**Multiple Choice Questions**

**Adult epilepsy and anaesthesia**

1. The husband of a 62-year-old woman presenting to the emergency department reports that she lost consciousness for 1 min. During this time, there was rapid rhythmic jerking of all four limbs as she fell to the ground and was incontinent of urine. The patient is now orientated but complains of feeling tired. She cannot recall anything about the episode, but states that she has had intermittent twitching of her right hand over the last month. Appropriate statements regarding this case include:

   (a) The patient is likely to have had a secondary generalized tonic-clonic seizure.
   (b) Out-patient neuroimaging should be arranged if there are normal findings with regard to neurological examination, vital observations, ECG, serum biochemistry and glucose.
   (c) Antiepileptic drug therapy is likely to be started.
   (d) An EEG showing spike-and-wave discharges confined to the left frontal region supports a diagnosis of epilepsy.
   (e) The patient is likely to be able to return to driving a motor vehicle 6 months after this event.

2. A 50-year-old man attends the preoperative assessment clinic before undergoing an elective inguinal hernia repair. He was diagnosed with epilepsy at age 10 years and takes sodium valproate 1.5 g once daily. Despite good medication compliance, he states that he has had five generalized tonic-clonic seizures in the past 6 months. Appropriate statements regarding medication and this patient’s epilepsy include:

   (a) Preoperative investigations should include liver function tests and measurement of plasma valproate levels.
   (b) Postoperative use of ibuprofen is likely to lead to an increase in plasma valproate concentration.
   (c) In the UK, guidelines recommend levetiracetam as an alternative first-line drug therapy for generalized tonic-clonic seizures.
   (d) Levetiracetam is an inhibitor of γ-amino butyric acid (GABA) transaminase.
   (e) Implantation of a vagal nerve stimulator could cure this patient’s epilepsy.

3. A 51-year-old woman is scheduled to undergo total abdominal hysterectomy. At the age of 27 years she presented with left-sided facial twitching and was diagnosed with focal epilepsy. After detecting a right frontoparietal arteriovenous malformation on computed tomography (CT) of the brain, a curative surgical resection was performed. Since that time she has continued to have left-sided face and arm focal motor seizures twice weekly as a result of cerebral scarring. However, there has been no focal seizure for the last 6 months. Furthermore, there has been no history of generalized seizures. Her neurologist has advised lifelong antiepileptic drug therapy, which entails controlled-release carbamazepine 200 mg twice daily. Appropriate statements regarding the periooperative management of this patient’s epilepsy include:

   (a) Preoperative carbamazepine concentration is unlikely to be measured.
   (b) For induction of general anaesthesia, etomidate rather than propofol is likely to be administered.
   (c) For immediate intraoperative analgesia, alfentanil would be preferable to fentanyl.
   (d) If the patient has much nausea after surgery, carbamazepine is likely to be administered i.v.
   (e) If the patient is allergic to morphine for postoperative analgesia, i.v. tramadol is likely to be administered.

4. A 23-year-old man who weighs 80 kg is brought in to the emergency department. He does not respond to questions, but he opens his eyes, groans and flexes his limbs in response to supraorbital pressure. Other clinical findings of note are a sinus tachycardia of 105 beats min⁻¹ and a core temperature of 38.1°C. Two minutes later, he has a generalized tonic-clonic seizure. His partner states that he has had eight seizures over the preceding 30 min and has been drowsy between them. The patient is known to have idiopathic epilepsy and is prescribed modified release lamotrigine 300 mg once daily, but frequently misses doses. Appropriate statements regarding emergency management of this patient include:

   (a) This patient is likely to be diagnosed with convulsive status epilepticus (CSE).
   (b) The underlying aetiology of the seizures is likely to be infective.
   (c) Intravenous phenytoin at a dose of 1.2 g is an appropriate treatment option in this situation.
   (d) If phenytoin is administered i.v., it should be administered via a central venous line.
   (e) If seizure control is not achieved with benzodiazepines or phenytoin, ketamine is the appropriate next treatment.
A neonate born at 30 weeks of gestation is now at 44 weeks after conception. To repair a small diaphragmatic hernia that was detected antenatally, he is now scheduled for a laparotomy. Despite this defect, the baby’s lungs appear to have developed normally and there is no evidence of pulmonary hypertension. The parents are querying whether the surgery is needed at this time as they have read in the press that general anaesthetics in early life could affect their child’s brain development. In this case, agents that are likely to increase the risk of apoptosis in the developing brain include:

(a) Sevoflurane.
(b) Clonidine.
(c) Propofol.
(d) Levobupivacaine.
(e) Remifentanil.

