONV can result in aspiration of stomach contents into the lungs, damage to wound sites caused by straining, and electrolyte imbalances (Wicker 2015).
- PONV is treated by using anti-emetics, such as haloperidol, ondansetron, metoclopramide and cyclizine. Acupuncture can also be used in certain circumstances.
- PONV can also be treated by reducing anxiety through communication with the patient and by alleviating pain.

Pain

Assessing and educating patients about pain relief and the use of analgesics will support patients following surgery (Wicker & Cox 2010). Practitioners need to inform patients about the approaches to pain treatment and the support that they can offer following surgery to reduce pain (Wicker & Cox 2010).

Acute Pain Services (APS) educate patients and ward nurses about pain management. APS also provide preoperative and postoperative information and care for patients, including patient-controlled analgesia and epidural infusions.

- Practitioners should inform patients preoperatively about the approaches to pain treatment and the support that they can offer following surgery, to reduce patient anxiety and postoperative pain.
- Medical drugs may be given to the patient postoperatively at the discretion of the anaesthetist. Pain killers can include opiates, NSAIDS (nonsteroidal anti-inflammatory drugs) and other drugs (Wicker 2015).
- APS can also provide preoperative and postoperative information and care for patients.

5 Perioperative Patient Care

The word *perioperative* refers to the patient's total surgical experience which includes the pre-, intra- and postoperative phases, from the time the patient arrives in reception to the time they leave the recovery area.

Preoperative visiting

Preoperative visiting has been available for many years, although the recent changes in the NHS and a fall in perioperative staff has made this more difficult to carry out. However, in the past both ODPs and nurses from operating theatres would carry out preoperative visiting to assess, identify and de-stress patients before they arrived in the operating department. Research over the years has shown that visiting patients can improve their overall care in the operating theatre, thereby reducing potential problems. Preoperative visits enable practitioners to develop a care pathway plan prior to the patient arriving in the department (Wicker & O'Neill 2010). Even today, some hospitals recommend preoperative visiting in order to reduce patient anxiety regarding the proposed treatment and to demonstrate high levels of patient care and safety.

In the modern NHS, patients often stay in hospital for less time, and most patients are admitted for surgery less than 24 h before surgery starts. Day surgery patients are also increasing, and they usually arrive and leave on the same day.

Because of the decrease in patient time and the decrease in staffing, preoperative visits by theatre staff would still contribute to the continuity of care. However, pre-admission/assessment clinics are now common in most hospitals and help to prepare the patient for surgery (Phillips 2004). It is therefore essential that there is good communication between preadmission clinics and the perioperative staff to ensure the patient's individual needs are identified and met.

Patient preparation

Preparing the perioperative environment starts before the patient arrives. Information is recovered by the theatre staff from the operating theatre list, which is provided daily before scheduled elective surgical lists. The theatre list provides the patient's name, age, gender and planned procedure, enabling practitioners to prepare the operating room (OR) to provide a safe environment (Goodman & Spry 2014). For example, this will involve (Wicker & O'Neill 2010):

- Preparing the correct airway equipment
- Preparing the operating table and positioning equipment
- Preparing equipment to offset patient allergies, for example a latex allergy
- Pressure area care, for example heel supports, shoulder roll, gel mattress or head ring
- Preparing equipment for immobility problems, for example stiff legs or arms
- Preparing for hearing problems, for example if the patient is undergoing local anaesthetic
- Reviewing the medical history, for example preparing drugs to prevent postoperative vomiting.



Photo 2 Admitting a patient to the operating department. Source: Courtesy of Liverpool Women's Hospital

Several other issues will also be covered if needed by the patient (Goodman & Spry 2014).

