Multiple Choice Questions

**Enhanced recovery for lower limb arthroplasty**

1. Appropriate statements regarding lower limb joint replacements include:
   (a) Both age of patients and duration of stay are increasing with time.
   (b) Compared with female patients, elderly male patients are more likely to have an increased duration of stay.
   (c) To reduce blood loss, the appropriate dose of tranexamic acid is 25 mg kg$^{-1}$.
   (d) Owing to the possibility of chondrolysis, patients should not receive intra-articular local anaesthetic.
   (e) Patients who receive femoral nerve block using 0.05% levobupivacaine, 20 ml, are unlikely to be able to mobilize 6 h after operation.

2. A 70-year-old patient with hypertension, well-controlled type 2 diabetes mellitus and stable angina has a total hip replacement under a new enhanced recovery programme. She is in the ASA class III category. She tells the staff that the operation will enable her to go to two forthcoming weddings. The day after the operation, her haemoglobin is 10.1 g dl$^{-1}$, her urine output is 50–70 ml h$^{-1}$ and her capillary refill time is <2 s. Appropriate statements regarding application of this programme include:
   (a) Based on her ASA class, she should not have been enrolled in the Enhanced Recovery after Surgery (ERAS) programme.
   (b) Prompt mobilization and discharge are likely to occur.
   (c) She is likely to receive both intraoperative and postoperative i.v. fluids.
   (d) She attends a preoperative educational group, which is likely to reduce both her anxiety and her duration of stay after hip replacement.
   (e) To treat postural hypotension during mobilization the day after surgery, the most appropriate strategy would be i.v. fluids before reattempting mobilization.

3. In the UK, enhanced recovery programmes:
   (a) Aim to discharge patients early and reduce procedural costs.
   (b) Were devised by a Danish anaesthetist in 1997.
   (c) Are based on a national protocol for lower limb arthroplasty.
   (d) Use a multidisciplinary multimodal technique.
   (e) Are a priority as defined by the Department of Health in the UK.

4. A 76-year-old patient with well-controlled diabetes mellitus is enrolled in an enhanced recovery programme after surgery. Optimal analgesia for knee arthroplasty is likely to include:
   (a) Both a low-dose femoral nerve block and a sciatic nerve block.
   (b) Posterior compartment infiltration and a femoral nerve block with 20 ml of bupivacaine 2.5 mg ml$^{-1}$.
   (c) Systemic ketorolac, which is as effective as ketorolac within the local infiltration solution.
   (d) A rescue femoral nerve block after operation when local infiltration of the knee alone fails.
   (e) Preoperative oral clonidine, provided that there is no $\beta$-blocker in the drug history.

**Pharmacology of anaesthetic agents I: intravenous anaesthetic agents**

5. Current evidence about the mechanism of action of i.v. general anaesthetics indicates that:
   (a) Most i.v. anaesthetics act by interacting with the lipid component of the neuronal cell membrane in various parts of the central nervous system (CNS).
   (b) Propofol exerts its anaesthetic effects by binding to a specific subunit on the $\gamma$-aminobutyric acid A (GABA$_{A}$) receptor ion channel.
   (c) Propofol action at the GABA$_{A}$ receptor inhibits excitatory neurotransmitter release.
   (d) Extrasynaptic GABA$_{A}$ receptors are likely to play a role in amnesia.
   (e) The interaction of anaesthetics with neural networks is unlikely to have a role in understanding the mechanism of action.

6. Appropriate statements regarding ketamine include:
   (a) Like most i.v. anaesthetics, ketamine acts at the $\gamma$-aminobutyric acid A (GABA$_{A}$) receptor.
   (b) Ketamine is active in the thalamus and limbic cortex.
   (c) Animal studies have linked ketamine to impaired learning ability and loss of cognitive function in the neonatal setting.
   (d) Ketamine is unlikely to be used for induction of anaesthesia when there is haemodynamic instability.
   (e) The main metabolic product of ketamine is unlikely to have active properties.
7. Appropriate statements regarding the GABAA receptor include:
(a) It is a G-protein-coupled receptor.
(b) It consists of a single globular unit that spans the neuronal cell membrane.
(c) When potentiated by an anaesthetic, there is increased chloride conductance and hyperpolarization within the postsynaptic neuronal cell.
(d) Anaesthetic agents that are effective at the GABAA receptor are likely to bind to the same subunit receptor site.
(e) These receptors are not found in the hippocampus.

