24 Postoperative care including perioperative opti

- Pressure sores
- Pulmonary embolus
- Renal and urinary system
- SURGERY-SPECIFIC COMPLICATIONS
- SYSTEM-SPECIFIC COMPLICATIONS Respiratory system
- Thoracic surgery
- Urology
- Vascular surgery
- Wound care
- Wound dehiscence

Abdominal surgery

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The abdomen should be examined daily for excessive disten - sion, tenderness or drainage from wounds or drain sites. In certain operations, such as those for intestinal obstruction or oesophageal and gastric procedures, a nasogastric tube ma y be required. This is of particular value in those patients with ileus or a marked level of altered consciousness, who are therefore liable to aspirate. Paralytic ileus Paralytic ileus may present with nausea, vomiting, loss of appetite, bowel distension and absence of flatus or bowel movements. Following laparotomy , gastrointestinal motility temporarily decreases. Treatment is usually supportive, with maintenance of adequate hydration and electrolyte levels. However, intestinal complications may present as prolonged ileus and so should be actively sought and treated. It is important to note that nutrient absorption from the gut will be impaired in the context of paralytic ileus, and parenteral with prolonged ileus. Return of function of the intestine occurs in the following order: small bowel, large bowel and then stomach. This pattern allows the passage of faeces despite continuing lack of stomach emptying and, ther efore, vomiting may continue even when the lower bowel has already started functioning normally . Localised intra-abdominal infection or anastomotic leakage Intra-abdominal infection may develop from a complication such as anastomotic leakage or persistent abscess following a laparotomy for a perforated viscus, as well as from less common causes such as iatrogenic perforation of a viscus during an elective operation. Intra-abdominal infection may be local ised, presenting with focal tenderness, a spiking fever, raised inflammatory markers and sometimes positive blood cultures and a prolonged ileus. These patients can often be managed by radiological drainage, if accessible, and appropria te antibiotic treatment. In some patients the leak may be more widespread, causing generalised peritonitis and severe sepsis and necessitat ing urgent laparotomy (see also Chapters 64 and 75). Bleeding Postoperative bleeding is a well-recognised complication but can still sometimes be overlooked. Hb levels may not always decrease in patients who are bleeding because of the relative haemoconcentration, and drains may not demonstrate signif icant blood loss if blocked with clot. It is important to have a high index of suspicion for bleeding and a low threshold for appropriate intervention for any postoperative patient with a drop in blood pr essure, tachycardia, demonstrable bleeding in the drains, progressive distension of the abdomen or a drop in Hb. Summary box 24.9 The main complications after abdominal surgery /uni25CF /uni25CF /uni25CF

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Cardiovascular system

Cardiovascular system

Thirty per cent of patients undergoing non-cardiac surgery will have at least one cardiovascular risk factor. In this group 30-day mortality is 0.5–2% as a result of cardiac complications. Routine pulse, blood pressure and electrocardiogram (ECG) monitoring will detect cardiovascular complications, reduce adverse outcomes and should be recor ded during emergence from, and recovery after, anaesthesia. There are certain categories of patient and procedure for which routine cardiovascular monitoring may be required for 24 hours or longer, usually on a PACU or high-dependency unit. Hypotension In the immediate postoperative period this is associated with adverse outcomes. Hypotension may be due to hypovolaemia, myocardial impairment or vasodilatation from subarachnoid - and epidural anaesthesia. Other causes of hypotension such as /uni25CF /uni25CF /uni25CF /uni25CF

Laboratory testing Increased urea and creatinine Low albumin Preoperative low saturation (<96%) or abnormal chest radiograph Preoperative anaemia (<10 g/dL) FEV /FVC <0.7 and FEV <80% predicted 1 1 , forced expiratory 1 Br J Anaesth 2017; 118 (3): 317–34.

PE, pericardial tamponade and anaphylaxis should also be considered in the di ff erential diagnosis. A high prevalence of diastolic dysfunction is seen in middle- aged patients having non-cardiac surgery . These patients are susceptible to exaggerated hypotension following hypovolaemia and pulmonary oedema in response to fluid overloading. Treatment should be aimed at the cause. Postoperative hypotension leading to end-organ dysfunction (e.g. decreased urine output <0.5 /uni00A0 mL/kg/h, decreased level of consciousness, myocardial ischaemia, capillar y refill >2 seconds) needs immediate management with fluid and may require the use of vasopressors and inotropes. Hypertension Hypertension is also common. It may be due to pain, agitation, anxiety , bladder spasm secondary to urinary catheterisation or pre-existing poorly controlled hypertension. The consequences include bleeding from vascular suture lines, cerebrovascular haemorrhage and myocardial ischaemia or infarction. Myocardial ischaemia Patients with a history of cardiovascular disease or with known cardiac risk factors undergoing major surgery are at risk of major adverse cardiac events (MACE). The spectrum of myocardial damage can range from injury (myocardial injury after non-cardiac surgery [MINS]) to ischaemia or infarction. Symptoms can include retrosternal pain radiating into the neck, jaw or arms, nausea, dyspnoea or syncope, but many events in the perioperative period are silent. ECG changes can include ST elevation in two continuous leads, new left bundle branch block or an arrhythmia. In the case of a non-ST segment myocardial infarction, only a rise in serial troponin levels will clarify the diagnosis. Cardiologists should be inv olved early and may start coronary reperfusion therapy in the form of primary percutaneous coronary intervention or thrombolysis. These should be discussed with the surgical team because of the risk of bleeding after major surgery . Arrhythmias When they occur in the postoperative period, arrhythmias can cause hypotension, myocardial ischaemia and cardiac arrest. Treatment should be guided by the Resuscitation Council UK’s peri-arrest guidelines.