The patient will be escorted to the reception area in the operating department by a porter and a ward nurse. The ward staff will check the validity of the patient's identity, consent form, patient notes and patient care plan (Photo 2). The patient can be transported towards the operating department by using a wheelchair, trolley or bed or by walking. The patient is admitted to the reception area and is checked by the reception staff to ensure all their information is correct, which enables staff to provide the best possible care. An elderly patient may have dementia or be confused, and may need further explanations and reassurance. The patient will be greeted by name, and then the practitioner will introduce themselves to the patient. A preoperative checklist is always completed, following hospital regulations to ensure the correct operation is carried out (Wicker & O'Neill 2010). The patient is always treated with privacy, dignity and respect to cultural, religious, ethnic and racial beliefs.

Care during anaesthesia

The anaesthetic practitioner prepares the anaesthetic room, anaesthetic machines and other anaesthetic equipment to provide safe care during anaesthesia (Wicker & O'Neill 2010). This will include:

- Checking the anaesthetic machine
- Checking intubation equipment
- Preparing anaesthetic drugs (Griffiths 2000)
- Checking oxygen supplies
- Checking suction equipment
- Preparing monitors as needed
- Preparing IV fluids and giving sets.

The anaesthetic practitioner must follow the anaesthetist's needs and display knowledge, skills and understanding about anaesthesia (Goodman & Spry 2014). The practitioner also needs to support the patient, including offering:

- Amiable communication, sometimes including humour
- Comfort and dignity for the patient
- Reassurance and discussion about anaesthesia and surgery
- Consideration of the needs of the patient.

Patients may be anxious on entry to the anaesthetic room, which may inhibit communication. It is therefore useful to talk to the patient and reassure them about the procedures that are going to take place (Harris 2015). It is always useful to have a practitioner in the room to spend time with the patient while the anaesthetic practitioner continues with preparing equipment for the anaesthetist.

When the anaesthetist arrives and anaesthesia is induced, all personnel in the anaesthetic room should be calm and quiet to minimise disruption or disturbance for the patient, which will help the patient maintain a calm state of mind (Griffiths 2000, Harris 2015). During anaesthesia, the anaesthetic practitioner will observe and monitor the patient's wellbeing, and assist the surgical team to position the patient safely.

Intraoperative care

The surgical team needs to assess, identify, control, monitor, reduce and evaluate risks to improve the quality of care delivered by using the WHO surgical safety checklist (Goodman & Spry 2014). During surgery, the patient is vulnerable and is reliant on the surgical team to ensure support and care, and that the surgery and anaesthesia are carried out safely and effectively.

Examples of clinical risks include:

- Patient positioning
- Infections
- Deep venous thrombosis (DVT)
- Hypothermia or hyperthermia
- Inappropriate use of equipment.

Many more risks are possible, which is why the WHO surgical safety checklist is now compulsory in every operating theatre to reduce the chances of harm to the patient.

Other examples of patient issues during the intraoperative phase include the following (Goodman & Spry 2014).

Patient positioning

- Avoiding nerve and joint injury
- Avoiding shearing, friction burns and damage to tissues
- Avoiding ischaemia and pressure sores from developing
- Avoiding radial nerve injury, if the arm is left hanging over the edge of the operating table
- Avoiding ulnar and fibular nerve injury due to compression or pressure.

Deep venous thrombosis

- DVT occurs because of haemostasis, vessel wall trauma and increased coagulation caused by anaesthetic drugs or physiological status of the patient.
- DVT prophylaxis includes the use of graduated compression stockings, low-molecular-weight heparin and intermittent pneumatic compression devices (Rothrock 2007).

Inadvertent hypothermia

Hypothermia happens in many patients because of the cool air and the light clothing worn, as well as the effects of anaesthetic drugs and surgical procedures. Hypothermia becomes a problem if the patient's temperature drops below 36 °C (Rothrock 2007). If the patient is hypothermic, the following areas need to be considered (Wicker & O'Neill 2010):

- Regular temperature monitoring must be carried out on all surgical patients.
- Operating room temperature should be a minimum of 21 °C.
- IV fluids should be warmed.
- The patient should have a warm blanket or Bear Hugger and be kept covered before surgery.
- Very young or very old patients may develop hypothermia.
- Long surgical procedures can result in hypothermia.
- Lack of mobility and shivering can reduce temperature.
- Anaesthetic drugs can lead to vasoconstriction, causing cold in the peripheries, or vasodilation which can lead to decrease of core body heat.
- Detrimental effects include bleeding, infection and increased stay in recovery (Goodman & Spry 2014, Rothrock 2007).

