Multiple Choice Questions

Practical approach to lung ultrasound

1. When obtaining images for lung ultrasound:
   (a). The lung causes ultrasound to be reflected back to the transducer because of the different acoustic impedances of air and water.
   (b). Useful information can only be obtained if the lung is highly fluid-filled or surrounded by fluid.
   (c). An abdominal curvilinear probe is best overall.
   (d). Multiple examination points (at least six each side) are needed to ensure an accurate diagnosis.
   (e). It is imperative to orientate the probe transversely to minimize rib shadows.

2. Regarding interstitial syndrome:
   (a). The sensitivity and specificity of lung ultrasound is close to 100% compared with computed tomography.
   (b). Interstitial syndrome is characterized by multiple, closely spaced A lines.
   (c). It is not possible to distinguish between the different causes of interstitial syndrome with ultrasound.
   (d). The sonographic features are useful in providing guidance of fluid therapy.
   (e). Severe alveolar oedema gives rise to an appearance of consolidation.

3. Regarding a pneumothorax:
   (a). It can confidently be ruled out in less than a minute with ultrasonography.
   (b). It can be diagnosed by stationary B lines which signify absent lung sliding.
   (c). The lung pulse represents the rejoining of the pleural layers in a pneumothorax.
   (d). Lung bullae give rise to false positives for a pneumothorax on ultrasonography.
   (e). Lung ultrasonography can detect small pneumothoraces that are missed on chest radiography.

4. In lung ultrasonography:
   (a). Consolidations often have B lines deep to the far margins.
   (b). Fluid bronchograms and dynamic air bronchograms make pneumonia much more likely than atelectasis.
   (c). The only certain way to distinguish between atelectasis and consolidation is to drain any pleural fluid and see whether the lung re-aerates.
   (d). Pleural thickening can be mistaken for an effusion.
   (e). Ultrasonography will accurately determine the volume of fluid in an effusion.

Quantitative Doppler echocardiography

1. Appropriate statements regarding Doppler measurements include:
   (a). Reflected sound wave velocity increases if the source is moving towards the observer.
   (b). Frequency is inversely proportional to wavelength.
   (c). The greatest Doppler shift occurs when the observer is perpendicular to the source.
   (d). Pulse-wave Doppler is used to measure the velocity in aortic stenosis.
   (e). Doppler velocities can estimate lengths using integration.

2. Appropriate statements regarding colour-flow Doppler include:
   (a). Colour-flow Doppler measures flow within cardiac chambers.
   (b). Red signifies pulsatile arterial flow and blue venous contraflow.
   (c). The Nyquist limit is the maximum blood velocity that can be measured by a crystal.
   (d). As a form of pulse-wave Doppler, only a single piezoelectric crystal is used.
   (e). Colour-flow Doppler is used to create PISAs (proximal isovelocity surface areas) to calculate valve areas.

3. Using the following 2-D imaging and Doppler measurements: LVOT diameter 1.9 cm; VTILVOT 21.3 cm; Vmax-LVOT 83.2 cm s–1; VTIAV 92.6 cm; Vmax-AV cm s–1 where LVOT is left ventricular outflow tract, VTI is velocity–time integral, Vmax is maximum velocity and AV is the aortic valve:
   (a). The LVOT cross-sectional area is 3 cm².
   (b). Stroke volume is 42.6 ml.
(c). Excepting LVOT diameter, all other variables can be measured using just one Doppler interrogation.
(d). The aortic valve area is 0.7 cm2.
(e). The pressure gradient through the aortic valve is 48 mm Hg.

4. Appropriate statements regarding quantitative echocardiography techniques include:
(a). Cardiac output is calculated using Doppler.
(b). The pressure half-time (PHT) can measure the normal mitral valve area.
(c). A PHT of 110 ms equals a mitral valve area of 2 cm2.
(d). dP/dt assesses left ventricular systolic function during the isovolumetric phase of contractility.
(e). The continuity equation cannot be used to calculate aortic valve area if both stenosis and regurgitation are present.

Update on the intraoperative management of adult cadaveric renal transplantation

1. The following drugs depend significantly on renal elimination for their disposition:
(a). Thiopental.
(b). Remifentanil.
(c). Sugammadex.
(d). Fentanyl.
(e). Atracurium.