After being born at 28 weeks of gestation and requiring 12 weeks of neonatal high-dependency care, a neonate weighing 2 kg is scheduled for a right inguinal herniotomy before discharge. After discussion with the parents and surgeon, it is agreed that a regional anaesthetic technique will be optimal for this baby. Plain levobupivacaine at concentration 5 mg ml⁻¹, dose 1 mg kg⁻¹ and volume 0.4 ml is administered into the spinal space. Oral sucrose and i.v. paracetamol 7.5 mg kg⁻¹ are also given but no sedative or general anaesthetic supplements are needed. The procedure takes a total of 40 min. After surgery, the baby is fed immediately and receives two further doses of oral paracetamol before being discharged home the next morning. Perioperative apnoea monitoring revealed no significant apnoeic spells. In neonates, awake regional anaesthesia is associated with:

(a) More hypotension than general anaesthesia.
(b) Less apnoea in the first 12 postoperative hours than general anaesthesia.
(c) Failure to establish an effective block for surgery in up to one in five cases.
(d) Less apnoea in the second 12 postoperative hours than general anaesthesia.
(e) Increased spinal cord apoptosis.

A 6-week-old baby born at term and now weighing 4 kg is diagnosed with pyloric stenosis. There is projectile vomiting and a pyloric tumour is visible on ultrasound. He has to undergo a pyloromyotomy under general anaesthesia. Hypochloraemic, hypokalaemic alkalosis noted on admission has been corrected gradually over 48 h and the surgeon is keen to operate. The anaesthetist has been asked by the parents about the potential adverse effects of a single episode of general anaesthesia and pain management on their child’s future development and behaviour. In this child, general anaesthesia lasting an hour is likely to be associated with:

(a) Autism.
(b) No significant effects on secondary school educational attainment.
(c) Protection from the adverse effects of surgery.
(d) Significant apnoeic episodes in the first 24 h after operation in 50% of cases.
(e) No significant increase in attention deficit hyperactivity disorder.

A 26-week gestation baby is delivered precipitously by emergency Caesarean section under general anaesthesia because of fetal distress caused by a placental abruption. This event happens in a centre undertaking research on cerebral protection after birth injury using induced localized hypothermia, which has proved effective in reducing cerebral injuries by 35%. The research group is working to improve their results by using xenon. From what is known up to the year 2014, xenon is likely to:

(a) Protect the developing brain from increased apoptosis induced by isoflurane.
(b) Increase neurodevelopmental damage after birth asphyxia.
(c) Be delivered to neonates by a closed circuit system.
(d) Be too costly to consider in the UK.
(e) Act as an anaesthetic agent.

Perioperative management for patients with a chronic spinal cord injury

A 35-year-old man is scheduled for cystoscopy. Six years ago he had a complete spinal cord injury at the second thoracic (T2) level. He has an indwelling urinary catheter and describes episodes of autonomic dysreflexia. Appropriate statements regarding autonomic dysreflexia include:

(a) During autonomic dysreflexia, hypotension and tachycardia are likely to be observed.
(b) Treatment of autonomic dysreflexia includes placing the patient in the Trendelenburg position.
(c) Given the level of the injury, the incidence of autonomic dysreflexia is likely to be high.
(d) Bladder distension is more likely to be a triggering factor than other stimuli, such as urinary tract infection and bowel distension.
(e) Sublingual glyceryl trinitrate is likely to be effective.