There are many other risks associated with patients during surgery; these include handling of instruments, swab and instrument counts, leaving instruments or objects inside wounds, diathermy burns, pressure sores and others (Rothrock 2007). Therefore, it is essential that the WHO checklist is carried out and the surgical team monitors the patient constantly to uphold their safety.

Transferring the patient to recovery

Following completion of the surgery, surgical practitioners undertake the last part of the WHO surgical safety checklist (WHO 2009) and complete the care plan accordingly, detailing, for example:

- The surgical procedure
- Patient's surgical positioning
- Use of diathermy
- Patient monitoring
- Confirmation of the needle, swab and instrument counts
- Method of skin closure
- Presence of any drains or catheters (WHO 2009).

The patient is normally extubated in the operating room, and gently woken up before being transferred to the recovery room. After the patient has left the operating room, the staff will then clean and tidy the OR and prepare for the arrival of the next patient.

Postoperative care

Recovery practitioners care for and assess the patient postoperatively to prevent potential complications and to ensure the patient's wellbeing until they are fully recovered. The recovery room is normally staffed by nurses and ODPs, who are expected to deal quickly and efficiently with any problems which the patient develops. Recovery practitioners manage the patient's care autonomously, although they would request assistance from anaesthetists and surgeons only when needed in urgent or emergency situations (Goodman & Spry 2014).

Practitioners prepare for each patient before the patient's arrival to ensure that equipment and drugs are available, including resuscitation equipment, airway equipment, oxygen and suction devices, monitoring equipment, patient warming equipment, analgesic pumps and so on (Reed 2003).

Transfer from the operating room to the recovery room happens once the anaesthetist is satisfied that the patient's condition is stable. On arrival in recovery, the patient's care is transferred to the recovery practitioner. The recovery practitioner then carries out immediate assessment of the patient, focussing on airway, breathing and circulation, as well as the patient's vital signs, wound site, comfort and safety.

The main areas for recovery practitioners to consider initially include the following.

Airway management

- The airway must be patent, clear of blood and mucous.
- Assess ventilation; in case of problems, insert a guedal or laryngeal mask airway.
- Assess the patient's position to optimise ventilation.
- Commence oxygen therapy immediately via an oxygen mask or nasal cannula. Usually, this is at 40%.
- Attach a pulse oximeter to a finger or ear lobe to monitor oxygen saturation.
- Continue to monitor the patient constantly until the patient recovers from the anaesthetic or surgery (Goodman & Spry 2014).

Breathing

- Ensure normal chest movements, and check on inhalations and exhalations.
- Check causes of noisy breathing, and take suitable actions.
- Check causes of silent breathing or no inhalations or exhalations.
- Check for peripheral cyanosis, for example lips or nailbeds.
- Check the respiratory rate.

Circulation

Once the airway has been established as being satisfactory, then blood pressure and pulse will be monitored (Wicker & O'Neill 2010). Assessment of appropriate blood circulation includes the presence of a conscious state, as well as normal skin temperature, pulse and blood pressure, which provide an indication that circulation is normal and is perfusing all organs (Rothrock 2007). Checking the blood pressure against the preoperative blood pressure, and the blood pressure in theatre, gives a good indication that the blood pressure is at a normal range for each individual patient.

- Inspect wounds and drains for evidence of bleeding.
- Check oxygen levels using a pulse oximeter and checking peripheries for cyanosis.

Once the initial assessment of airway, breathing and circulation has been completed, the recovery practitioner will discuss the information given about the patient with the anaesthetist and the theatre practitioner (Reed 2003). The discussion will include:

- Past medical history
- The surgical procedure
- Any issues with vital signs
- Drugs given to the patient, including analgesics and sedatives
- Any blood loss
- Type and amount of intravenous infusions
- Presence of any catheters and drains
- Any errors that occurred during the surgery and any potential postoperative problems.