2. The following anaesthetic interventions have evidence to support their use in renal transplantation:
(a). Preoperative mean arterial pressure (MAP) + 20% at the time of arterial clamp release.
(b). Central venous pressure (CVP) of 12–14 cm H2O.
(c). Administration of fluid volume before arterial clamp removal.
(d). Cardiac output monitoring.
(e). Intraoperative cardiovascular variables have no effect on the incidence of delayed graft function.

3. The following analgesic techniques should be avoided postoperatively after renal transplantation:
(a). Patient-controlled analgesia (PCA) with morphine.
(b). Diclofenac.
(c). Epidural catheter techniques.
(d). Oxycodone PCA.
(e). Paracetamol.

4. Lymphocyte-depleting biological immunosuppressants may cause the following adverse reactions:
(a). Anaphylaxis.
(b). Cytokine release syndrome.
(c). Hypothermia.
(d). Cardiac tamponade.
(e). Progressive multifocal leucoencephalopathy (PML).

Anaesthesia for paediatric lower limb surgery

1. Patients with arthrogryposis multiplex congenita:
(a). Do not routinely require pre-operative cardiac echocardiography
(b). Have near-normal life expectancy
(c). Have multiple, progressive, symmetrical, rigid joint contractures
(d). Have an increased risk of bradycardia if suxamethonium is used
(e). Are easier to perform tracheal intubation on with increasing age

2. When using limb tourniquets:
(a). The maximum inflation pressure in paediatric lower limb surgery is 250 mmHg
(b). Sickle cell disease is an absolute contra-indication to lower limb tourniquet
(c). They should ideally be inflated for no longer than two hours
(d). An immediate increase in blood pressure may be noted on inflation
(e). Patients can become hyperthermic

3. Therapeutic botulinum toxin injections:
(a). Are clinically available in seven serogroups
(b). Are painful and require excellent multi-modal analgesia
(c). Bind to pre-synaptic acetylcholine receptors
(d). May cause dystonia
(e). Give a reduction in tone within 1-2 hours

4. Concerning post-operative care in paediatric lower limb surgery:
(a). Non-steroidal anti-inflammatory drugs (NSAIDs) should be avoided in osteogenesis imperfecta
(b). Low concentration local anaesthetic solution is preferred for epidural infusions
(c). Children may be at increased risk of compartment syndrome
(d). The FLACC (Face, Legs, Activity, Cry, Consolability) pain scale is suitable for children aged up to 7 years
(e). An extended period of pulse oximetry monitoring is recommended in cerebral palsy

Splanchnic circulation

1. Regarding physiological control of the splanchnic circulation:
   (a). Accumulation of metabolites during periods of reduced perfusion causes vasoconstriction and serves to further compromise splanchnic blood flow.
   (b). Myogenic theory refers to the mechanism by which transmural pressure influences vessel tone.
   (c). Prostaglandins may contribute to an increase or decrease in splanchnic blood flow.
   (d). Sympathetic control of the splanchnic circulation is mediated primarily by β-adrenergic vasodilatation.
   (e). Vagal stimulation increases gastrointestinal motility and blood flow.

2. Regarding regional anaesthesia as a therapeutic intervention in disorders of the splanchnic circulation:
   (a). In the animal model sympathetic blockade by thoracic epidural anaesthesia attenuates circulatory disturbance in sepsis.
   (b). The relationship between central neuraxial blockade and splanchnic blood flow is well established.
   (c). Thoracic epidural anaesthesia (TEA) increases the rate of bowel anastomotic leak.
   (d). Thoracic epidural anaesthesia has been used safely to manage severe acute pancreatitis (SAP) in intensive care.
   (e). Using thoracic epidural anaesthesia in patients with sepsis increases the rate of septic complications.

3. Interventions that are likely to impair splanchnic perfusion include:
   (a). Prone position ventilation.
   (b). Permissive hypercapnoea.
   (c). Positive end-expiratory pressure (PEEP) of 10 cm H2O.
   (d). Spontaneous breathing efforts during airway pressure release ventilation.
   (e). Recruitment manoeuvres.

4. Substances and interventions that produce vasodilation of splanchnic vessels include:
   (a). Vasopressin.
   (b). Dopamine.
   (c). Total parenteral nutrition.
   (d). Adenosine.
   (e). Angiotensin II.