A 58-year-old gentleman is scheduled for debridement of his sacral pressure sore. Thirty years ago he had a car...
accident leading to complete spinal cord injury at the fifth cervical level (C5). His history includes hypertension, type 2 diabetes mellitus and autonomic dysreflexia. On examination, you note that he has a permanent tracheostomy. His preoperative investigations are:

- haemoglobin 108 g litre$^{-1}$;
- white cell count 14.2 \times 10^9 litre$^{-1}$;
- platelets 212 \times 10^9 litre$^{-1}$; urea 7 mmol litre$^{-1}$;
- creatinine 80 µmol litre$^{-1}$;
- potassium 3.8 mmol litre$^{-1}$;
- sodium 136 mmol litre$^{-1}$;
- ECG shows sinus rhythm, left axis deviation and left ventricular hypertrophy;
- forced vital capacity (FVC) 3.3 litres;
- predicted FVC 4.15 litres;
- forced expiratory volume in 1 s (FEV$_1$) 2.7 litres;
- predicted FEV$_1$ 3.27 litres;
- FEV$_1$/FVC ratio 0.82;
- total lung capacity (TLC) 3.9 litres;
- predicted TLC 5.8 litres;
- diffusing capacity of carbon monoxide (DL$_{CO}$) 20 ml min$^{-1}$ mm Hg$^{-1}$;
- predicted DL$_{CO}$ 17–22 ml min$^{-1}$ mm Hg$^{-1}$.

Appropriate statements regarding this case include:

(a) There is an obstructive ventilatory deficit.
(b) This patient should be recovered in the supine position.
(c) His tracheostomy tube is likely to be changed at induction of general anaesthesia.
(d) Since the operative site is well below the level of the spinal injury, an anaesthetist is unlikely to be required.
(e) Invasive arterial blood pressure monitoring is likely to be a routine requirement.

3. A patient with a spinal cord injury at the seventh cervical level (C7) has pressure sores and is scheduled for second-stage skin grafting. Whilst playing rugby 3 years ago, he had emergency spinal surgery involving decompression and cervical fixation. On intensive care, weaning from mechanical ventilation via a surgical tracheostomy was prolonged. Since that time, his voice has remained hoarse and occasionally noisy when lying supine. Currently, there is spasticity and painful muscle spasms, for which he takes benzodiazepines and opioids. He experiences autonomic dysreflexia, which seems to be triggered by the spasms. During your preoperative discussion with him, he maintains that under no circumstances does he want to stay awake during the operation. Given his autonomic dysreflexia and his preference, you conclude that your anaesthetic approach is a combination of spinal and general anaesthesia. Appropriate statements regarding this situation include:

(a) A magnetic resonance imaging (MRI) scan of the neck is likely to be requested and assessed before general anaesthesia.
(b) Despite the patient’s preference to be asleep during surgery, awake fibre-optic intubation should be considered.
(c) If an i.v. agent is used to induce general anaesthesia, the dose should be based on ideal body weight.
(d) On emergence, the patient’s tidal volume is around 100 ml and his respiratory rate is 18 bpm. The most appropriate course of action is to continue general anaesthesia and positive pressure ventilation.
(e) If there is a low tidal volume and a high respiratory rate before extubation, the patient is likely to receive naloxone to reverse the effect of opioids.

4. A pregnant lady of BMI 41 kg m$^{-2}$ is seen in the anaesthetic clinic for discussion of labour and delivery. Ten years ago she sustained a spinal cord injury at the fifth thoracic (T5) level and required spinal fixation. Appropriate statements regarding her future anaesthetic care include:

1. An epidural is likely to be contraindicated.
2. As her uterus will be insensate, she is unlikely to require regional anaesthesia during labour.
3. If a rapid sequence induction is required, then rocuronium rather than succinylcholine is likely to be used.
4. She should be told that nasal congestion, piloerection and chills may be the initial features of the onset of labour.
5. Blood loss during Caesarean section is likely to cause a greater degree of anaemia than in a normal pregnant patient.

Humidification in anaesthesia and critical care

1. Appropriate statements regarding humidity include:

(a) Absolute humidity is defined as the mass of water vapour that a volume of gas contains at its critical temperature.
(b) Relative humidity is the ratio of the water vapour pressure to the saturated water vapour pressure expressed as a percentage.
(c) As the temperature in a closed system increases, the relative humidity will increase.
(d) Fully saturated air at room temperature (20°C) contains 25 g m$^{-3}$ of water.
(e) Fully saturated air at body temperature (37°C) contains 44 g m$^{-3}$ of water.
2. An infant is admitted to the paediatric intensive care unit directly from the accident and emergency department. Unfortunately, no method of humidification had been used after tracheal intubation and ventilation of the lungs. Appropriate statements regarding this situation include:

(a) If a heat and moisture exchanger was used in the first instance, there would be a risk of increasing the arterial partial pressure of carbon dioxide.
(b) The isothermic saturation boundary (ISB) within the airway is likely to be located just proximal to the carina.
(c) Over a 24-h period at rest, water lost from the respiratory tract accounts for 40% of insensible losses in infants.
(d) Mucosal damage begins to occur within 1 h of starting to deliver dry gas in mechanically ventilated patients.
(e) During mechanical ventilation, the risk of respiratory infection is likely to be reduced by supraphysiological levels of humidification.

3. Appropriate statements regarding heat and moisture exchangers (HMEs) include:

(a) The hygroscopic membrane is an integral feature of all HMEs.
(b) HMEs are likely to be used in a paediatric patients whose lungs are ventilated with a protective strategy.
(c) HMEs are likely to take 20 min to reach full efficiency.
(d) When HMEs are used, absolute humidity will rarely reach beyond 30 mg litre\(^{-1}\).
(e) In patients admitted to the intensive care unit after cardiac arrest outside the hospital, HMEs are likely to be used during mechanical ventilation.

4. Appropriate statements regarding humidification include:

(a) Passive humidification rather than active humidification within the breathing system is likely to be associated with ventilator-associated pneumonia (VAP).
(b) Conditions in the heated humidification chamber are tightly controlled to prevent fresh gas flow from becoming fully saturated.
(c) The heating wire in the inspiratory limb of the circuit allows the inspiratory gases to be warmed as they travel through it, thereby increasing the relative humidity.
(d) During nebulization, small droplets enable more efficacious humidification than large droplets.
(e) There is strong evidence of improved clinical outcome when humidification is used during non-invasive ventilation (NIV).

Local anaesthetic systemic toxicity

1. A 33-year-old man has a right axillary nerve block for hand surgery. He weighs 60 kg and is in the category I of the American Society of Anesthesiologists classification. Three minutes after administration of levobupivacaine 0.5% 20 ml he has a cardiac arrest. Clinical features that are likely to support a diagnosis of local anaesthetic systemic toxicity (LAST) include:

(a) Seizures.
(b) Cardiac arrest without clear preceding symptoms or signs.
(c) Disturbed colour vision.
(d) Torsades de pointes.
(e) Dry mouth.

2. You are about to perform a femoral nerve block for an 85-year-old man who weighs 50 kg. He has a left ventricular ejection fraction of 35% and renal failure that requires peritoneal dialysis. You recognize that this patient has several risk factors for local anaesthetic systemic toxicity (LAST). Appropriate statements regarding management of this case include:

(a) Compared with a young adult, dose reduction is required because there is an increase in the sensitivity of the nerve to the action of local anaesthetics.
(b) If ropivacaine rather than bupivacaine is administered, the risk of LAST is likely to be reduced.
(c) If there is poor perfusion to the site of injection, there is likely to be a decrease in the peak plasma concentrations of free local anaesthetic.
(d) Aspiration of the syringe plunger before injection of the local anaesthetic is likely to both reduce and prevent toxicity.
(e) Compared with patients with normal renal function, this patient is likely to have lower \(\alpha_2\)-acid glycoprotein (AAG) and a smaller risk of LAST.

3. You are asked to go urgently to the labour ward, where you find a 32-year-old female in cardiac arrest. On examination, you note that her epidural bag of local anaesthetic is connected to her i.v. line. You immediately stop the infusion and discard the bag of local anaesthetic. You suspect that her cardiac arrest may be related to LAST and hence you administer i.v. lipid emulsion. In addition, members of the team are likely to:
(a) Avoid adrenaline since i.v. lipid emulsion has been given.
(b) Submit an incident report.
(c) Administer an initial bolus of i.v. lipid emulsion of 1.5 ml kg⁻¹.
(d) Request an abdominal computed tomography (CT) scan rather than serum amylase and lipase, if they suspect that the patient has pancreatitis.
(e) Have glucose concentrations measured by the colorimetric method rather than by potentiometry.