The anaesthetist will also discuss specific postoperative instructions for each patient, including analgesics, oxygen therapy and monitoring requirements (Rothrock 2007).

Following the discussion, the recovery practitioner will continue to undertake further patient assessments (Reed 2003), including:

- Checking the patient's consciousness level
- Identifying reflexes or movements
- Checking for need for intravenous infusions, including type and rate of delivery
- Recognising pain in the patient by using a pain-scoring chart, and taking actions to reduce pain and discomfort
- Reducing postoperative nausea and vomiting to relieve the patient of discomfort and problems such as excessive bleeding, pain, and pulmonary and cardiovascular complications
- Filling of wound drains
- Filling of urine bags using urinary catheters, including colour, drainage and amount
- Completing observations, such as observing monitors of temperature, pulse and blood pressure; checking wound site; preventing pressure sores and so on.

The recovery practitioner must always record the postoperative assessment and observations in the patient's documentation to ensure that any actions taken are recorded in case of future problems; this record thereby provides a detailed record of their care and interventions undertaken by healthcare professionals (Goodman & Spry 2014). Waking up from the anaesthetic can also be a frightening experience for the patient because of bright lights, noises, different surroundings, confusion and disorientation caused by the anaesthetic drugs. The recovery practitioner can help reduce anxiety by reassuring the patient, speaking with and supporting the patient by letting him or her know where they are, what is happening and how problems are being solved (Reed 2003). It is also important that practitioners preserve confidentiality, privacy, dignity and respect for the patient.

Discharge of the patient back to the ward

The length of time the patient stays in the recovery room depends on the type of anaesthetic, the surgical procedure and any postoperative recovery issues. Discharge is allowed once the patient has fully recovered and has been assessed for the level of consciousness, respiration, circulation, pain control, haemostasis and wound care (Reed 2003). All written and recorded information is given to the ward nurse, and information is also given about the patient's physiological status. Discharge criteria are also met on the patient's intracranial pressure. The ward nurse will then take on the responsibility for the patient's postoperative care on the return to the ward.

Throughout the perioperative experience, practitioners should always have the patient's best interests in the forefront of their minds and be the patient's advocate at all times.

6 Operating Theatre Attire and Personal Protective Equipment

Operating theatre attire usually includes tops, trousers, hats, socks and clogs. Personal protective equipment (PPE), which protects staff from cross-infection or cross-contamination, includes gowns, gloves, masks, aprons, eye protection and disposable, fluid-resistant shoe covers. PPE is made available to personnel to reduce the risk of exposure to infection during surgery (Goodman & Spry 2014). Hospital guidelines usually identify the need to wear PPE during surgical procedures, and so normally certain items of PPE would always be used during surgical cases. PPE, including masks, gowns and shoe covers, must be removed before leaving the operating room. If shoe covers are not worn, then shoes covered in blood, body fluids or pus must be removed and washed before leaving the operating room.

Protective eyewear is used during surgery to prevent splashes in the eyes, by substances such as blood, tissues, body fluids, infected materials or faeces. It is advisable for the surgical team to wear masks with full face shields, or alternatively glasses or goggles (Goodman & Spry 2014). Normal eyeglasses are not considered to be a safe form of protection as they will often allow splashes to enter the eye, leading to a potential for cross-infection problems for the surgeon or the surgical team.

All individuals who enter the operating department must wear designated surgical attire (DOH 2010). This attire is worn only once at the beginning of the shift and then sent for cleaning to a laundry service when leaving the facility. If a practitioner needs to leave the operating department to go to a ward or other department, then either cover gowns should be used, or outside attire worn instead. Moving outside the operating department in normal surgical attire is not considered to be appropriate or standard practice, according to hospital regulations, to prevent the exposure of patients and practitioners to cross-infection. Practitioners should also change theatre scrubs if they become soiled, especially if there is need for the practitioner to move to another theatre and a different surgical procedure (DOH 2010). For example, if a practitioner participated in vascular surgery in the morning, and then moves to general surgery in the afternoon, he or she should change theatre scrubs because of the risk of cross-contamination transfer of the microorganisms from the previous operating room to the next operating room.