8. Appropriate statements regarding i.v. general anaesthetics agents include:
(a) Etomidate exerts its effect via the N-methyl-D-aspartate (NMDA) receptor.
(b) Etomidate-like drugs are likely to eliminate the adrenal suppression of etomidate.
(c) Investigations of anaesthetic action at specific receptors within the sleep–awake neuronal cycle are likely to provide further insight into the mechanism of action of anaesthesia.
(d) There is rapid emergence from general anaesthesia after a prolonged infusion of thiopentone.
(e) Long-term, high-dose propofol infusion for sedation in intensive care medicine is unlikely to be associated with any major problem.

**Pharmacology of anaesthetic agents II: inhalation anaesthetic agents**

9. Appropriate statements regarding the mechanism of action of inhaled general anaesthetics include:
(a) There is a single molecular mechanism of action for inhalational general anaesthetic agents.
(b) In contrast with i.v. general anaesthetic agents, inhalational anaesthetics rarely act at the GABAA receptor.
(c) The anaesthetic gas xenon exerts its action at NMDA receptors.
(d) Inhalational agents may influence both presynaptic release of neurotransmitters and the postsynaptic response of ion channel receptors.
(e) Tandem pore domain calcium channels may be a target for the action of inhalational anaesthetics.

10. Rapid rate of onset of inhalational anaesthesia is favoured by:
(a) A high inspired concentration of the agent.
(b) Minimal tidal volume breathing by the patient.
(c) A high blood gas partition coefficient of the agent.
(d) High pulmonary blood flow.
(e) High body mass index (BMI).

11. Nitrous oxide (N2O):
(a) Was discovered before William Morton’s demonstration of the efficacy of ether in 1846.
(b) Exerts its effects at the y-aminobutyric acid GABAA receptor.
(c) Has a minimum alveolar concentration (MAC) of 50%.
(d) Administration indirectly activates the enzyme methionine synthetase.
(e) Has recently been shown in a prospective randomized trial to have an adverse cardiac outcome.

12. Xenon:
(a) Like the volatile inhalational anaesthetics, exerts its effects at the GABAA receptor and enhances inhibition of postsynaptic neural impulses.
(b) Has a minimum alveolar concentration (MAC) of 105%.
(c) Is likely to be contraindicated in patients with severe cardiovascular instability.
(d) Is unlikely to cause malignant hyperthermia.
(e) Is manufactured easily using molecular biology techniques.

**Hazards of blood transfusion in adults and children**

13. Appropriate statements regarding paediatric transfusion include:
(a) Adverse events associated with transfusion are more common in children than in adults.
(b) Children are at higher risk of transfusion-related circulatory overload (TACO) than adults.
(c) Blood components should be prescribed in ml kg⁻¹ to reduce the risk of transfusion-related lung injury (TRALI).
(d) Haemolytic disease of the newborn is a condition that the first rhesus-positive fetus may suffer when born to a rhesus-negative mother who has not received anti-D antiglobulin.
(e) A neonate with DiGeorge syndrome who requires transfusion during cardiac surgery may be at risk of graft-versus-host disease unless the prescribed red cells are irradiated.