4. Owing to being involved in a critical incident involving LAST, you decide to present information about i.v. lipid emulsion at your next clinical governance meeting. Appropriate statements that you are likely to make include:

(a) Of the i.v. lipid emulsions available for treating seizures related to local anaesthetic systemic toxicity, Intralipid® is the most effective in inducing seizure termination.
(b) Lipid emulsion therapy was first discovered to be a potential therapy for local anaesthetic systemic toxicity in 1998, after Weinberg et al. demonstrated that it could resuscitate rats from a local anaesthetic overdose.
(c) The ‘lipid sink’ theory explains fully why lipid emulsion therapy is an effective treatment for local anaesthetic toxicity.
(d) Since the year 2014, randomized controlled trials have shown that lipid emulsion therapy is effective in humans.
(e) In July and August 2006, the first two case reports describing the role of i.v. lipid emulsion in local anaesthetic-induced cardiac arrest in humans were published.

Smoke inhalation injury

1. A 62-year-old man arrives at the emergency department in an ambulance with its blue light on. He had fallen asleep whilst smoking in bed. On arrival he is disorientated and uncooperative. Your examination shows that he is heavily stained with soot and has torso and facial burns occupying 20 and 2% of their surface area, respectively. Initial arterial blood gas analysis reveals a carboxyhaemoglobin (COHb) of 20%. Whilst breathing 4 litres min⁻¹ oxygen via a Hudson mask, his pulse oximetry reading is 98%. Appropriate statements regarding this scenario include:

(a) A diagnosis of smoke inhalation injury is likely to increase the probability of mortality after the burn.
(b) The history is suggestive of a thermal burn below the glottis.
(c) Administration of high-flow oxygen at 15 litres min⁻¹ through a non-rebreathing mask is a priority.
(d) Respiratory casts are likely to be formed.
(e) Prophylactic antibiotics are likely to be given after bronchoscopy confirms a diagnosis of smoke inhalation.

2. An 8-year-old girl weighing 25 kg has been brought into the paediatric emergency department. She has sustained a flash burn after lighter fuel was sprayed by her father onto the coal on the barbecue cart. The incident occurred 30 min ago. On examination, there are burns affecting 4% of the surface areas of her cheeks, jaw and lips. Her respiratory rate is 24 bpm and the pulse oximetry reading on room air is 100%. Analysis of her arterial gas reveals:
   - oxygen partial pressure 13.0 kPa;
   - carbon dioxide partial pressure 4.5 kPa;
   - pH 7.4;
   - lactate 0.6 mmol litre⁻¹;
   - carboxyhaemoglobin 2%.

Appropriate statements regarding the care of this patient include:

(a) This girl is likely to be intubated as soon as possible.
(b) If intubation is required, then a size 6.5 oral tracheal tube cut to 17 cm is likely to be optimal.
(c) Opioid analgesia is likely to be avoided for pain management in the emergency department.
(d) If her voice is hoarse at presentation, intubation should be performed.
(e) Succinylcholine is likely to be avoided for muscle relaxation during intubation in the emergency department.

3. Two hours after pouring petrol over his head and setting himself on fire in his kitchen, a 21-year-old man of 80 kg is presented to the emergency department. The flame burn of full thickness occupies 75% of his body surface area but spares his lower legs. His trachea is intubated and his lungs are ventilated with an inspired oxygen of 100%. Using the Parkland formula, i.v. fluid is administered. Other observations 1 h after arrival include:

- urine output 20 ml h⁻¹;
- arterial blood pH 7.21;
- lactate 5.2 mmol litre⁻¹;
- carboxyhaemoglobin (COHb) 2%.

During the delay of 4 h before transfer to the regional burn centre, mechanical ventilation of his lungs deteriorates, with decreasing tidal volumes. Appropriate statements regarding the management of this patient include:
Multiple Choice Questions

(a) In view of the possible inhalation injury, administration of fluid using the Parkland formula should be reduced.
(b) Before transfer, escharotomy of the chest should be discussed with the burn centre.
(c) A diagnosis of carbon monoxide poisoning is likely to be excluded.
(d) Bronchoscopy is likely to be beneficial.
(e) Owing to the high probability of death, transfer to a burn centre is not likely to be needed and should be cancelled.