Practitioners working in the operating room would include the following attire for the purpose of self-protection:

1. Disposable surgical caps which cover hair, or hoods which also cover facial hair such as beards or moustaches and prevent hair or dandruff from falling into the patient's wound area.
2. Scrub trousers and tops which are found in changing rooms and have been cleaned and laundered. Tops may be tucked into the pants to prevent skin scales being released into the air. Surgical attire that becomes contaminated with blood or body fluids must be changed as soon as possible to prevent infection.

3. Jackets are useful to keep circulating staff warm if the operating room is below normal temperature of around 21 °C.
4. Disposable shoe covers are worn in some operating rooms, but often they are not worn as removing them can lead to infection on the hands. If they are worn, then they must be changed when visibly contaminated and removed before leaving the operating room.
5. Surgical clogs or shoes need to be clean and offer protection from injury. They normally have no holes or perforations along with a low heel and non-skid soles.
6. Surgical masks are always worn during major surgical procedures or when the scrub practitioner is starting to set up for a sterile procedure. A new facemask should be used for each new surgical procedure. The face masks should also not be hung around the neck or placed in pockets after they have been used; they should be disposed of carefully (Wicker & O'Neil 2010).

Jewellery, such as earrings, bracelets or necklaces, are not normally allowed in operating rooms as they could come loose and drop into the patient's wound or be permanently lost (Wicker & O'Neil 2010). Jewellery should therefore be kept confined in the practitioner's dressing cupboard or in their scrub attire. Rings and watches may be allowed, depending on hospital regulations, but they must always be removed before surgical hand scrubs. A necklace may be worn if it is not viewable and is confined within the scrub attire. Small earrings may be acceptable for circulating staff but they should be kept under the cap, especially when surgical procedures are being performed.

It is also important that perfume, aftershave or any strong odour (such as sweating armpits) that is considered offensive to patients or interferes with employees' roles should not be allowed. Any visitors, guests or company representatives who enter the operating room must also follow the hospital's surgical attire policy. Identification badges are normally worn by all operating room staff, and they must be pinned to the surgical attire top, and be visible and safe for patients. Nail polish should not be worn by scrub practitioners or circulating practitioners in the theatre area (NICE 2013). Practitioners undertaking direct patient contact must also keep nails less than $\frac{1}{4}$ inch long and not wear artificial nails or nail extenders to prevent harm to the patient (NICE 2008).

All surgical practitioners working in the operating room have the authority and responsibility to monitor proper surgical attire compliance in case staff do not wear the correct attire or PPE. In some hospitals, different colours hats and scrubs are worn for practitioners undertaking different roles, or if levels of experience are different, for example in students and qualified and senior practitioners. Any issues that arise must be corrected immediately, and if there are further problems then they need reporting to the theatre manager or supervisor. Noncompliance with attire and PPE may result in disciplinary action being taken by the theatre manager.

7 Surgical Safety Checklist

The WHO Surgical Safety Checklist (SSCL) was developed in 2008 (PSF 2015), with a goal to reduce the number of deaths and patient complications through surgical intervention. It is also to improve the safety of surgery, and it produces a framework to enable hospitals to augment patient safety. Most hospitals now use the WHO SSCL and develop policies to make sure it is used properly. The WHO SSCL has also been updated over the years and is now much more efficient and effective (NPSA 2009). Managers, such as Chief of Surgery, Matrons, General Managers and lead practitioners, now have the responsibility to ensure that staff undertake the SSCL in the correct manner, and also look into incidents or 'never events'. The SSCL is used for all patients, and the completed checklist is retained in the patient's notes. Failure of staff to follow the SSCL may result in disciplinary actions.

