Multiple Choice Questions

Sleep physiology and the perioperative care of patients with sleep disorders

1. In normal sleep:
   (a) K-complexes and sleep spindles are found in stage N1, shortly after onset.
   (b) Rapid eye movement (REM) occurs shortly after sleep onset and represents deep sleep.
   (c) REM is prevalent in the latter half of the night and is associated with dreams that may be recalled on waking.
   (d) A typical night may contain seven or eight sleep cycles, as demonstrated on a hypnogram.
   (e) Muscle tone increases during REM sleep.

2. Appropriate statements regarding sleep disorders include:
   (a) Idiopathic hypersomnia is associated with a deficiency of orexin- and hypocretin-producing neurones in the hypothalamus.
   (b) Hypnagogic and hypnopompic hallucinations are common in individuals with cataplexy.
   (c) Cataplexy is characterized by a brief loss of consciousness in response to emotional triggers such as anger and laughter.
   (d) Melatonin is commonly used in the management of narcolepsy to promote the consolidation of deep sleep.
   (e) Status cataplecticus is likely to be precipitated by the abrupt withdrawal of sodium oxybate therapy.

3. Obstructive sleep apnoea (OSA) is likely to:
   (a) Be deemed severe when 35 apnoeic events are seen in an overnight sleep study.
   (b) Affect more than 10% of an unselected surgical population.
   (c) Be severe if more than 30 hypopnoeic events occur per hour of sleep.
   (d) Be a contraindication for day-case surgery.
   (e) Be diagnosed with a 2% oxygen desaturation frequency greater than five events per hour.

4. The following elements are components of the STOP-BANG questionnaire indicating likely presence of obstructive sleep apnoea:
   (a) Body mass index >30 kg/m².
   (b) Age >60 years.
   (c) Falling asleep after lunch without alcohol if circumstances permit.
   (d) A Mallampati score of ≥3.
   (e) Neck circumference >40 cm.

Atmospheric science, anaesthesia, and the environment

5. Appropriate statements concerning power and energy include:
   (a) The kilowatt-hour (kWh) is a unit of power.
   (b) A 1000 W electrical appliance running for an hour uses 3.6 × 10⁶ joules (J).
   (c) Reduced SO₂ emission from gas-fired power stations is the main reason for closing coal-fired power stations in the UK.
   (d) Drax power station in Yorkshire, UK, burns coal to produce electricity. The maximum output is 4000 MW. In an hour about 2500 tonnes (t) of CO₂ will be emitted, assuming that 700 g of CO₂ is produced per kilowatt-hour.
   (e) The amount of electrical energy used per person in the UK is decreasing.

6. Appropriate statements concerning the environmental and atmospheric effects of nitrous oxide (N₂O) include:
   (a) The highest local environmental concentration of N₂O is likely to be found in the delivery suite.
   (b) Nitrous oxide is a normal constituent of the atmosphere.
   (c) Once in the troposphere, N₂O contributes significantly to global warming.
   (d) Nitrous oxide contributes significantly to stratospheric ozone depletion.
   (e) The infrared absorption characteristic of N₂O corresponds to the change in charge of the N–N triple bond.

7. Appropriate statements concerning the carbon dioxide equivalent (CO₂e) include:
   (a) The CO₂e allows expression of all environmental effects on a single scale.
   (b) For a particular greenhouse gas, it is the product of the mass released and radiative forcing.
(c). It is higher for a desflurane anaesthetic than for a sevoflurane anaesthetic.
(d). As the CO$_2$e for CO$_2$ is unity, greenhouse gases with a high CO$_2$e are likely to be implicated in climate change.
(e). It is used to monitor progress towards Britain’s climate change obligations.

8. Appropriate statements concerning the carbon dioxide equivalent (CO$_2$e) of inhalational anaesthesia include:

(a). Driving 12 km to work 5 days a week for 46 weeks of the year produces 883 kg of CO$_2$ if one’s car produces 160 g km$^{-1}$. This mass is more than the CO$_2$e resulting from the vaporization of ten 250-ml bottles of isoflurane.
(b). The CO$_2$e of fully vaporizing one 240-ml bottle of desflurane is approximately equivalent to the CO$_2$ from a year’s 12-km commute.
(c). To generate the electricity to run an 800-W anaesthetic of desflurane with nitrous oxide.
(d). The CO$_2$e of total intravenous anaesthesia is four times smaller than that of an inhalational anaesthetic of desflurane with nitrous oxide.
(e). The CO$_2$e of the manufacture and distribution of volatile agents is greater than that resulting from their liberation into the atmosphere.