4. A 50-year-old patient weighing 65 kg arrives at the burns centre. He has been the victim of a house fire involving one fatality at the scene. He had been using a chip pan after a night drinking alcohol at the pub. On examination, there is a burn occupying 12% of his body surface area, and involving 5% of his face. He was unconscious and intubated at the scene of the incident. There are regular ventricular ectopics on his ECG and his blood pressure is 90/50 mm Hg. Pulse oximetry shows an oxygen saturation of 100%. His carboxyhaemoglobin (COHb) is 22% and the arterial blood gas lactate concentration is 12 mmol litre$^{-1}$. Appropriate statements regarding this situation include:

(a) Cyanide toxicity is unlikely to be present.
(b) A cyanide antidote should be given immediately after blood cyanide levels are taken.
(c) Sodium nitrite 300 mg by slow i.v. injection is likely to be the first-line antidote.
(d) You observe that the QRS interval becomes prolonged on his ECG and that his next arterial blood gas results are: pH 7.12, lactate 14 mmol litre$^{-1}$ and bicarbonate 14 mmol litre$^{-1}$. Given this situation, you are likely to administer sodium bicarbonate 8.4%, 50 ml.
(e) Despite ongoing resuscitation with fluids and oxygen, his cardiovascular status deteriorates and he has a cardiac arrest. In addition to advanced life support, hydroxycobalamin 5 g should be given immediately.

Tracheostomy management

1. A 71-year-old man of BMI 40 kg m$^{-2}$ is scheduled to have radical surgery of the craniocervical junction for removal of a cervical tumour. The surgeons are planning an elective tracheostomy before surgery and seek your advice on the most appropriate tube type for his anatomically large neck. Appropriate statements regarding the tracheostomy tube include:

(a) The Moore tube would be suitable during surgery as it can fit a standard catheter mount.

(b) The long-term silver Negus tube may be beneficial to the patient on discharge from hospital as it is likely to have an in-built speaking valve.
(c) For management on the intensive care unit after operation, a single-lumen tube is likely to be safer than a double-cannula type.
(d) A Montgomery T tube acts as both an airway and a tracheal stent.
(e) Adjustable flange tubes for use in patients with challenging neck anatomy are becoming increasingly popular and may prove to be the best choice for this patient.

2. You are asked to assess a 30-year-old woman who has had a cuffed tracheostomy tube for 1 month after a severe subarachnoid haemorrhage. The medical team is keen to deflate the cuff. Criteria that the patient must meet before deflation include:

(a) The patient is able to swallow food and drink with success.
(b) The patient is able to cough secretions out of the tracheostomy tube or into the mouth.
(c) The patient has been assessed as having a reasonable swallowing reflex and is not drooling saliva.
(d) The modified Evans blue test shows that dye introduced orally is not suctioned from the tracheostomy tube.
(e) There is a patent upper airway, above the level of the tracheostomy.

3. As the lead doctor for anaesthesia and critical care, you are updating your department’s guidance for tracheostomies. Situations that support the placement of a tracheostomy are likely to include:

(a) Mechanical ventilation exceeding several days.
(b) Drooling of secretions and tolerance of the tracheal tube with little or no irritation.
(c) A patient with obstructive sleep apnoea who has failed non-invasive night-time ventilatory support and continues to exhibit signs of severe obstructive apnoea.
(d) A patient presenting with stridor after trans-oral surgery
(e) After successful ventilation of the lungs using the bag–valve–mask method, there is failure to pass a supraglottic airway and failure to intubate the trachea.

4. You are called to the high-dependency ward to assess a 60-year-old man for decannulation of his tracheostomy tube. Criteria that suggest that decannulation is likely to be successful include:

Multiple Choice Questions

(a) In view of the possible inhalation injury, administration of fluid using the Parkland formula should be reduced.
(b) Before transfer, escharotomy of the chest should be discussed with the burn centre.
(c) A diagnosis of carbon monoxide poisoning is likely to be excluded.
(d) Bronchoscopy is likely to be beneficial.
(e) Owing to the high probability of death, transfer to a burn centre is not likely to be needed and should be cancelled.