The structure of the SSCL provides a standard set of checklists, which often varies between hospitals and may include:

- Pre and post-surgery briefing
- SIGN IN before Anaesthesia
- 'Stop before you block' – for regional anaesthesia
- The TIME OUT Pause before surgery starts
- Sign Out.

Team brief

While all theatre practitioners learn technical and nontechnical skills, it is the nontechnical skills, for example poor communication or poor teamwork, which account for most adverse clinical events. A gathering of the team to discuss the pre-list briefing before the theatre list starts helps to enhance the team's knowledge and understanding of the surgical list and enables healthcare practitioners to have a greater understanding of actions required for patient care (Hunter & Finney 2011).

The team briefing involves some of the following actions:

- Staff discuss the actions needed for all surgical patients before the operating list starts.
- The brief is updated if there are any changes, for example consultant surgeons leave the operating room or new patients are added to the list.
- All members of the anaesthetic, surgical and theatre teams are included in the brief.
- The lead practitioner normally leads the discussion and identifies the key areas for discussion.
- The brief covers main issues such as health of the patient, type of anaesthetic required, the surgical procedure, moving and handling, patient positioning, equipment required and so on.

Pre-anaesthetic SIGN IN

The SIGN IN section of the WHO checklist is carried out by the anaesthetist and the anaesthetic practitioner before anaesthesia starts for every patient. The SIGN IN questions and

checks on the WHO SSCL are read aloud by the anaesthetic practitioner and confirmed by the anaesthetist (NPSA 2009). When the anaesthetist delivers a local anaesthetic, he or she confirms the site for delivery of the local anaesthetic by referring to the operating list, the consent form and the site marking on the patient. Other checks for the SIGN IN may include:

- Checking the patient for potential risk factors such as allergies, airway problems, cardiac problems and so on
- Risk of blood loss during surgery
- Checking of anaesthetic machine
- Preparation of instruments and equipment
- Preparation of anaesthetic drugs
- Confirmation of surgical site marking.

TIME OUT

The TIME OUT phase happens before surgery starts to confirm the correct patient is present, the correct procedure and the correct site for surgery (Hunter & Finney 2011). All staff must stop and listen when the TIME OUT is being discussed to give their full attention and understanding.

The surgeon undertaking the surgery initiates the TIME OUT and asks a theatre practitioner to read the TIME OUT section of the SSCL form aloud (WHO 2013). Issues include:

- Checking the identity of the patient against the medical notes and the patient's wristband
- Confirming the consent form is signed and dated
- Confirming the checks are correct
- If there are any problems, any member of the theatre team should raise a concern and confirm issues such as identity, correct consent, correct site, correct surgery and so on.

SIGN OUT

On completion of surgery and before the patient and members of the team leave the operating theatre, the final SIGN OUT is read verbally and the checklist completed (Haynes *et al.* 2009).

- The theatre practitioner confirms with the team the name of the procedure recorded for the patient. This happens because the procedure may have changed during the operation, so any updates must be described by the surgical team.
- Practitioners must confirm that instruments, swabs and sharps counts are correct, following local hospital policy. This prevents missing or retained swabs and instruments being left inside the patient.
- Practitioners must ensure that specimens are correctly labelled. This is important as false labelling can result in false results for the patient, or potential mix-ups with other patients.
- Highlighting any equipment problems ensures the removal of faulty equipment from the operating theatre and new equipment installed.
- Any key concerns for the patient during recovery are identified by the Surgeon, Anaesthetist and Registered Practitioner, including for example postoperative pain, nausea, vomiting, harm to joints, pressure sores and so on. The team will carry out a review of the postoperative recovery plan, focussing issues that might affect the patient.

Conclusion

Using the SSCL helps to address important safety concerns for the patient, enabling all members of the surgical team to focus on the patient and the procedure. This enables the surgical team to proceed confidently with the surgical procedure, delivering excellent