Tachycardia (sinus or supraventricular, including atrial fibrillation) may occur as a result of anxiety , pain, myocardial ischaemia or infarction, hypov olaemia, sepsis, electrolyte imbalance or hypoxia in the postoperative period. Consideration should be given to correction of the underlying causes and the rate controlled with β -blockers, amiodarone or cardioversion, depending on the state of the patient. Sinus bradycardia may be normal in athletes, but it may also be associated with hypoxia, preoperative β -blockers, digoxin and increased intracranial pressur e. Pharmacological options include glycopyrrolate or atropine intravenously . A prolonged QT interval may be seen in the perioperative period. It is multifactorial in origin with most patients having predisposing risk factors, such as long QT syndrome or electrolyte abnormalities. Cardiovascular complications /uni25CF /uni25CF /uni25CF

Hypotension and hypertension in the postoperative period can be multifactorial and result in serious morbidity Arrhythmias can be prevented and corrected by treating hypotension and electrolyte imbalance Arrhythmias, myocardial ischaemia/infarction and stroke will need management with the help of cardiologists and neurologists

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DISCHARGE OF PATIENTS

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Patients discharged home need a ‘discharge letter’ detailing the postoperative plan. The discharge letter should include details of the final diagnosis, the treatment and any complications that may have occurred. There should be advice for referring the patient back to hospital and indications for readmission if specific problems do occur. The general practitioner (GP) - should be informed of the subsequent care plan, including follow-up, physiotherapy and other support needed. Pathology results should be included if available, and the basis of these in the subsequent care plan should be described along with the prognosis if appropriate. Discharge letter /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF

Diagnosis Discharge plan Treatment Support needed Laboratory results Follow-up Complications

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Deep vein thrombosis

Deep vein thrombosis

Deep vein thrombosis (DVT) is a well-known and, when complicated by pulmonary embolus, potentially fatal compli - cation of surgery (Table 24.6). All hospitals must have a process for screening all surgical patients to identify those at risk and for implementing prophylactic measures to avoid this dreaded complication. Risk assessment should occur within 24 hours of admission. Risk should be reviewed if the clinical situation changes. Methods of prevention are guided by the risk score and include the use of compression stockings, calf pumps and pharmacological agents, such as low-molecular-weight heparin. Compression stockings are not o ff ered to patients who have suspected or proven peripheral arterial disease or neurop - athy . They are also avoided or used with caution in those with sensitive or broken skin and in those who are allergic to the material used, have severe leg oedema or have a leg deformity . The symptoms and signs of DVT include calf pain, swell - ing, warmth, redness and engorged veins. However, most will show no physical signs. On palpation the muscle may be tender and there may be a positive Homans' sign (calf pain on dorsi - flexion of the foot), but this test is neither sensitive nor specific. Use the two-level DVT Wells score to assess the probability of D VT (Table 24.7). /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF

TABLE 24.6 Strati /f_i cation of surgical procedure and the associated risk of deep vein thrombosis. Low Maxillofacial surgery Neurosurgery Cardiothoracic surgery Medium Inguinal hernia repair Abdominal surgery Gynaecological surgery Urological surgery High Pelvic elective and trauma surgery Total knee and hip replacement

If DVT is suspected, duplex Doppler ultrasound and venography can be used to assess flow and the presence of a thrombosis. If DVT is unlikely by Wells's score then d-dimer testing can be done. A negative d-dimer test makes DVT unlikely; however, patients should be told about the signs and symptoms of PE and how to seek medical help if necessary . If a significant DVT is found (one that extends above the knee), treatment with parenteral anticoagulation initially , followed by longer term warfarin or a new oral anticoagulant (refer to national guidance, e.g. National Institute for Health and Car e Excellence [NICE]; see Further reading) is necessary . In some patients with a large DVT , a caval filter may be required to decrease the possibility of PE.

score. Clinical features Points Active cancer (treatment ongoing, within 6 1 months or palliative) Paralysis, paresis or recent plaster 1 immobilisation of the lower extremities 1 Recently bedridden for 3 days or more, or major surgery within 12 weeks requiring general or regional anaesthesia Localised tenderness along the distribution of 1 the deep venous system Entire leg swollen 1 Calf swelling at least 3 /uni00A0 cm larger than 1 asymptomatic side Pitting oedema con /f_i ned to the symptomatic 1 leg Collateral super /f_i cial veins (non-varicose) 1 Previously documented DVT 1 An alternative diagnosis is at least as likely as –2 DVT Clinical probability simpli /f_i ed score Points DVT likely 2 points or more DVT unlikely 1 point or less

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Drains

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Drains are used to prevent accumulation of blood and sero sanguineous or purulent fluid. In clean surgery , such as joint replacement, blood collected in drains can be transfused back into the patient provided that an adequate volume is collected rapidly and that a specifically designed drain and filter system is used. the evidence for their benefits has been questioned. Complica - tions of drains include trauma to surrounding tissues and infec - tion. The quantity and c haracter of drain fluid can be used to identify an abdominal complication such as fluid leakage (e.g. bile or pancreatic fluid) or bleeding. Drains should be removed as soon as it is considered safe to do so. The timing of drain remo val is related to the volume and nature of fluid being e vacuated (e.g. a drain may be left lon - ger to evacuate a pancreatic leak, but removed earlier if only serous fluid is draining) and balanced against the risk of leaving the drain in place (such as damage to the surrounding tissues). - Drains

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Enhanced recovery is an approach to the perioperative care of patients undergoing surgery . It is designed to speed clinical recovery of the patient and reduce both the cost and the length of stay of the patient in the hospital. It is achieved by optimising the health of the patient before surgery through prehabilitation and then delivering evidence-based best care in the perioperative period. Postoperative strategies advocated by enhanced recovery protocols include: /uni25CF early planned physiotherapy and mobilisation; /uni25CF early oral hydration and nourishment; /uni25CF opioid-sparing analgesia regimens that include the use of regional blocks, regular non-steroidal anti-inflammatory drugs and paracetamol; /uni25CF early discharge planning (started even before the patient is admitted to hospital and involving support from stoma care nurses, physiotherapists and other community care workers). DVT , urinary retention, atelectasis, pressure sores and faecal impaction. Telephone follow-up is carried out to make sure that the pa tient is recovering well.
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FURTHER READING

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handbook/7-effective-transfusion-in - surgery-and-critical-care/7-1-transfusion-in-surgery .pdf. Miskovic A, Lumb AB. Postoperative pulmonary complications. Br J Anaesth 2017; 118 (3): 317–34. National Institute for Health and Care Excellence. Acute kidney injury: prevention, detection and management . NICE Guideline 148. London: NICE, 2019. Available from https://www .nice.org.uk/guidance/ ng148. National Institute for Health and Care Excellence. Venous thromboembolic diseases: diagnosis, management and thrombophilia testing . NICE Guideline 158. London: NICE, 2020. Available from https://www . nice.org.uk/guidance/ng158. Sellers D, Srinivas C, Djaiani G. Cardiovascular complications after non-cardiac surgery . Anaesthesia 2018; 73 (Suppl 1): 34–42. Smetana GW , Lawrence V A, Cornell JE. Preoperative pulmonary risk stratification for non-cardiothoracic surgery: systematic review for the American College of Physicians. Ann Intern Med 2006; 144 : 581–95.