4. A 50-year-old patient weighing 65 kg arrives at the burns centre. He has been the victim of a house fire involving one fatality at the scene. He had been using a chip pan after a night drinking alcohol at the pub. On examination, there is a burn occupying 12% of his body surface area, and involving 5% of his face. He was unconscious and intubated at the scene of the incident. There are regular ventricular ectopics on his ECG and his blood pressure is 90/50 mm Hg. Pulse oximetry shows an oxygen saturation of 100%. His carboxyhaemoglobin (COHb) is 22% and the arterial blood gas lactate concentration is 12 mmol litre$^{-1}$. Appropriate statements regarding this situation include:

(a) Cyanide toxicity is unlikely to be present.
(b) A cyanide antidote should be given immediately after blood cyanide levels are taken.
(c) Sodium nitrite 300 mg by slow i.v. injection is likely to be the first-line antidote.
(d) You observe that the QRS interval becomes prolonged on his ECG and that his next arterial blood gas results are: pH 7.12, lactate 14 mmol litre$^{-1}$ and bicarbonate 14 mmol litre$^{-1}$. Given this situation, you are likely to administer sodium bicarbonate 8.4%, 50 ml.
(e) Despite ongoing resuscitation with fluids and oxygen, his cardiovascular status deteriorates and he has a cardiac arrest. In addition to advanced life support, hydroxycobalamin 5 g should be given immediately.

Tracheostomy management

1. A 71-year-old man of BMI 40 kg m$^{-2}$ is scheduled to have radical surgery of the craniocervical junction for removal of a cervical tumour. The surgeons are planning an elective tracheostomy before surgery and seek your advice on the most appropriate tube type for his anatomically large neck. Appropriate statements regarding the tracheostomy tube include:

(a) The Moore tube would be suitable during surgery as it can fit a standard catheter mount.

(b) The long-term silver Negus tube may be beneficial to the patient on discharge from hospital as it is likely to have an in-built speaking valve.
(c) For management on the intensive care unit after operation, a single-lumen tube is likely to be safer than a double-cannula type.
(d) A Montgomery T tube acts as both an airway and a tracheal stent.
(e) Adjustable flange tubes for use in patients with challenging neck anatomy are becoming increasingly popular and may prove to be the best choice for this patient.

2. You are asked to assess a 30-year-old woman who has had a cuffed tracheostomy tube for 1 month after a severe subarachnoid haemorrhage. The medical team is keen to deflate the cuff. Criteria that the patient must meet before deflation include:

(a) The patient is able to swallow food and drink with success.
(b) The patient is able to cough secretions out of the tracheostomy tube or into the mouth.
(c) The patient has been assessed as having a reasonable swallowing reflex and is not drooling saliva.
(d) The modified Evans blue test shows that dye introduced orally is not suctioned from the tracheostomy tube.
(e) There is a patent upper airway, above the level of the tracheostomy.

3. As the lead doctor for anaesthesia and critical care, you are updating your department’s guidance for tracheostomies. Situations that support the placement of a tracheostomy are likely to include:

(a) Mechanical ventilation exceeding several days.
(b) Drooling of secretions and tolerance of the tracheal tube with little or no irritation.
(c) A patient with obstructive sleep apnoea who has failed non-invasive night-time ventilatory support and continues to exhibit signs of severe obstructive apnoea.
(d) A patient presenting with stridor after trans-oral surgery
(e) After successful ventilation of the lungs using the bag–valve–mask method, there is failure to pass a supraglottic airway and failure to intubate the trachea.

4. You are called to the high-dependency ward to assess a 60-year-old man for decannulation of his tracheostomy tube. Criteria that suggest that decannulation is likely to be successful include:
Multiple Choice Questions

(a) When the cuff is deflated the patient’s respiratory rate increases and he begins to use his abdominal muscles to breathe. However, desaturation does not occur immediately.

(b) The patient has been able to swallow his own saliva.

(c) After cuff deflation and application of a cap to the tracheostomy tube for an hour, it is noted that there is some increase in expiratory effort and an increase in respiratory rate from 15 to 22 bpm. Arterial carbon dioxide (PaCO₂) has increased from 4.8 to 6.2 KPa.

(d) A speech and language therapist performs a modified Evans blue dye test and does not aspirate any dye from the tracheostomy tube.

(e) The strength of the patient’s cough is sufficient for him to expectorate sputum into his mouth.

Ultrasound-guided central neuraxial blocks and peripheral nerve blocks in children

1. Appropriate statements regarding the physics of ultrasound include:

(a) Ultrasound waves travel in a longitudinal direction.