**Pain management in day-case surgery**

9. A 35-year-old female presents to the day surgery unit for excision of a breast lump. She cannot take non-steroidal anti-inflammatory drugs because they exacerbate her asthma. In the past her experience with pain control after minor operations has been poor. She is very anxious. Appropriate statements regarding management of pain in this patient include:

(a). Provide the patient and her carer verbal as well as written information on perioperative pain management.
(b). Avoiding postoperative nausea and vomiting does not contribute to postoperative pain control.
(c). Ineffective pain management is one of the most common causes of unanticipated admission after day surgery.
(d). The pain management options in this case are limited to oral or intravenous doses of paracetamol and morphine or other opioids.
(e). Pre-emptive regional analgesia is superior to preventative regional analgesia in preventing chronic postsurgical pain in this case.

10. A 46-year-old man with an 18 pack-year history of smoking is to have stripping and ligation of varicose veins. He has no other known medical problems. Appropriate statements regarding analgesia and perioperative outcome after spinal anaesthesia include:

(a). Compared with general anaesthesia, this patient’s analgesic satisfaction is likely to be superior.
(b). In the postoperative period, regular oral analgesics are likely to be started before the neuraxial block wears off.
(c). Compared with general anaesthesia, there is likely to be reduced perioperative mortality.
(d). Compared with general anaesthesia, there is likely to be less PONV.
(e). Addition of 10 μg of fentanyl to the spinal anaesthetic is likely to reduce block failure but unlikely to contribute to postoperative analgesia.

11. A 48-year-old man is on the day surgery list for arthroscopic subacromial decompression of his right shoulder. He had a brachial plexus block 2 years ago for an operation on his left shoulder. Appropriate statements regarding interscalene block and other local anaesthetic techniques in this case include the following:

(a). The patient should not be discharged home with loss of sensation over the deltoid muscle area and inability to abduct the shoulder.
(b). Perineural administration of dexamethasone 4 mg with long-acting local anaesthetic is likely to prolong the duration of brachial plexus block.
(c). Postoperative analgesia with continuous peripheral nerve block (CPNB) of the brachial plexus is likely to be superior to that with oral or intravenous morphine.
(d). Suprascapular nerve block alone is likely to be a suitable alternative to interscalene block for perioperative analgesia.
(e). CPNB is not performed routinely owing to commonly associated major complications, such as nerve damage and local anaesthetic toxicity.

12. A 69-year-old male patient is due to have an inguinal hernia repair. He is independent and lives with his wife, but is worried about whether the postoperative pain would limit him from going home on the day of the surgery. He has long-standing neck pain. Appropriate statements regarding pain management and outcome in this patient include:

(a). You can reassure him that his analgesic requirements will be reduced because pain perception decreases with age.
(b). He needs to be encouraged to report postoperative pain.
Multiple Choice Questions

(c). He is likely to be given appropriate oral pain medications, which are to be taken regularly after the operation.
(d). Compared with general anaesthesia, neuroaxial and local anaesthesia is likely to provide better postoperative pain control.
(e). Compared with a young adult, this patient is more likely to have chronic postsurgical pain after hernia repair.

Iatrogenic airway injury

13. A 37-year-old man weighing 95 kg and 190 cm tall is scheduled for incision and drainage of a perianal abscess. After induction of general anaesthesia, a size 5 Laryngeal Mask Airway (LMA) is placed in the appropriate position and 40 ml of air is administered to inflate the cuff. Appropriate statements regarding issues related to injury of the airway include:

(a). Compared with a size 3 LMA, a size 5 LMA is likely to be associated with a higher risk of nerve injury in this patient.
(b). Compared with patients who have had tracheal intubation, this patient is more likely to complain of a sore throat after surgery.
(c). The intra-cuff pressure of this LMA is likely to be similar to that measured in patients whose airway is managed by tracheal intubation.
(d). Injury to the lingual nerve by the LMA is likely to be caused by the compressive effect of the cuff rather than that of the tube.
(e). Overinflation and excessive contact pressure are likely to be prevented by cuff inflation to the maximum volume of air recommended by the manufacturer.

14. A 45-year-old woman presents to her general practitioner with a history of progressive shortness of breath. Her medical history reveals a 2-week period of intubation on intensive care for pneumonia 1 year ago. She has been unsuccessfully treated with inhalers for asthma and so the general practitioner decides to investigate her respiratory function further. The flow-volume loop obtained by spirometry is displayed below. Appropriate statements regarding this situation include:

(a). This pattern is likely to be caused by obstruction of small airways.
(b). The obstructing lesion is likely to be intrathoracic.
(c). Postintubation tracheal stenosis is unlikely if her trachea was intubated with a tracheal tube with a high-volume, low-pressure cuff.
(d). Her tracheal lumen is likely to be more than 75% stenosed.
(e). Duration of intubation is a significant factor in the development of postintubation tracheal stenosis.

