Question 1 (FSBA953)

A 39-year-old male (weight 152 kg, height 180 cm) is scheduled for a laparoscopic gastric bypass under general anaesthesia. You plan to use a propofol TCI with the Eleveld model.

Which of the following best explains how the Eleveld model improves accuracy in dosing for this patient compared to the Marsh or Schnider models?

A. It adjusts the ke0 value upward in obese individuals to compensate for increased adipose tissue distribution
B. It assumes a two-compartment model with slower distribution into peripheral tissues in obese individuals
C. It automatically limits total infusion rates when BMI exceeds 40, to avoid excessive plasma concentrations
D. It includes continuous covariate-based scaling of both volume and clearance using fat-free mass and applies allometric functions to account for obesity
E. It uses fixed lean body mass estimates, thereby preventing overdose in obese patients

Correct answer: D

Explanation:

The Eleveld model is built from an extensive dataset (over 10,000 individuals), allowing it to apply continuous covariate adjustments for parameters such as age, sex, height, weight, and fat-free mass. Importantly, it uses allometric scaling for both volume of distribution and clearance, which is particularly crucial in obese patients. This contrasts with models like Marsh, which scales linearly with total body weight (risking overdose), and Schnider, which relies on fixed lean body mass equations (potentially inaccurate at the extremes of weight).

By avoiding both fixed parameters and oversimplified assumptions, the Eleveld model can provide more accurate target concentrations in morbidly obese patients, reducing the risk of both underdosing and excessive accumulation.

Why the other options are incorrect:

- A) The ke0 in Eleveld decreases with obesity and age; it is not increased.
- B) Eleveld uses a three-compartment model, not two.
- C) The model does not "cap" infusion rates arbitrarily.
- E) Fixed lean body mass is used in Schnider, not Eleveld.

Question 2 (FSBA972)

A 58-year-old woman presents 18 hours after sudden-onset headache and collapse. CT head confirms a diffuse subarachnoid haemorrhage with no hydrocephalus, and CT angiography shows a 6 mm anterior communicating artery aneurysm.

She is scheduled for endovascular coiling under general anaesthesia in the neurointerventional suite.

Preoperative findings:

- GCS 15
- BP 165/95 mmHg
- HR 70 bpm
- Na^+ 134 mmol/L, normal osmolality
- She has received nimodipine orally
- Arterial line and large bore IV access are in situ

During the case, her MAP drops to 55 mmHg. $EtCO_2$ is 4.3 kPa. The interventionalist is about to advance the microcatheter across the aneurysm neck.

Which of the following is the most appropriate action to optimise cerebral physiology at this point?

A. Administer labetalol to blunt potential BP surges during microcatheter passage
B. Administer mannitol 0.5 g/kg IV to reduce cerebral swelling
C. Hyperventilate the patient to $EtCO_2$ of 3.5 kPa to reduce cerebral blood volume
D. Reduce anaesthetic depth to increase BP and allow cerebral vasodilation
E. Start phenylephrine infusion

Correct answer: E

Explanation:

This is a vulnerable phase of endovascular coiling after SAH. The aneurysm is unsecured, and the patient is at risk of cerebral ischaemia due to impaired autoregulation. A MAP of 55 mmHg is inadequate and may cause cortical or deep perfusion failure.

- Maintaining adequate CPP (cerebral perfusion pressure) is critical, even in normocapnia

Option Analysis:

A. Labetalol: Dangerous at this stage — would worsen hypotension. BP surge management is important after coiling, not during this hypotensive episode.

B. Mannitol: Not indicated — no raised ICP or oedema evident. Also risks worsening hypotension by osmotic diuresis.

C. Hyperventilation: Will cause vasoconstriction, worsening cerebral perfusion — dangerous in this context.

D. Reducing anaesthetic depth: May improve BP, but risks awareness and patient movement; also unpredictable.

E. Phenylephrine: Best choice — supports CPP while minimising ICP risk.

Question 3 (FSBA976)

A 42-year-old ASA I male is undergoing laparoscopic adrenalectomy under TIVA with target-controlled propofol (effect-site target 4.0 µg/mL) and remifentanil (2.5 ng/mL). He received rocuronium 50 mg 30 minutes ago. BIS monitoring with full EEG and DSA display is in use.

Midway through surgery, you observe the following changes over 5 minutes:

- BIS rises from 44 to 58
- The DSA shows loss of delta (0.5–4 Hz) and alpha (8–12 Hz) power
- A prominent increase in high-frequency beta activity (15–30 Hz) is seen, along with increased EMG contamination
- Raw EEG shows low-amplitude, high-frequency activity without burst suppression or artefact
- Blood pressure and heart rate are unchanged
- Propofol and remifentanil infusions are confirmed running and connected.

The surgeon is using diathermy intermittently.

What is the most appropriate action?

A. Administer a bolus of rocuronium to remove EMG interference
B. Decrease the propofol target concentration to prevent propofol-related burst suppression and hypotension
C. Reposition EEG electrodes and reassess trace quality as this is likely to be diathermy interference
D. Increase the propofol effect-site target concentration
E. Increase the remifentanil effect-site target concentration

Correct answer: D

Explanation:

This question requires nuanced interpretation of DSA and raw EEG features in a complex clinical setting.