(b) Clinical ultrasound has a frequency range of 0.5–1.5 MHz.

(c) High resolution and deep tissue penetration are obtained by high-frequency ultrasound.

(d) In a 6-year-old child, a 2–5 MHz curvilinear probe is likely to be used for a transversus abdominis plane block.

(e) In the obese child, the maximum dose of local anaesthetic allowable is likely to be calculated on the basis of the measured body weight.

2. Appropriate statements regarding ultrasound-guided caudal injections in children include:

(a) Compared with that of an adult, the sacral canal in the 3-year-old child is likely to be better visualized during ultrasound imaging.

(b) The risk of dural puncture is likely to be eliminated by the use of ultrasound imaging.

(c) In infants, the dura ends at sacral level S3–S4.

(d) The caudal end of the dural sac is likely to reach adult level by the age of 6 years.

(e) A swirl-like ultrasound image during administration of saline by the caudal route provides confirmatory evidence of intravascular injection.

3. Appropriate statements regarding ultrasound-guided blocks for analgesia after abdominal surgery include:

(a) After subcostal incisions, posterior transversus abdominis plane blocks are useful for pain relief.

(b) The nerves in the transversus abdominis plane are located in the plane between the external oblique and transversus abdominis muscles.

(c) Transversus abdominis plane blocks have been shown to reduce postoperative morphine requirement after laparotomy.

(d) In rectus sheath blocks, the aim is to deposit the local anaesthetic between the rectus muscle and its posterior sheath.

(e) Large volumes of dilute local anaesthetic are more effective than low volumes of undiluted local anaesthetic of the same dose.

4. Appropriate statements regarding ilioinguinal and iliohypogastric blocks guided by ultrasonography include:

(a) The failure rate is higher than for the landmark technique.

(b) These nerves are derived from the L2 nerve root.

(c) The nerves are visible as oval hypoechoic structures in the transversus abdominis plane.

(d) Compared with in-plane visualization, the out-of-plane approach is preferable.

(e) Compared with the landmark technique, the rate of absorption of local anaesthetic is likely to be higher after ultrasound-guided block.

Ultrasound-guided peripheral nerve blocks of the upper limb

1. Appropriate statements regarding ultrasound images obtained during peripheral nerve block involving the upper limb include:

(a) Nerves are likely to appear hypoechoic.

(b) Tendons are likely to have a fibrillar pattern.

(c) A transducer of 10–15 MHz provides optimal views.

(d) The in-plane approach shows the needle in cross-section.

(e) Local anaesthetic is hyperechoic.

2. An ultrasound image of the distal forearm is shown during peripheral nerve block. A needle, indicated by the small vertical arrows, lies adjacent to the superficial radial nerve (SRN). The anterior interosseus nerve (AIN) and the flexor digitorum profundus muscle are shown.
Multiple Choice Questions

Appropriate statements regarding this image include:

(a) ‘a’ is the median nerve.
(b) ‘b’ is the anterior interosseus membrane.
(c) ‘c’ is flexor carpi ulnaris.
(d) ‘d’ is the humerus.
(e) ‘e’ is the ulnar artery.

3. Compared with the landmark or neurostimulation approach, peripheral nerve blocks guided by ultrasonography are likely to have the following characteristics:

(a) Slower sensory onset.
(b) Increased risk of vascular puncture.
(c) Increased volume of local anaesthetic for successful block.
(d) Decreased risk of neurological complications.
(e) Reduced rate of successful block and patient satisfaction.

4. A 70-year-old man with a history of limited exercise tolerance consequent upon chronic obstructive airway disease presents for treatment of Dupuytren’s contracture affecting the small finger of the hand. A regional anaesthetic is deemed to be appropriate for this patient, who gives informed consent. A needle, indicated by the small unlabelled arrows, lies adjacent to the ulnar nerve (UN).

Appropriate statements regarding this image include:

(a) ‘a’ is the radial artery.
(b) ‘b’ is flexor digitorum superficialis.
(c) ‘c’ is the tendon of flexor carpi ulnaris.
(d) ‘d’ is flexor digitorum profundus.
(e) ‘e’ indicates a hyperechoic pool of local anaesthetic.