15. Two days after open reduction and internal fixation in the region of the right ankle, you are asked to review a 45-year-old man who is short of breath. A review of the anaesthetic chart shows that tracheal intubation was unexpectedly difficult and a bougie was used to aid passing of the tracheal tube. Features that are likely to suggest oesophageal perforation include:

(a). Neck or chest pain.
(b). Subcutaneous emphysema.
(c). Drooling saliva.
(d). A temperature of 38.6°C.
(e). A heart rate of 110 beats min⁻¹.

16. You are asked to review a 55-year-old female patient who has a hoarse voice. Two days ago she had a laparoscopically assisted hysterectomy under general anaesthesia. Her airway was managed by tracheal intubation using a size 8.0 cuffed tube. An ear, nose and throat surgeon is on the ward reviewing her and together you perform a nasendoscopy. The view of her glottis is displayed. Appropriate statements regarding this scenario include:
(a). The patient’s right vocal cord is in an abnormal position.
(b). This appearance is likely to be attributable to a right recurrent laryngeal nerve palsy.
(c). This injury is more likely to occur in women than in men.
(d). If the hoarseness presents 2 days later, it is unlikely to be a complication of anaesthesia.
(e). This lesion is likely to be attributable to overinflation of the tracheal tube cuff.

Major obstetric haemorrhage

17. Appropriate statements regarding major obstetric haemorrhage (MOH) in the UK include:

(a). The incidence is one in 3000 deliveries.
(b). Mortality is approximately 25% of avoidable maternal deaths.
(c). Most postpartum cases of MOH are caused by coagulopathy.
(d). MOH is more common in the obese compared with patients of normal body mass index.
(e). Delivery of a small baby weighing <2 kg is a risk factor for postpartum haemorrhage.

18. Ergometrine:

(a). Causes uterine but not systemic smooth muscle contraction.
(b). Is an ergot alkaloid.
(c). Should be avoided in hypertension.
(d). Should be avoided in asthma.
(e). Is licensed for direct injection into the myometrium.

19. Appropriate statements regarding maternal physiology in comparison with the non-pregnant state include:

(a). There is an increase in cardiac output of 10–15% at term.
(b). Stroke volume increases, in contrast to heart rate, which decreases in compensation.

(c). Uterine blood flow is likely to increase to 700 ml min–1 at term.
(d). Red cell mass decreases by 20% at term.
(e). The level of fibrinogen increases in pregnancy.

20. Appropriate statements regarding cell salvage and activated factor VIIa in obstetric practice include:

(a). Cell salvage is recommended when the volume of blood loss is expected to exceed 1500 ml.
(b). Cell salvage is likely to be used only in obstetric patients refusing autologous transfusion.
(c). Episodes of hypertension are likely to be observed during administration of blood obtained by cell salvage.
(d). To be effective, factor VIIa requires the platelet count to be at least 100 × 10^9 litre–1.
(e). To be effective, factor VIIa requires a fibrinogen concentration of at least 1 g litre–1.

Anaesthesia for neonatal emergency laparotomy

21. Appropriate statements regarding ventilation for neonatal laparotomy include:

(a). The capnograph is likely to provide a reliable reflection of alveolar partial pressure of carbon dioxide.
(b). Ventilation on high-frequency jet ventilation in the neonatal intensive care unit (NICU) is likely to be a contraindication to commencing the laparotomy.
(c). Continuous positive airway pressure (CPAP) in the NICU is likely to be continued on transfer to the theatre.
(d). Application of PEEP is likely to lead to a combined increase in oxygenation, oxygen delivery and cardiac output.
(e). Despite a haemoglobin saturation of 100%, retinopathy of the newborn is unlikely to occur.

22. You are asked to anaesthetize a 6-week-old neonate who requires a laparotomy for necrotizing enterocolitis. Because a stoma was formed 3 weeks ago, this event will constitute his second abdominal operation. The neonate was born after 30 weeks of gestation and weighs 1.2 kg. The preoperative haemoglobin concentration is 109 g litre–1. Appropriate statements regarding blood transfusion during laparotomy include:

(a). Weighing swabs is likely to indicate the need to commence blood transfusion.
(b). Blood loss of 20 ml is likely to be an accurate transfusion trigger.
(c). The case is likely to be commenced with packed red cells that are cross-matched but not necessarily in the vicinity of the anaesthetic room.