Fever

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GENERAL POSTOPERATIVE COMPLICATIONS Bleeding

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Postoperative haemorrhage is most common in the immediate postoperative period. It may be caused by an arterial or venous leak, but also by a generalised ooze or a coagulopathy . Slow bleeds may go undetected for hours and then the patient suddenly decompensates. All patients must have their vital signs (pulse rate, blood pressure, oximetry , central venous pressure, if available, and urine output) monitored regularly . Dressings and drains should be inspected regularly in the first 24 hours after surgery . If haemorrhage is suspected, blood samples should be taken for a full blood count, coagulation profile and cross- match. A large-bore intravenous cannula should be sited and fluid resuscitation commenced. If the source of bleeding is in doubt and the patient is stable, an ultrasound or computed tomography (CT) scan may be required to determine the nature of the bleed (most commonly if a haematoma is suspected in the days following surgery). If the patient’s cardiovascular system is unstable or compromised in any way (for example neck haematoma or bleeding tonsil) they should be taken back to the operating theatre immediately . The treatment of haemorrhage is both to stop the bleeding and supportive. Supportive treatment includes oxygen and fluid resuscitation. It may require correction of coagulopathy . All patients will require close observation. Blood transfusion carries risks (acute haemolytic transfusion reaction, sensitisation, fluid overload, hyperkalaemia, transfusion-related lung injury and transmission of blood-borne infection). There is much published about what is the right transfusion trigger and how to balance the need for adequate tissue perfusion and the risks of transfusion. According to the Joint United Kingdom (UK) Blood Transfusion and Tissue Transplantation Services Professional Advisory Committee transfusion should be considered if the haemoglobin (Hb) level is below 8g/dL. The decision to transfuse should be based on the clinical condition of the patient with acceptance of higher thresholds in individual cases. If the Hb level is below 7g/dL transfusion is usually indicated (see also Chapter 2). John Homans , 1877–1954, Professor of Clinical Surgery , Harvard Medical School, Boston, MA, USA. Philip Wells , contemporary , physician, University of Ottawa, Ottawa, Ontario, Canada. pain, orthostatic hypotension or tachycardia unresponsive to fluid resuscitation, or who have congestive heart failure may need transfusion at a higher thr eshold. All hospitals should have a ‘major haemorrhage protocol’ in - place. The consultant surgeon, anaesthetist and haematologist should all be involved early on in the care of unstable patients. Summary box 24.5 Postoperative bleeding /uni25CF /uni25CF

All hospitals should have a major haemorrhage protocol in place The need to transfuse blood in the absence of continued bleeding, guided by the Hb level, should be weighed against the risks

GENERAL POSTOPERATIVE COMPLICATIONS Bleeding

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GENERAL POSTOPERATIVE PROBLEMS AND MANAGEMENT

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This section provides an overview of selected important post operative problems and the principles of their management. It does not set out to describe such problems relating to the vast arra y of all surgical techniques and procedures. The reader is advised to consult chapters where specific procedures are described in more detail. Moreover, when considering post operative problems, the importance of pain control and fluid management should be appreciated, and the reader is directed to Chapters 23 and 25 . GENERAL POSTOPERATIVE PROBLEMS AND MANAGEMENT

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Introduction

INTRODUCTION

Perioperative care is integrated care delivered to the patient by a multidisciplinary team before, during and after surgery . The multidisciplinary perioperative team comprises doctors from various specialties, such as surgery , anaesthesia, acute medicine, care of the elderly and cardiology , along with nur ses, physiotherapists and occupational therapists. The aim of this is to bring together the patient and the care team in the perioperative period to improve the patient’s outcome and reduce healthcare-related costs. The input from the multidisciplinary team will vary depending on the medical condition of the patient and the complexity of the surgery . Many patients coming for surgery will have long term health problems that are at risk of worsening in the perioperative period. The time period between a decision to operate and the actual surgery can be used by the perioperative team to risk assess the patient and identify medical problems and treat them according ly to ensure an optimal medical state prior to surgery . This will stop deterioration in long-term health problems perioperatively and will prevent a delay in discharge. Risk assessment may involve simple blood tests to identify health problems, e.g. heart or renal failure, or more sophisticated tests, such as cardiopulmonary exercise testing (CPET), to assess the patient’s level of fitness. Providing high-quality care during surgery is essential and expected. Preventing harm by medical errors is also important. Checklists, such as the World Health Organization’s (WHO) ‘Surgical Safety Checklist’, are now routinely used to prevent surgical errors. Postoperative pain can delay the patient’s recovery , increase the risk of chest complications and chronic pain and contribute to a poor patient experience. A well- trained perioperative team led by an anaesthetist can develop a plan for managing pain. Increasingly patients are coming for surgery with complex medical problems that require management from the multidisciplinary team of physicians. This role is now taken over by anaesthetists as they have a better understanding of complications occurring in the perioperative setting. After complex surgery , many patients will need more intensive monitoring of their physiological parameters than is possible on a normal surgical ward, but they do not necessarily need all of the facilities a vailable on an intensive care unit. In such a case, patients are admitted for a period of 24–48 hours to an ‘overnight intensive recovery unit’ or ‘postanaesthesia care unit’ (PACU), where this facility can be provided. After this time period patients are transferred to either a surgical ward or critical care unit depending on how they are recovering from surgery or according to the level of cardiac or respiratory - support they need. Hospital beds are a finite and expensive resource. The beds can be utilised e ffi ciently if the patient can be discharged home quickly and safely . Good communication between hospital and care giver s in the community will facilitate a smooth transition to home.