14. A 60-year-old man with rhesus-positive blood group A receives a blood transfusion after a gastrointestinal bleed. Immediately before the transfusion his haemoglobin concentration was 83 g litre⁻¹ (normal range 138–172 g litre⁻¹). Within 15 min of the start of infusion he complains of pain at the infusion site, nausea and back pain. The infusion is stopped and blood samples are sent to the laboratory, revealing a haemoglobin concentration of 71 g litre⁻¹, prothrombin time 17.2 s (normal range 10–14 s), activated partial thromboplastin time 41 s (normal range 25–39 s), fibrinogen concentration 1.2 g litre⁻¹ (normal range 1.45–3.48 g litre⁻¹), d-dimers 2400 ng ml⁻¹ (normal range 0–250 ng ml⁻¹), free haemoglobin concentration 1.1 g dl⁻¹ (normally 0 g dl⁻¹) and serum haptoglobin 0 mg dl⁻¹ (normal range 100–150 mg dl⁻¹). On visual inspection the plasma appears pink. Appropriate statements regarding this incident include:
(a) The most likely diagnosis is an acute allergic transfusion reaction.
(b) Initial treatment is most likely to include stopping the infusion and administration of adrenaline and chlorpheniramine intravenously.
(c) The transfused blood was noted to be AB-positive, suggesting a probable haemolytic transfusion reaction.
(d) Investigations should include a blood sample sent to the laboratory for a direct antiglobulin (Coombs) test.
(e) Treatment should include broad-spectrum antibiotics.

15. Transfusion-transmitted infection in the UK is increasingly rare. Appropriate reasons include:
(a) Introduction of universal leucodepletion in the year 1999.
(b) Disposal of the initial volume of harvested blood from the donor.
(c) Storage of red cells at 4°C.
(d) Exclusion of multiparous women from the donor pool.
(e) Reduction in the national prevalence of human immune deficiency virus (HIV) and chronic hepatitis B infection.

16. After emergency Caesarean section for fetal distress, a healthy 22-year-old female is found to have a systemic blood pressure of 87/45 mm Hg and a heart rate of 112 beats min⁻¹. Despite active management of the third stage, her uterus is found to be atonic and there is a constant trickle of fresh blood from the vagina. Her blood loss is difficult to assess. Appropriate statements concerning this scenario include:
(a) Rapid transfusion predisposes to transfusion-related lung injury (TRALI).
(b) In the absence of a massive transfusion, the restoration of the circulating volume is likely to be associated with hypokalaemia.
(c) The restoration of the circulating volume is likely to be associated with hypercalcenaemia.
(d) If cardiopulmonary arrest occurs, then inadvertent mild to moderate hypothermia is likely to be associated with an improved neurological outcome.
(e) Her risk of transfusion-related circulatory overload (TACO) is likely to be low.

**Anaesthesia for vascular surgery of the upper limb**

17. Chronic upper limb ischaemia is likely to occur as a result of:
(a) Scleroderma.
(b) Clavicular fracture.
(c) Diabetes mellitus.
(d) Thoracic outlet syndrome.
(e) Meningococcal infection.

18. In patients with subclavian steal:
(a) Symptoms are caused by retrograde flow in the carotid artery and occlusion of the ipsilateral proximal subclavian artery.
(b) Symptoms include dizziness, vertigo, transient visual loss, double vision and loss of consciousness.
(c) Computed tomography (CT) angiography is not required for diagnosis.
(d) Restenosis rates after endovascular repair can be up to 20%.
(e) Invasive arterial monitoring is essential when open repair is required.

19. In patients with thoracic outlet syndrome (TOS):
(a) Symptoms follow a dermatomal distribution when the brachial plexus is compressed.
(b) Strenuous upper body exertion can cause arterial TOS.
(c) Physiotherapy is used to manage all types of TOS.
(d) Neuromuscular blocking drugs should be avoided in complex cases of neurogenic TOS.
(e) An erect chest radiograph in recovery is essential after transaxillary rib resection.

20. Appropriate statements regarding vascular access for haemodialysis include:
(a) Despite having a high rate of primary failure, native arteriovenous fistulae are the first choice.
(b) Arteriovenous fistulas can be cannulated earlier than grafts.
(c) True aneurysms and pseudoaneurysms occur in 3–5% of fistulas and grafts.
(d) Interscalene, supraclavicular, infraclavicular and axillary blocks are all suitable anaesthetic techniques for vascular access procedures.
(e) Indwelling catheters are only suitable for short-term use.