Analgesia in intensive care: part 1

1. Appropriate statements regarding the management of pain in intensive care include:
   (a). Vital signs have high specificity in identifying patients in pain.
   (b). Emphasis on achieving adequate analgesia decreases the need for sedative drugs.
   (c). Pain management is best achieved by using a single analgesic drug to avoid drug interactions.
   (d). Different pain scales may be needed to assess pain in different patients.
   (e). Non-pharmacological interventions have very little impact on the management of pain.

2. Appropriate statements regarding the drugs used in the treatment of pain in intensive care include:
   (a). Gabapentinoids can be administered both enterally and parenterally.
   (b). Cyclooxygenase-2 (COX-2) inhibitors have less deleterious effect on renal blood flow compared with non-selective non-steroidal anti-inflammatory drugs (NSAIDs).
   (c). Ketamine may minimize the incidence of chronic postsurgical pain.
   (d). Paracetamol can cause hepatic injury even in normal recommended doses.
   (e). α2-Agonists and opioids have synergistic analgesic action.

3. A 75-year-old man undergoes emergency laparotomy for perforation peritonitis. He has no major past medical history. Laboratory investigations are as follows: haemoglobin 112 g L−1 (120±180 g L−1); white cell count 21 × 109 L−1 (4–11 × 109 L−1); C-reactive protein 350 mg L−1 (0–10 mg L−1); platelets 200 × 109 L−1 (150–400 × 109 L−1); prothrombin time 20 s (12–14 s), international normalized ratio (INR) 1.5 (0.8–1.1); activated partial thromboplastin time 45 s (28–39 s); sodium 138 mmol L−1 (135–147 mmol L−1); potassium 4.0 mmol L−1 (3.5–5.0 mmol L−1); urea 11 mmol L−1 (2.5–7.8 mmol L−1); creatinine 170 µmol L−1 (55–125 µmol L−1); estimated glomerular filtration rate (eGFR) 25 ml min−1 1.73 m−2. The patient had a general anaesthetic and regional anaesthesia was not done because of deranged clotting. After operation the patient was transferred to the intensive care unit for
mechanical ventilation. Appropriate statements would include:

(a). He could not be in pain as he is sedated.
(b). Delirium can ensue as a result of postoperative pain.
(c). Treating his pain with opioids would prolong mechanical ventilation.
(d). Multimodal analgesia with regular paracetamol and NSAIDs should be started first for his pain management.
(e). Morphine infusion will provide best pain relief.

4. A 75-year-old morbidly obese man undergoes emergency laparotomy for perforation peritonitis. His past medical history includes obstructive sleep apnoea and well-controlled hypertension. Laboratory investigations are as follows: haemoglobin: 112 g L⁻¹ (120–180 g L⁻¹), white cell count: 21 × 10⁹ L⁻¹ (4–11 × 10⁹ L⁻¹); C-reactive protein 350 mg L⁻¹ (0–10 mg L⁻¹); platelets 200 × 10⁹ L⁻¹ (150–400 × 10⁹ L⁻¹); prothrombin time 20 s (12–14 s); international normalized ratio (INR) 1.5 (0.8–1.1); activated partial thromboplastin time 45 s (28–39 s); sodium 138 mmol L⁻¹ (135–147 mmol L⁻¹); potassium 4.0 mmol L⁻¹ (3.5–5.0 mmol L⁻¹); urea 5.5 mmol L⁻¹ (2.5–7.8 mmol L⁻¹); creatinine 85 µmol L⁻¹ (55–125 µmol L⁻¹); albumin 20 g L⁻¹ (35–55 g L⁻¹). The patient had a general anaesthetic and regional anaesthesia was not done because of the deranged clotting. After operation the patient was extubated and transferred to the intensive care unit for vasopressor support. Appropriate statements would include:

(a). Fentanyl infusion will provide reliable and predictable pain relief.
(b). The enteral route for analgesia is preferable to the intravenous route.
(c). Poor pain management can lead to chronic pain in the future.
(d). Clonidine may be a good adjunct in addition to patient-controlled analgesia (PCA).
(e). Ketamine may be a good adjunct in addition to PCA.