- A rising BIS, loss of alpha and delta power, and dominance of beta and EMG activity are all electrophysiological markers of light anaesthesia or consciousness
- The presence of neuromuscular blockade means clinical signs (movement) of awareness may be absent, increasing the risk of unrecognised intraoperative awareness
- Diathermy artefact usually causes transient, sharply spiked waveforms or signal dropout, not persistent beta activity or BIS drift
- Stable haemodynamics do not exclude awareness, especially under remifentanil
- Propofol delivery failure, underdosing, or increased requirements (e.g. due to pharmacokinetic variability, equipment error, or increased cerebral demand) may underlie this scenario

Question 4

A 34-year-old woman presents for an elective laparoscopic cholecystectomy. She has an implanted left-cervical vagus nerve stimulator (VNS) device for drug-resistant epilepsy.

Which of the following is the most appropriate management step prior to induction of general anaesthesia?

A. Apply a magnet over the VNS generator at the time of induction only
B. Leave the device active and proceed with routine anaesthetic and surgical care
C. Leave the device active but avoid electrocautery during the procedure
D. Formally deactivate the VNS device before induction of general or spinal anaesthesia
E. Program the VNS to maximum stimulation (“burst mode”) immediately prior to surgery

Correct answer: D

Explanation

Why D is correct:
The *Association of Anaesthetists* guideline (Broderick et al., 2023) advises that “it is generally safer to formally deactivate vagus nerve stimulation devices before general and spinal anaesthesia.”
Deactivation reduces risks of intra-operative bradyarrhythmia, airway obstruction, cough, or interference with electrocautery and monitoring.

Why the other options are incorrect:

A. Apply a magnet over the VNS generator at the time of induction only –
Magnet use may inhibit stimulation temporarily but is unreliable. The guideline recommends formal deactivation via the programmer rather than relying on a magnet during induction.

B. Keep the VNS active and proceed with routine anaesthetic care –
Leaving the stimulator running throughout surgery increases the risk of adverse effects such as bradycardia, apnoea, or device interference. Routine care without deactivation is not considered safe practice.

C. Leave the device active but avoid electrocautery during the procedure –
Although avoiding electrocautery reduces electromagnetic interference, it does not mitigate the cardiovascular and respiratory risks of ongoing stimulation. Deactivation remains the safer and recommended approach.

E. Program the VNS to maximum stimulation (“burst mode”) immediately prior to surgery - This would heighten the risk of bradyarrhythmias and airway complications and is explicitly contraindicated in the guideline.

Question 5

A 12-year-old girl with cerebral palsy is scheduled for bilateral pelvic osteotomies. She is gastrostomy-fed, non-ambulant, and takes baclofen and sodium valproate. She has mild scoliosis and occasional episodes of gastro-oesophageal reflux.

Which of the following strategies is most appropriate to provide effective analgesia while minimising complications specific to her condition?

A. Single-shot caudal epidural with 0.25% bupivacaine (1 ml/kg) and clonidine 1 μg/kg

B. Continuous lumbar epidural with bupivacaine 0.1% and fentanyl 2 μg/ml

C. Bilateral fascia iliaca blocks under ultrasound guidance with levobupivacaine 0.25% (0.5 ml/kg per side)

D. Continuous intravenous morphine infusion titrated to comfort

E. Intrathecal morphine (3 μg/kg) at the end of surgery combined with multimodal oral analgesia

Correct answer: B

Explanation

Why B is correct:

- Bilateral pelvic osteotomies produce severe somatic and muscle spasm pain, especially in children with spastic CP.
- A continuous lumbar or low thoracic epidural provides superior, segmental analgesia, reduces muscle tone and spasm, and minimises systemic opioid needs.
- The combination of low-concentration local anaesthetic (0.1%) and opioid allows prolonged infusion with preserved lower limb motor function—beneficial for early physiotherapy.
- Epidural catheter placement should occur under direct vision intra-operatively (especially in patients with scoliosis or previous spinal surgery, where blind placement may fail).

This technique aligns with current best practice and is supported by the *BJA Education* review on anaesthesia for children with cerebral palsy (Kilbride & Davis, 2018).

Why the other options are incorrect:

A. Single-shot caudal epidural with bupivacaine and clonidine –
Duration of analgesia (≈6–8 h) is inadequate for this major orthopaedic surgery requiring days of pain control. Clonidine may cause excessive sedation and hypotension in this population.

C. Bilateral fascia iliaca blocks –
These provide partial coverage of hip and thigh pain but do not address posterior pelvic or muscle spasm pain. Analgesia would be incomplete, particularly after osteotomy.

D. Continuous intravenous morphine infusion –
Provides less effective pain control, risks respiratory depression and delayed gastric emptying, and worsens postoperative ileus in a child with pre-existing reflux and poor airway protection.

E. Intrathecal morphine with multimodal oral analgesia –
Offers good early analgesia (12–24 h) but unpredictable duration and carries risk of delayed respiratory depression, particularly problematic in a child with reduced airway tone and secretion management issues.