How to predict, recognise, prevent and treat common • postoperative complications The principles of enhanced recovery •

Learning objectives

Learning objectives

To understand: The integrated approach to caring for patients in the • perioperative period Common postoperative problems seen in the immediate • postoperative period Learning objectives

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Neck surgery

Neck surgery

Patients undergoing neck surgery , e.g. thyroid surgery , must be observed for accumulation of blood in the wound, which may obstruct the airway and cause rapid asphyxia. This potentially life-threatening complication necessitates systems for early detection and prompt evacuation (see guidelines from the Di ffi cult Airway Society , the British Association of Endocrine and Thyroid Surgeons and the British Association of Otorhinolaryngology , Head and Neck Surgery). Another potential but less dangerous complication is damage to the recurrent laryngeal nerve, which can produce voice change (see also Chapter 55). Neck surgery

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Orthopaedic surgery

Orthopaedic surgery

Neurovascular supply to the extremity Patients who have undergone extremity surgery , for example open reduction and internal fixation of a fracture, require regular neurovascular observations, both in recovery and on the ward (this will usually follow a local or national guideline). Moreover, if a tourniquet has been used, the restoration of the distal neurovascular supply should be established. Careful documentation of findings before and after surgery will allow comparison. Concern about the neurovascular status requires urgent and experienced surgical review and further manage ment. Circumferential casts can be split and dressings cut down to skin to improve the blood supply to the limb. Raised pressure in an osseofascial compartment can manifest after surgical intervention to a limb and can prevent adequate tissue perfusion. Patients with compartment syndrome complain of pain that is (i) out of proportion to that expected, (ii) increasing in intensity , and (iii) worse on passive stretching of the muscles in the a ff ected compartment. Other symptoms that relate to pressure on nerves (paralysis, paraesthesia) and blood vessels (pallor and pulselessness) may only be noticed after irretrievable injur y to the limb has occurred from the ischaemia. Extreme vigilance and early intervention is neces - sary to identify and manage compartment syndrome. When suspected, prompt senior input is required. In terms of initial management, circumferential casts can be split, dressings cut - down to skin and the limb elevated. Further management will require experienced judgement and may include compartment pressur e monitoring and/or fasciotomies. Compartment syndrome is considered more extensively in Chapters 3 and 32 . - Summary box 24.10 Compartment syndrome symptoms and signs /uni25CF /uni25CF /uni25CF - /uni25CF

Pain out of proportion to that expected Pain that is increasing Pain on passive stretching of the muscles in the affected compartment Paralysis, paraesthesia, pallor and pulselessness generally occur late

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POSTOPERATIVE COMPLICATIONS

POSTOPERATIVE COMPLICATIONS

Postoperative complications are an important cause of morbidity , mortality , extended hospital stay and increased costs. Most patients at increased risk of developing postoperative complications can be identified prior to surgery at the preop erative assessment clinic using a variety of scoring systems (for example the American College of Surgeons National Surgical Quality Improvement Program surgical risk calculator for a patient’s risk of postoperativ e complications [ACS NSQIP], as discussed in Chapter 21). Early identification of risk allows for targeted, appropriate, anticipatory and supportive medical care, which will reduce both the incidence and severity of such complications when they occur. The Clavien–Dindo classification of postoperative compli cations (Table 24.1) is used to objectively and reproducibly /uni25CF /uni25CF Pierre-Alain Clavien , contemporary , professor, University Hospital Zurich, Zurich, Switzerland. Daniel Dindo , contemporary , surgeon, Centre for Surgery , Zurich, Switzerland. - measure the impact of surgical complications on the outcome of the procedure. Complications are graded according to the - treatment they require. This eliminates subjective bias and pre - vents complications from being downgraded. Complications can occur throughout the postoperative period. However, certain complications are more common earlier in the postoperative period than others, as shown in Figure 24.3 . P ostoperative complications can be further classified into system-specific and surgery-specific complications.

TABLE 24.1 Clavien–Dindo classi /f_i cation of postoperative complications. Grade De /f_i nition I Any deviation from the normal postoperative course without the need for pharmacological treatment or surgical, endoscopic or radiological intervention Acceptable therapeutic regimens are: drugs as antiemetics, antipyretics, analgesics, diuretics and electrolytes and physiotherapy. This grade also includes wound infections opened at the bedside II Requiring pharmacological treatment with drugs other than such allowed for grade I complications. Blood transfusions and total parenteral nutrition are also included III Requiring surgical, endoscopic or radiological intervention IIIa Intervention not under general anaesthesia IIIb Intervention under general anaesthesia IV Life-threatening complication (including CNS complications, e.g. brain haemorrhage, but excluding TIAs) requiring ICU management IVa Single-organ dysfunction (including dialysis) IVb Multiorgan dysfunction V Death of a patient CNS, central nervous system; ICU, intensive care unit; TIA, transient ischaemic attack. Super /f_i cial surgical Deep/organ space site infection surgical site infection Venous thromboembolism Myocardial infarction Kidney injury/failure 25 20 15 10 5 Incidence estimates (per 10 000 patient-days) 0 0 10 20 30 Postoperative day Figure 24.3 Timing and incidence of postoperative complications. Modi /f_i ed from Hyder JA, Wakeam E, Arora V et al . Investigating the “Rule of W,” a mnemonic for teaching on postoperative complications. J Surg Educ 2015; 72 (3): 430-7.

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POSTOPERATIVE OBSERVATIONS

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The patient’s vital signs (including pulse, blood pressure and pulse oximetry reading), level of consciousness, pain and hydration status are monitored in the recovery room and supportive treatment is given. In recent years, patient observations have been collated in recording systems designed to provide an early warning of clinical deterioration (Figure 24.1). The recording of observations as an ‘early warning system’ begins in recovery and is continued on the ward until the patient is discharged from the hospital. NEW score Aggregate score 0–4 Red score Score of 3 in any individual parameter score 5–6 Aggregate Aggregate score 7 or more * Response by a clinician or team with competence in the assessment and treatment of acutely ill patients and in recognising when the escalation of care to a critical care team is appropriate. *The response t eam must also include staff with critical care skills, including airway management. are routinely measured, are used to calculate the score: 1 respiration rate; 2 oxygen saturation; 3 systolic blood pressure; 4 pulse rate; 5 level of consciousness or new-onset confusion, disorienta - tion and/or agitation; 6 temperature. Each measured parameter is allocated a score depending on how much it varies from a normal value. Two points are added if the patient needs supplemental oxygen. The score is then ag gregated. An aggregate score places patients in di ff er - ent risk categories (low to high risk) that trigger an appropriate clinical response, as seen in Figure 24.2 . Depending on the risk categories patients may need level 2 or level 3 care. Patients w ho are in the high-risk category of clinical deterioration will need urgent assessment by sta ff with critical care experience and airway skills. Surgery-specific observations, such as Doppler flow for a free flap, regular neurological evaluation and laboratory tests, such as blood gas analysis, should also be performed when necessar y . The patient can be discharged from PACU when they fulfil the following criteria: /uni25CF they are fully conscious; /uni25CF respiration and oxygenation are satisfactory; /uni25CF they are normothermic, not in pain and not nauseous; /uni25CF cardiovascular parameters are stable; /uni25CF oxygen, fluids and analgesics have been prescribed; /uni25CF there are no concerns relating to the surgical procedure. However, as discussed above, some patients who have had complex surgery or who have severe chronic health conditions will stay for a period of 24–48 hours on PA CU or an overnight intensive recovery unit until they are discharged to either a surgical ward or critical care unit. Clinical risk Response Low Ward-based response Low–medium Urgent ward-based response Medium Key threshold for urgent response* High Urgent or emergency response**