(d). The anaesthetist should transfuse packed cells so that the volume of packed cells is approximately equal to the volume of blood loss.

(e). The Hemocue is the safest method of deciding whether transfusion should commence.

23. Appropriate statements regarding induction of general anaesthesia for laparotomy in a neonate include:

(a). Induction of general anaesthesia is likely to occur by the classic rapid sequence method.

(b). Neonates are likely to be intolerant to sevoflurane above 3%.

(c). There is likely to be no preference between inhalational and intravenous induction.

(d). To avoid transfer from anaesthetic room to theatre, induction of general anaesthesia in most neonates is likely to be done inside the theatre.

(e). Thiopental is likely to be avoided, even at low doses.

24. Factors associated with an increased risk of postoperative apnoea in neonates include:

(a). Gestational age.

(b). History of apnoeas.

(c). Haematocrit of less than 30%.

(d). Postconception age.

(e). Ethnicity.

Paediatric vascular access

25. A 10-year-old boy with cystic fibrosis has frequent pulmonary exacerbations. He is short of breath and has been prescribed intravenous antibiotics for 2 weeks. Given his presentation and history of difficult venous access, various intravenous approaches are considered. Statements relating to venous access devices include:

(a). A peripheral cannula is likely to be appropriate.

(b). A peripherally inserted central catheter is likely to be appropriate.

(c). An implantable vascular access device (port) is likely to be appropriate.

(d). A short-term central venous catheter is likely to be appropriate.

(e). If an implantable vascular device (port) is to be inserted, it would not be usable until the port pocket insertion site had healed.

26. Appropriate statements regarding the presentation of a 3-year-old child with meningococcal meningitis and septic shock include:

(a). If peripheral cannulation cannot be achieved after approximately 5 min, an intraosseous cannula should be inserted.

(b). It is acceptable to administer an infusion of adrenaline via an intraosseous cannula.

(c). The proximal tibia is the preferred site for intraosseous access.

(d). A 22 gauge (G) portless intravenous cannula (e.g. Jelco®) is suitable for arterial access.

(e). A size 5 French gauge (Fr) central line is suitable for central venous access.

27. Appropriate statements concerning peripheral cannulation in children include:

(a). Chlorhexidine gluconate 2% in isopropyl alcohol 70% should not be used in neonates.

(b). Transillumination is likely to be useful in infants but not in older children.

(c). For topical analgesia in an 8-month-old child receiving phenytoin, a eutectic mixture of local anaesthetics (EMLA) is likely to be used.

(d). After topical application with an occlusive dressing for 45 min, the duration of action of 4% tetracaine gel is likely to be 4 h.

(e). Breast-feeding is likely to reduce the distress associated with the procedure.

28. Implantable vascular access devices (ports) in children are:

(a). Central venous catheters.

(b). Likely to be inserted under local anaesthesia.

(c). Likely to be accessed with a sterile hypodermic needle.

(d). Likely to allow drug administration without pain.

(e). Likely to be inserted into the inferior vena cava using a transhepatic approach when there is central venous stenosis or occlusion.

Pain in complex trauma: lessons from Afghanistan

29. Appropriate statements regarding the ‘reverse pain ladder’ include:

(a). The 0–10 scale is the preferred pain scoring system in military casualties.

(b). In lieu of codeine 30–60 mg every 4–6 h, immediate-release oral morphine 2.5–10 mg every 4 h is a valid option for ‘step 2’ pain.
(c). Ketamine infusions at 0.1–0.2 mg kg\(^{-1}\) h\(^{-1}\) are likely to be associated with an acceptably low incidence of psychotropic side-effects.

(d). To ensure that minimal doses are prescribed on discharge from hospital, sustained-release opioids such as morphine modified release and oxycodone modified release are likely to be reviewed.

(e). To limit the growth of heterotrophic ossification after blast injury with major limb trauma, analgesics such as celecoxib 200 mg daily should be prescribed if possible.

30. A 25-year-old man has sustained bilateral amputations below his knees, abdominal haemorrhage requiring laparotomy and an upper-limb crush injury in a motor vehicle accident. Appropriate statements regarding the use of regional analgesia include:

(a). When combining peripheral and central infusions of ropivacaine 0.2%, a maximum of two infusions of up to 10 ml h\(^{-1}\) each is likely to be used at any one time to minimize the risk of local anaesthetic toxicity.