**Opioid-induced hyperalgesia**

21. A patient continues to experience severe radicular leg pain a year after having had a lumbar discectomy for a herniated disc. His physician has been attempting to control his pain with escalating doses of opioids, yet his pain has become progressively worse and now diffusely involves his low back with a deep aching quality. Follow-up imaging of the lumbar spine shows no progression of lumbar disc disease or significant arthritic changes. The patient is now consuming 350 mg of oral morphine equivalents per day. Appropriate statements regarding this scenario include:
(a) The escalating doses of opioids may be worsening this patient’s leg pain.
(b) Opioid-induced hyperalgesia usually occur months to years after opioid therapy is initiated.
(c) The patient has become tolerant to the opioid medication and requires escalating doses of opioid for control of leg pain.
(d) Decreasing his daily opioid dose will eventually result in worse pain scores.
(e) If the diagnosis is opioid opioid-induced hyperalgesia, the leg pain is likely to remain confined to the original radicular pattern.

22. When an opioid binds to its receptor at the cellular level, appropriate analgesic mechanisms include:
(a) Closure of voltage-gated calcium channels.
(b) Stimulation of potassium efflux.
(c) Closure of voltage-gated sodium channels.
(d) N-methyl-D-aspartate (NMDA) receptor agonism.
(e) Reduced neuronal cell excitability.

23. Quantitative sensory testing (QST):
(a) Is a diagnostic assessment tool in the management of opioid-induced hyperalgesia (OIH).
(b) Involves assessment of thermal detection thresholds but not mechanical pain detection thresholds.
(c) Assesses the function of large $\beta$ and small (A$\delta$ and C) nerve fibres and the central pain processing pathways.
(d) Is limited in scope to investigative use in research studies.
(e) Uses an array of stimulus modulation to assess the functional capacity of primary afferent fibres. There is indirect information about processing of information related to noxious stimuli.

24. A patient presents to a general practitioner after having sustained a cervical whiplash injury in a motor vehicle accident 1 week ago. She has been using a sustained-release hydromorphone preparation, 12 mg three times a day, for chronic pelvic pain from endometriosis and has been stable on this dose for 2 years. She requests additional hydromorphone, as she has been taking more than her usual prescribed dose in order to self-treat her neck pain. Appropriate statements regarding her opioid use include:
(a) The patient has become tolerant to opioid medication but may respond to weaker analgesics such as non-steroidal anti-inflammatory drugs (NSAIDs).
(b) The patient’s pain is being undertreated, leading her to display behaviour resembling addiction.
(c) The patient is addicted to opioids.
(d) The patient has developed opioid-induced hyperalgesia and requires a reduction in her daily opioid dose.
(e) The patient is experiencing withdrawal symptoms.

**Rapid sequence induction: its place in modern anaesthesia**

25. Appropriate statements regarding preoxygenation include:
(a) Obese patients have a larger functional residual capacity (FRC) and therefore take longer to preoxygenate than patients with a normal body mass index (BMI).
(b) Owing to the risks of denitrogenation atelectasis, preoxygenation should not be performed with 100% oxygen.
(c) Non-invasive ventilation at pressures $<25$ cm H$_2$O should not be used as a preoxygenation technique because of the risk of gastric insufflation.
(d) Adopting a 30° head-up tilt position increases FRC and may improve preoxygenation in all patients.
(e) There is no advantage in administering oxygen after the patient has becomes apnoeic.

26. Appropriate statements regarding induction agents include:
(a) Ketamine is a bronchodilator.
(b) Etomidate causes adrenal suppression.
(c) In non-traumatic brain injury, administration of ketamine should be avoided.
(d) Ketamine 3–7 mg $\text{kg}^{-1}$ is an appropriate choice for induction of anaesthesia in a patient with haemodynamic instability.
(e) If etomidate is used for induction in patients with sepsis, then hydrocortisone should be given prophylactically.