Figure 24.2 Risk category from the National Early Warning (NEW) score and response. *Response by a clinician or team with competence in the assessment and treatment of acutely ill patients and in recognising when the escalation of care **The response team must also include staff with critical care skills, including airway management. (Reproduced from Royal College of Physicians . National

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Postoperative period /uni25CF /uni25CF /uni25CF /uni25CF

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PREHABILITATION

PREHABILITATION

The functional capacity of a patient can be reduced following major surgery . This can have a significant negative impact on the recovery of patients with poor functional reserve prior to surgery . Prehabilitation is a process of improving the functional capacity of patients prior to major surgery in order to improve postoperative outcomes. The time period between the decision to operate and the surgery date itself is used for prehabilitation. The patient is medically optimised by asking them to, for example, stop smoking, r educe their alcohol intake or lose weight. Anaemia should be treated and blood sugar can be e ff ectively controlled in patients with diabetes during this period. Existing medication should be reviewed and modified if necessary to better control 0 1 2 3 DATE OF BIRTH DATE TIME ≥25 21–24 + A B 18–20 Respirations Breaths/min 15–17 12–14 9–1 1 ≤8 ≥96 94–95 + A B 92–93 SpO Scale 1 2 Oxygen saturation (%) ≤91 on O ≥97 2 † SpO Scale 2 2 Oxygen saturation (%) 95–96 on O 2 Use Scale 2 if target 93–94 on O 2 range is 88–92%, eg in hypercapnic ≥93 on air respiratory failure 88–92 86–87 † ONLY use Scale 2 84–85 under the direction of a qualified clinician ≤83% A=Air Air or oxygen? O L/min 2 Device ≥220 201–219 C 181–200 Blood 161–180 pressure mmHg 141–160 Score uses l systolic BP on y 121–140 111–120 101–110 91–100 81–90 71–80 61–70 51–60 ≤50 ≥131 121–130 C 111–120 Pulse Beats/min 101–110 91–100 81–90 71–80 61–70 51–60 41–50 31–40 ≤30 Alert Confusion D V Consciousness Score for NEW P i onset of confus on i (no score if chron c) U ≥39.1° 38.1–39.0° E 37.1–38.0° Temperature °C 36.1–37.0° 35.1–36.0° ≤35.0° NEWS TOTAL Monitoring frequency Escalation of care Y/N Initials DATE OF ADMISSION DATE TIME 3 3 ≥25 21–24 2 2 18–20 15–17 12–14 9–1 1 1 ≤8 3 ≥96 94–95 1 92–93 2 ≤91 3 on O ≥97 3 2 95–96 on O 2 2 93–94 on O 2 1 ≥93 on air 88–92 86–87 1 84–85 2 ≤83% 3 A=Air O L/min 2 2 Device 3 ≥220 201–219 181–200 161–180 141–160 121–140 111–120 101–110 1 91–100 2 81–90 71–80 61–70 3 51–60 ≤50 ≥131 3 121–130 2 111–120 101–110 1 91–100 81–90 71–80 61–70 51–60 41–50 1 31–40 3 ≤30 Alert Confusion V 3 3 P © Royal College of Physicians 2017) U 2 ≥39.1° 1 38.1–39.0° 37.1–38.0° 36.1–37.0° 35.1–36.0° 1 ≤35.0° 3 TOTAL Monitoring Escalation Initials National Early Warning Score 2 (NEWS2

Figure 24.1 An example of an early warning system using patient observations: the National Early Warning System (NEWS) from the Royal College of Physicians. (Reproduced from Royal College of Physicians. of acute-illness severity in the NHS . Updated report of a working party. London: RCP , 2017.) National Early Warning Score (NEWS) 2: Standardising the assessment

hypertension. Functional capacity can be assessed formally using either CPET or the 6-minute walk test. Patients should be encouraged to undertake strength and aerobic exercises in formal programmes or as far as possible to improve their physical fitness. A poor preoperativ e nutritional state leads to poorer outcomes, and correcting nutritional imbalances will help the recovery of the patient. Psychological interventions to reduce anxiety prior to surgery and improve the patient’s motivation to recover after surgery will benefit the patient greatly . Preoperative assessment, including assessment of high-risk surgical patients, has been covered in Chapter 21 . Anaesthesia

and pain relief has been covered in Chapter 23 . The postoperativ e phase begins at the end of surgery when the patient is transferred to ‘recovery’ or ‘PACU’. At the end of surgery , a ‘sign out’ is performed as part of the WHO checklist. The thea tre team should then formally hand over the care of the patient to the PACU sta ff . The information provided should include the patient’s name and age, the surgical procedure, the anaesthetic and analgesics given, fluid replacement, blood loss, urine output, any surgical/anaesthetic problems encountered or expected, existing medical problems and allergies. A plan for the management of pain and nausea or vomiting should also be conveyed. PREHABILITATION

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Figure 24.1 An example of an early warning system using patient observations: the National Early Warning System (NEWS) from the Royal College of Physicians. (Reproduced from Royal College of Physicians. of acute-illness severity in the NHS . Updated report of a working party. London: RCP , 2017.) National Early Warning Score (NEWS) 2: Standardising the assessment

hypertension. Functional capacity can be assessed formally using either CPET or the 6-minute walk test. Patients should be encouraged to undertake strength and aerobic exercises in formal programmes or as far as possible to improve their physical fitness. A poor preoperativ e nutritional state leads to poorer outcomes, and correcting nutritional imbalances will help the recovery of the patient. Psychological interventions to reduce anxiety prior to surgery and improve the patient’s motivation to recover after surgery will benefit the patient greatly . Preoperative assessment,

including assessment of high-risk surgical patients, has been covered in Chapter 21 . Anaesthesia and pain relief has been covered in Chapter 23 . The postoperativ e phase begins at the end of surgery when the patient is transferred to ‘recovery’ or ‘PACU’. At the end of surgery , a ‘sign out’ is performed as part of the WHO checklist. The thea tre team should then formally hand over the care of the patient to the PACU sta ff . The information provided should include the patient’s name and age, the surgical procedure, the anaesthetic and analgesics given, fluid replacement, blood loss, urine output, any surgical/anaesthetic problems encountered or expected, existing medical problems and allergies. A plan for the management of pain and nausea or vomiting should also be conveyed.