(b). Peripheral nerve catheters should be removed after 5 days owing to the risk of infection.

(c). Massive blood transfusion is likely to be an absolute contraindication to epidural analgesia.

(d). Peripheral nerve catheters are best inserted under ultrasound control.

(e). An upper limb regional nerve catheter is likely to be avoided as the patient is at risk of compartment syndrome.

31. A 30-year-old man sustains a traumatic amputation below his right knee in a motorcycle accident. Three days after the injury, he presents with features below his right knee in a motorcycle accident. Three days after this injury she presents for surgery to excise extensive heterotrophic ossification from her right stump and a neuroma from her left distal femur. Appropriate statements regarding effective perioperative analgesic management include:

(a). A lumbar epidural is likely to be useful.

(b). An increase in her pregabalin dose to 300 mg twice daily is likely to be useful.

(c). Bilateral surgery is not advisable and should be discussed with both the surgeon and the patient.

(d). Non-steroidal anti-inflammatory drugs (NSAIDs) should be avoided during the perioperative phase.

(e). As she is already taking oxycodone, tramadol 50–100 mg every 6 h is likely to be avoided.

**Perioperative acute kidney injury**

33. A 70-year-old man who weighs 80 kg undergoes open repair of an infrarenal aortic aneurysm. His preoperative creatinine is 130 µmol litre\(^{-1}\). Surgery is complicated by significant blood loss and 5 units of red cells are transfused in the intraoperative period. By the third postoperative day, his creatinine has risen to 265 µmol litre\(^{-1}\) and his urine output has been no greater than 22 ml h\(^{-1}\) over last the 24 h. Appropriate statements regarding this scenario include:

(a). The presence of pre-existing chronic kidney disease (CKD) is associated with an increased risk of perioperative acute kidney injury (AKI).

(b). Compared with females, this man is not at increased risk of AKI.

(c). Transfusion of red cells is associated with an increased risk of AKI.

(d). His risk of AKI is likely to be attenuated if endovascular repair rather than open surgery had been undertaken.

(e). According to the standard consensus definition, the patient has developed AKI stage 2 by the third postoperative day.

34. You are asked to assess a 65-year-old lady with a history of rheumatoid arthritis, hypertension and ischaemic heart disease. She has been unwell for a week with shingles and has been admitted after a fall. Unfortunately, there is a fracture in the neck of her right femur which requires hemi-arthroplasty. Her regular medication includes etoricoxib, prednisolone, prednisolone, diltiazem and bisoprolol. In addition, she has been started on intravenous aciclovir. Since admission, serum creatinine has risen from 45 to 90 µmol litre\(^{-1}\). Her heart rate has been maintained at around
85 beats min⁻¹ and her blood pressure is 140/75 mm Hg. Medications that are likely to have contributed by direct nephrotoxicity to her current acute kidney injury (AKI) include:

(a). Etoricoxib.
(b). Prednisolone.
(c). Diltiazem.
(d). Aciclovir.
(e). Bisoprolol.

35. A 68-year-old man with diabetes, hypertension and stage 3 chronic kidney disease presents for a right hemicolectomy. Preoperative cardiopulmonary exercise testing reveals an anaerobic threshold of 10 ml min⁻¹ kg⁻¹. Perioperative goal-directed haemodynamic therapy (GDT) is employed and appropriate statements regarding its use include:

(a). Acute kidney injury is likely to be reduced significantly by GDT.
(b). Compared with conventional fluid management in the intraoperative period, significantly more fluid is likely to be infused during GDT.
(c). GDT is best carried out with gelatin colloids rather than crystalloids.
(d). GDT should be carried out using fluids and inotropes to target supranormal values of oxygen tissue delivery [oxygen delivery index (DO2I) >600 ml min⁻¹ m⁻²] throughout critical illness.
(e). GDT would be beneficial for this patient irrespective of the type of surgery performed.

36. A 60-year-old man with a past medical history of congestive cardiac failure is admitted to the high-dependency unit after emergency embolectomy for an acutely ischaemic lower limb. His serum creatinine rises from 110 to 190 µmol litre⁻¹ in the first 24 h. Appropriate indications for using loop diuretics in the postoperative period are likely to be:

(a). Oliguria if he is euvolaemic.
(b). Oliguria if he is hypervolaemic.
(c). The presence of rhabdomyolysis after fasciotomy for compartment syndrome.
(d). Treatment of the increase in serum creatinine.
(e). Treatment of hyperkalaemia of 7.5 mmol litre⁻¹ in the context of anuria.