27. Appropriate statements regarding neuromuscular block in patients needing a rapid sequence induction include:
(a) There is no difference between the onset times of succinylcholine 1 mg $\text{kg}^{-1}$ and rocuronium 1.2 mg $\text{kg}^{-1}$.
(b) Succinylcholine 1 mg $\text{kg}^{-1}$ produces superior intubating conditions to rocuronium 1.2 mg $\text{kg}^{-1}$.
(c) Rocuronium 1.2 mg $\text{kg}^{-1}$ followed by sugammadex 16 mg $\text{kg}^{-1}$ is likely to result in a faster return to spontaneous ventilation than allowing succinylcholine 1 mg $\text{kg}^{-1}$ to wear off in normal patients.
(d) In normal patients, the mean recovery time to adequate spontaneous ventilation after succinylcholine 1 mg $\text{kg}^{-1}$ is 5 min.
(e) Rocuronium is contraindicated in patients who have had a stroke.

28. Cricoid pressure:
(a) Has been shown to reduce aspiration in clinical trials.
(b) Is likely to reduce gastric insufflation during assisted mask ventilation.
(c) Should be removed for insertion of a supraglottic airway device (SAD).
(d) May have to be reduced if there is an inadequate laryngeal view during a rapid sequence induction (RSI).
(e) Should not be applied before loss of consciousness because of the risks of active vomiting and oesophageal rupture.

**Regional anaesthesia for trauma: an update**

29. Appropriate statements concerning techniques of nerve localization after trauma include:
(a) Use of ultrasound is precluded in oedematous or bruised tissues.
(b) Nerve stimulation is generally well tolerated in injured limbs.
(c) When there is a requirement for administration of small volumes of local anaesthetic, nerve block by nerve stimulation is more reliable than that by ultrasound.
(d) Ultrasound is an appropriate technique when there has been amputation of an extremity.
(e) Absence of motor response to peripheral nerve stimulation confirms there has been no contact between needle and nerve.

30. A 41-year-old patient sustains a complex radial fracture. A supraclavicular brachial plexus catheter is sited and a low concentration of local anaesthetic infusion is started. The patient complains of pain 6 h later. Immediate appropriate management is most likely to include:
(a) Assessment of clinical evidence of compartment syndrome.
(b) Administration of a bolus of a concentrated, long-acting local anaesthetic solution.
(c) Supplemeting the brachial plexus block by prescribing patient-controlled analgesia without further clinical review.
(d) Monitoring of compartment pressure.
(e) Inspection of the catheter site.
31. Appropriate statements concerning regional anaesthesia for upper limb trauma include:
   (a) For bilateral injuries, the risk of inadvertent phrenic nerve block can be minimized by an interscalene approach.
   (b) Intravenous regional anaesthesia (IVRA) is considered the technique of choice for open procedures.
   (c) Assessment of neurological function is likely to occur before performing the block.
   (d) Shoulder dislocation is amenable to reduction with an axillary brachial plexus block.
   (e) By reducing the need for sedation and supplementary analgesia, procedures performed under regional anaesthesia are likely to facilitate hospital discharge.

32. Appropriate statements regarding regional anaesthesia in trauma include:
   (a) Central neuraxial approaches are generally preferred to peripheral techniques because there are fewer contraindications after injury.
   (b) Pain is considered a sensitive predictor of compartment syndrome.
   (c) After injury, sustained pain control with regional techniques is expected to provide protection from chronic pain.
   (d) In patients undergoing regional intervention, the use of point-of-care coagulation tests is established.
   (e) There is strong evidence that regional techniques should not be performed on anaesthetized patients.

We no longer publish the answers to the MCQs in the journal. Instead, you are invited to take part in a web-based, self test. Please visit the journal web site: www.ceaccp.oxfordjournals.org to obtain a certificate and CME points.