Plastic surgery

Plastic surgery

The viability of flaps is crucial and the perfusion needs to be monitored regularly . The blood supply may be compromised by position, dressings or collection of fluids or blood beneath the flap. Plastic surgery

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Pressure sores

Pressure sores

Patients undergoing surgery for a prolonged period of time are vulnerable to the development of a pressure sore or to worsening of a pre-existing sore as a result of prolonged immobility during, and sometimes after, the operation. Careful positioning and padding of the patient are standard practice result of friction or persisting pressure on soft tissues. They particularly a ff ect the pressure points of a recumbent pa tient, including the sacrum, greater trochanter and heels. Risk factors are poor nutritional status, dehydration, lack of mobility and nerve block anaesthesia technique. Early mobilisation of the patient and regular inspection of pressure points by the nursing team can act to prevent pressure sores. High-risk patients may be nursed on an air mattress, which automatically relieves the pressure areas. Pressure ulcers can be graded according to an interna - tionally recognised grading system based on the extent of skin loss. Category 1 ulcers involve non-blanching erythema with intact skin. Category 2 ulcers have partial thickness skin loss and appear as a shallow open ulcer with a r ed-pink wound bed or an intact or ruptured serum-filled blister. Category 3 ulcers have full thickness skin loss, with subcutaneous fat visible in the wound, but not bone, tendon or muscle. Category 4 ulcers have full thickness loss with exposed bone, tendon or muscle; osteomyelitis may develop at these sites. Summary box 24.8 he Preventing pressure sores /uni25CF /uni25CF /uni25CF

Recognise patients at risk Address nutritional status Keep patients mobile or regularly turned if bed-bound

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Pulmonary embolus

Pulmonary embolus

PE is not usually an immediate complication but can present in the early postoperative period. Thrombus can arise from DVT in the legs/pelvis, venae cavae or the right atrium. Signs and symptoms depend on the size of the embolus and may range from dyspnoea, cough and pleuritic chest pain to sudden cardiovascular collapse. Diagnosis of PE begins with the history (including risk factors and recent surgery) and a physical examination (which may include signs of DVT). The two-level Wells PE score (Table 24.8) can be used to determine the probability of PE. Depending on the presentation, investigations may include ECG, chest radiograph, blood tests (arterial blood gas and d-dimer) and radiological tests (usually CT pulmonary angiography). Christian Johann Doppler , 1803–1853, Professor of Experimental Physics, Vienna, Austria, enunciated the ‘Doppler principle’ in 1842. If the presentation includes cardiovascular collapse, resuscitation will be needed. Thrombolysis can be considered with massive PE causing cardiovascular collapse, but this should include senior clinical opinion and would generally follow appropriate guidelines. The patient may need inotropes and admission to the intensive care unit. In less severe cases of PE, supportive measures include oxygen therapy and analgesia. After initial resuscitation, the patient will need anticoagulation – initially parenteral anticoagulation – followed by long-term oral anticoagulation (refer to national guidance, e.g. NICE; see Further reading). A vena cava filter may be needed if anti - coagulation is not possible or if the pa tient has an embolism while anticoagulated (see Further reading).

score. Clinical features Points 3 Clinical signs and symptoms of DVT (minimum of leg swelling and pain with palpation of the deep veins) An alternative diagnosis is less likely than PE 3 Heart rate more than 100 beats per minute 1.5 Immobilisation for more than 3 days or surgery 1.5 in the previous 4 weeks Previous DVT/PE 1.5 Haemoptysis 1 Malignancy (on treatment, treated in the last 6 1 months or palliative) Clinical probability simpli /f_i ed score Points PE likely More than 4 points PE unlikely 4 points or less DVT, deep vein thrombosis.

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Renal and urinary system

Renal and urinary system

Acute kidney injury Renal failure occurring during the perioperative period is associated with considerable mortality and morbidity . About one-quarter of cases of hospital-acquired renal failure occur in the perioperative period and are associated with high mortality , especially after cardiac and major vascular surgery . Several definitions of acute kidney injury have been proposed that use changes in serum creatinine and urine output to stage kidney injury . One of the more recent examples is KDIGO (Kidney Disease: Improving Global Outcomes), which is shown in Table 24.3 . Certain groups of patients with comorbidities such as dia - betes or those undergoing emergency surgery or certain high- risk procedures such as cardiac/transplantation surgeries are more susceptible. Table 24.4 lists the causes of perioperative acute kidne y injury . To prevent acute kidney injury in the perioperative period it is important to identify patients who are more susceptible to it. Normo volaemia and normal blood pressure should be main - tained during surgery . Avoiding nephrotoxic agents and unnec - essary blood transfusions and treating infections promptly will also help to avoid acute kidney injury . Urine output is reduced during surgery and does not correlate with r enal function. Fluids should not be given excessively to treat oliguria.

TABLE 24.3 KDIGO: Kidney Disease: Improving Global Outcomes. Stage 1 Increased sCr × 1.5–1.9 of baseline that is known or presumed to have occurred within the preceding 7 days or sCr increase ≥ 0.3 /uni00A0 mg/dL within 48 hours or Urine output <0.5 /uni00A0 mL/kg/h for 6–12 hours Stage 2 Increased sCr × 2–2.9 of baseline or Urine output <0.5 /uni00A0 mL/kg/h for ≥ 12 hours Stage 3 Increased sCr × 3 of baseline or sCr ≥ 4 /uni00A0 mg/dL or initiation of RRT 2 or GFR decrease to <35 /uni00A0 mL/min/1.73 /uni00A0 m in patients <18 years old or Urine output <0.3 /uni00A0 mL/kg/h for ≥ 24 hours or anuria for ≥ 12 hours GFR, glomerular /f_i ltration rate; RRT, renal replacement therapy; sCr, serum creatinine.

/uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF Urinary retention Inability to void after surgery is common after anaesthesia and surgery with the incidence ranging from 5% to 70%. Risk factors include age >50 years, male sex, certain surgeries such as hernia, anorectal and pelvic surgery , a history of benign prostatic hypertrophy and neurological disease. Neuraxial anaesthesia and certain drugs given during anaesthesia such as anticholinergic medications, α -/ β -blockers, sedatives and fluids increase the risk. The diagnosis of retention may be confirmed by clinical examination and by using ultrasound imaging. Urinary retention needs treatment as it can cause not only discomfort but also long-term bladder dysfunction. Catheterisation should be performed prophylactically when an operation is expected to last 3 hours or longer, or when large volumes of fluid are administered. Urinary infection Urinary infection is one of the most commonly acquired infections in the postoperative period. Patients may present with dysuria and/or pyrexia. Immunocompromised patients, patients with diabetes and those with a history of urinary retention are known to be at higher risk. Treatment involves adequate hydration, proper bladder drainage

and antibiotics depending on the sensitivity of the microorganisms. Summary box 24.4 Renal and urinary complications /uni25CF /uni25CF /uni25CF James Parkinson , 1755–1824, general practitioner of Shoreditch, London, UK, published Thomas Addison , 1795–1860, physician, Guy's Hospital, London, UK, described the e ff ects of disease of the suprarenal capsules in 1849. Postoperative delirium and postoperative cognitive dysfunction Postoperative delirium (POD) is characterised by a reduced awareness of the environment and a disturbance in attention accompanied by either hallucinations or disorientation or temporary memory loss. Postoperative cognitive dysfunction (POCD) refers to dete - rioration in cognition temporally associated with surgery . POD can occur during recovery from anaesthesia or a few days after surgery . The overall incidence of POD is 5–50%. It occurs more frequently in elderly orthopaedic patients and those undergoing emergency surgical procedur es. Delirium is associated with increased all-cause morbidity , mortality and discharge to a nursing home. There are two types of delir - ium: hyperactive (restlessness, incoherent speech, agitation, hallucinations) and hypoactive (withdrawn, poorly responsive to the environment, depressed). Preoperative risk factor s for POD include pre-existing cognitive impairment, dementia, frailty , Parkinson's disease, severe illness, renal impairment and depression. Precipitating factors include surgery , intraoperative administration of narcotics and benzodiazepines, change of medications, electrolyte and fluid abnormalities, constipation, catheterisation and an unfamiliar environment (Table 24.5). Correcting any reversible cause, involving relatives or friends whom the patient knows and pain control can all con - tribute to reducing the impact and duration of delirium. As a last option, haloperidol may be given in titrated doses accord - ing to local protocols. /uni25CF An essay on the shaking palsy in 1817.

Prerenal Hypovolaemia due to third space losses and bleeding Sepsis Cardiac failure Low cardiac output due to anaesthesia and cardiopulmonary bypass Increased intra-abdominal pressure Cirrhosis, hepatorenal syndrome Aortic cross-clamp Renal In /f_l ammation and sepsis Chronic kidney disease and comorbidities, e.g. diabetes, obesity Endogenous (e.g. myoglobin) and exogenous (e.g. radiocontrast dyes) toxins Blood transfusions Chloride-rich solution and hydroxyethyl starch Post renal Surgery Tumour Benign prostatic hypertrophy Neurogenic bladder Postoperative renal failure is associated with high mortality Prophylactic measures to prevent renal failure should be taken in high-risk cases Urinary retention and infection are common problems postoperatively TABLE 24.5 Causes of delirium. Renal Renal failure/uraemia Hyponatraemia and electrolyte disorders Urinary tract infection Urinary retention Respiratory Hypoxia, e.g. chest infection Atelectasis Cardiovascular Pulmonary embolism Dehydration Septic shock Myocardial infarction Chronic heart failure Arrhythmia Drugs Opiates including heroin Hypnotics Cocaine Alcohol withdrawal Hypoglycaemia Neurological Epilepsy Encephalopathy Head injury Cerebrovascular accident Idiopathic (rare) Hypothyroidism Hyperthyroidism Addison's disease

Stroke is a recognised complication of carotid endarterectomy surgery both early (secondary to emboli) and later (secondary to cerebral hyperperfusion syndrome). It is also a recognised consequence of both hypotension and hypertension. Throm bolysis may be indicated but the neurology and surgical teams must discuss together the risks and benefits of such a treatment plan. Seizures These are uncommon except in those patients with known poorly controlled epilepsy . They may occur as a complication of neurosurgery . Renal and urinary system

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SURGERY-SPECIFIC COMPLICATIONS

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SYSTEM-SPECIFIC COMPLICATIONS Respiratory system

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Early detection of respiratory complications is facilitated by periodic assessment of airway patency , respiratory rate and routine oxygen saturation measurement, performed during emergence and recovery as described earlier. Postoperative respiratory complications can occur immediately on PACU or later when a patient is on the surgical ward or is discharged home. Immediate respiratory complications on PACU Airway Upper airway obstruction is one of the commonest immediate postoperative complications and can be due to laryngospasm, persisting relaxation of airway muscles, soft-tissue oedema, haematoma, vocal cord dysfunction or a foreign body . Vigi - lance and early intervention are necessary to prevent harm to the patient. Most interventions are simple and involve manual support of the jaw or insertion of an oral or nasal airway . The residual e ff ects of anaesthetic drugs (neuromuscular blockers, anaesthetic agents, opioids) can contribute to reduced or impaired adequacy of ventilation postoperatively . Continuous pulse oximetry and respiratory rate evaluation can identify respiratory compromise and consequent hypoxia early . Supplemental oxygen should be given to all patients on PACU until adequate respiration and oxygenation are restored. Hypoxaemia This may occur, in addition to the situations already described above, as a consequence of acute pulmonary oedema (fluid overload, cardiac failure, postobstructive), bronchospasm, De novo pneumonia is very nary embolism (PE) (Figure 24.5). unusual in the immediate postoperative period. Hypoxaemia develops most quickly in patients with obstructive sleep apnoea (OSA), lung disease and obesity; these patients should therefore be closely observed. Patients with hypoxaemia should be treated urgently . If the patient is breathing spontaneously , oxygen should be admin - istered at 15 /uni00A0 L/min using a non-rebreathing mask. A head tilt, chin lift or jaw thrust should relieve obstruction related to reduced muscle tone. Suctioning of any blood or secretions and insertion of an oropharyngeal airway may be needed. Early anaesthetic intervention may be required. V ocal cord palsy (as a consequence of recurrent laryngeal nerve injury), neck haematoma and post-tonsillectomy bleed - ing are recognised as life-threatening complications of head and neck surgery , which need immedia te medical attention for safe resolution. Although the above respiratory complications are more common on P ACU, they can occur after discharge from PACU as well. Respiratory complications after discharge from PACU Postoperative pulmonary complications are a significant cause of postoperative morbidity and mortality (figures vary between 5% and 70%). Complications include fever (due to micro - atelectasis), cough, dyspnoea, bronchospasm, hypercapnia, atelectasis (Figure 24.6), pneumonia (Figure 24.7), pleural e ff usion, pneumothorax and respiratory failure. The risk of each varies with

the patient and the type of sur gery being performed. Thoracic or abdominal surgery carries the highest risk. The majority of patients at risk (obese, smokers, chronic lung disease, OSA, poor nutritional status) can be identified

Figure 24.4 Radiograph showing a right tension pneumothorax with tracheal deviation to the left (courtesy of Professor Stephen Eustace, Dublin, Ireland). Figure 24.5 Computed tomography scan showing a pulmonary artery blood embolism (arrow) (courtesy of Professor Stephen Eustace, Dublin). Figure 24.6 Radiograph showing right upper lobe atelectasis (cour

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preoperatively , facilitating the development of strategies that will reduce the impact of surgery on the individual patient. Table 24.2 shows risk factors for developing a postopera tive pulmonary complication. /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF

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Figure 24.7 Radiograph showing classical Staphylococcus aureus pneumonia (courtesy of Professor Stephen Eustace, Dublin, Ireland). TABLE 24.2 Risk factors for developing a postoperative pulmonary complication. Patient factors Procedure-related factors Non-modi /f_i able Non-modi /f_i able Type of surgery Age Upper abdominal or vascular surgery Male sex Emergency surgery ASA grade >II Long-duration surgery (>2 /uni00A0 hours) Frailty Reoperation or multiple surgery Acute respiratory infection within 1 month of surgery Impaired cognition/sensorium/stroke Malignancy Weight loss >10% (within 6 months Long-term steroid use Prolonged hospitalisation Modi /f_i able Modi /f_i able Smoking Use of general anaesthesia versus regional anaesthesia COPD/asthma OSA Use of neuromuscular blocking agents BMI <18.5 or >40 Mechanical ventilation strategy Hypertension Open versus laparoscopic surgery Chronic heart failure Intraoperative blood transfusion Chronic liver failure/ascites Renal failure Diabetes mellitus Alcohol GORD Preoperative sepsis and shock ASA, American Society of Anesthesiologists; BMI, body mass index; COPD, chronic obstructive pulmonary disease; FEV volume in 1 second; FVC, forced vital capacity; GORD, gastro-oesophageal re /f_l ux disease; OSA, obstructive sleep apnoea. Modi /f_i ed from Miskovic A, Lumb AB. Postoperative pulmonary complications. Respiratory complications can occur either immediately or a few days later on the ward Obesity, smoking, chronic lung disease, poor nutritional status and OSA predispose to a higher risk of respiratory complications Early intervention and multidisciplinary involvement can prevent life-threatening respiratory complications

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Thoracic surgery

Thoracic surgery

Careful fluid management is important in patients undergoing a lobectomy or pneumonectomy as they are susceptible to fluid overload in the first 24–48 hours postoperatively . Chest drains require regular review . If the fluid in a chest drain swings then the drain has been correctly inserted into the pleural cavity . Bubbling of the chest drain confirms the release of air from the pleural cavity; however, if the bubbling persists, this may represent a bronchopleural fistula. A haemothorax or pleural e ff usion will reveal itself as a prolonged loss of blood or fluid, - respectively , into the drain. Cardiac patients require continu - ous ECG monitoring postoperatively (see also Chapter 60). Postoperatively the patient should be kept under close observation. A rise in intracranial pressure may be signalled by a deterioration in the state of consciousness, as well as by neurological signs. Urgent imaging and intervention are likely to be necessary in these cases to avoid the risk of mortality from complications such as an intracranial haematoma. Some patients may have an intracranial monitoring device to allow for more sensitive monitoring. Thoracic surgery

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Urology

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Catheter patency must be checked regularly following urolog ical surgery . In patients who have undergone transurethral resection of the prostate, continuous bladder irrigation may be used. More generalised complications can occur, for example transurethral r esection syndrome, and are discussed further in the appropriate section. Urology

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Vascular surgery

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The patency of grafts and anastomoses, for example femoro popliteal bypasses and abdominal aneurysm, needs to be checked by regular clinical assessment of the limbs and by Doppler ultrasound in the postoperative phase. Vascular surgery

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Wound care

Wound care

Within hours of the wound being surgically closed, the dead space fills up with an inflammatory exudate. Within 48 hours of closure a layer of epidermal cells from the wound edge bridges the gap. Consequently , sterile dressings applied in theatre should not be removed before this time. Wounds should be inspected only if there is a concern about their condition or the dressing needs changing. Inspection of the wound should be performed under sterile conditions. If the wound looks inflamed, a wound swab can be taken and sent for microbiological examination, but this can be unreliable. Infected wounds and haematomas may need treatment with antibiotics or even wound washout. If a surgical procedure is - performed it gives an opportunity to collect samples for bacte - riology (before any antibiotics, if the patient’s general condi - tion allows), to excise dead tissue and to control any bleeding. Depending on location, the wound may require packing if it is contaminated or if non-viable tissue remains. The dressing should then be changed regularly until the w ound is clean. Skin sutures or clips are usually removed between 6 and 10 days after surgery . The period can be shorter in wounds on the face or neck, or longer for tougher tissues such as the back. Wound healing is delayed in patients who are malnourished or in those who have vitamin A and C deficiency . Steroids also inhibit the adequate healing of wounds as they inhibit protein - synthesis and fibroblast proliferation. Poorly controlled diabe - tes delays wound healing and increases the risk of infection at the surgical site (see also Chapter 3). - Wound care

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Wound dehiscence

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Wound dehiscence is disruption of any or all of the layers in a wound. Dehiscence may occur in up to 3% of abdominal wounds, increases the risk of postoperative mortality and is very distressing to the patient. Wound dehiscence most commonly occurs from the fifth to the eighth postoperative day when the strength of the wound is at its weakest. It may herald an underlying abscess and usually presents with a serosanguinous discharge. T patient may have felt a popping sensation during straining or coughing. Most patients with a full thickness dehiscence of an abdominal wound will need to return to the operating theatre for resuturing. In patients in whom tissues are suspected to be infected, of poor quality or under excessive tension, it may be appropriate to leave the wound open and treat with dressings or vacuum-assisted closure pumps. Summary box 24.7 Risk factors in wound dehiscence /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF

General Malnourishment Sepsis Diabetes Cancer Obesity Treatment with steroids Renal failure Emergency surgery Jaundice Local Inadequate or poor closure of wound or closure of a wound under tension Poor local wound healing, e.g. because of infection, haematoma or seroma Increased intra-abdominal pressure, e.g. in postoperative patients with chronic obstructive airway disease, during excessive coughing

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