FRCA Final SOE 1 Question Example:
Clinical Anaesthesia with linked Applied Clinical Science

Neurofibrosis Craniotomy with Physiology of the elderly

Clinical case

Examiners guidance
Candidates should know the features of neurofibromatosis with relevance to anaesthetists and the impact of an occipital SOL and be able to describe a safe and appropriate anaesthetic for craniotomy to pass

A 75 year-old man with neurofibromatosis and bullous lung disease presents for resection of a occipital lobel SOL that is causing neurological symptoms?

Describe the features of neurofibromatosis

Autosomal dominant. Type 1 (von recklinghausens 1:3000 births. 20,000 patients in UK) chromosome 17, Lisch nodules (iris hamartomas) common intellectual impairment(30-60%) and skeletal abnormality. Café au lait spots
Multiple associated abnormalities (scoliosis (5-10%), phaeochromocytoma, pulmonary fibrosis, cardiomyopathy, renal artery stenosis)
Don't have cataracts or cutaneous swannomas

Type 2 1:40,000 births chromosome 22. Associated with bilateral acoustic neuroma, and cataracts in 60-80% of patients and cutaneous schwannomas
Both have
Neural tumours (central and peripheral neurofibromas, meningiomas, astrocytomas,gliomas, epenymomas, neuromas)

What symptoms and signs may the patient have presented with?

Headache , poor balance , visual loss (homonymous hemianopsia), seizure possible brain stem compression if large lesion so assess bulbar function and other cranial nerve defects and long tract signs and severe N and V

How urgent is the case?

Depends on neurological features but generally category 3 so can wait 24-36 hours
It is not an emergency – time for further investigations and management of his medical problems
Generaly start on dexamethasone with proton pump gastro protection if there is evidence of cytotoxic oedema and correct electrolytes which may be deranged from poor oral intake/ vomiting or as side effect or anticonvulsants
Optimise lung function with physiotherapy, smoking cessation and pharmacological regime as appropriate

What are the key goals in this case?
Bullae so risk pneumothorax during IPPV. Unavoidable so need to avoid high insp pressures and tidal volumes
Managing co morbidities of neurofibromatosis

Likely multiple previous craniotomy so could be technically difficult.
Maintain cerebral perfusion pressure CPP= MAP – (ICP + CVP)
Prevent BP surges (intubation, pins, and emergence) to limit BP and ICP
Still patient
Rapid wake-up with little residual sedation to allow assessment post-op
Anti-emesis
Risk of air embolism if sitting or significantly head up
Limitation of ICP (slack brain):
Low/normal PaCO2
Normal oxygenation
Head up position
Prevent cough/strain
Mannitol
Avoid agents which increase ICP (N2O, volatiles at high MAC)
Reduce cerebral metabolic rate (anaesthetic agents)
Manage fits (increases CMRO2 and ICP)
Prevent hyperthermia

The patient has been optimised, how would you proceed with the induction?

Pre-op:
Explain anaesthetic to patient
Discuss with surgeon positioning could be Concorde, sitting, park bench or prone and degree of intra-cranial mass effect
Plan for post-op HDU/high care area

Induction:
Full monitoring
Art line
Wide bore access
Pre-oxygenation – may take longer in view of lung disease
Induction – remi/propofol/NMBD Thio useful if concerns re fitting
Maintainence – TIVA or volatile + remi
Monitor TO4 before administration muscle relaxant and ensure paralysed prior to intubation
ETT reinforced
Secure the tube well due to prone position
Avoid tapes which may impede venous return
Limit pressor response with remi/beta-blocker/lignocaine
Positive pressure ventilation aim low normal PaCO2 4.5 kPa
Increase RR with low tidal volume to limit pneumothorax risk in this patient
Neck central line useful if surgery likely to be long duration or air embolus high risk /

How would you prone this patient and what are the adverse effects of prone positioning?

Positioning:
Prone –
Protect eyes, padding
Secure ETT
6 person team
Patient rolled with arms by side onto arms of people by side
Care to avoid head rotation
Chest and pelvis support
Abdo free
Face down or to side
Avoid pressure areas eyes and facial nerve
Arms care to avoid brachial plexus injury
Care regarding padding of pressure areas

Adverse effects –
Blindness several causes posterior ischemic optic neuritis most likely if direct pressure is avoided in positioning
Reduced access to airway
Increased airway pressure if abdomen splinted and reduced venous return
Displacement of tubes and lines during proning
Injuries during turning – neck
Brachial plexus injuries
Compression injuries – eyes, facial nerve, sciatic, ulnar nerve, lateral cutaneous nerve of the thigh

How would you maintain anaesthesia for this patient and what are the advantages/disadvantages of your chosen technique?

Maintenance

TIVA – propofol + remi
Reduces CMRO2 and maintain auto-regulation reducing ICP
Easily titrated during different phases of surgery
Rapid smooth emergence
Reduced PONV
Risk of awareness if iv dislodged
Slow waking compared to vapours
Need use BIS

Volatile + Remi
Sevo/Des in oxygen/air
Avoid N20 as it increases ICP and risk/size of pneumothorax
No effect on autoregulation in the normal clinical range
Animal model suggests useful ischemic preconditioning with reduced apoptosis in hypoxic injury, via reduced calcium release from intracellular stores

Either technique:
Pins - increase depth of anaesthesia and analgesia
Vasopressor infusion to maintain MAP phenylephrine or metaraminol
Either neuromuscular blockade or remi to prevent coughing
Normal saline maintenance
Hypertonic saline mannitol to reduce oedema ask concentration and doses
Avoid dextrose containing fluids
Maintain normothermia

Filler

How would you manage emergence?

If significant oedema, or loss of bulbar function keep asleep and allow recovery in ITU
Otherwise Neuro HDU/High Care area
Maintain anaesthesia until supine and out of pins
100% O2
Anti-emesis
Reversal with monitoring via nerve stimulator
Deep emergence best plan to limits cough and hypertensive response, can do airway exchange to I gel, remifentanil technique etc

Opening question
What factors might influence your anaesthetic technique in an 75 year-old undergoing major surgery?

Scientific principles to be explored
The physiological changes that occur with ageing in all the main body systems and their effect upon anaesthetic technique

Guidance to examiners
Candidates should be able to demonstrate a thorough understanding of the altered responses of the elderly to anaesthesia and the causative physiological changes.

Question
Physiology question Artefact N
Factors influencing anaesthetic choice:
• **Surgical**
o Urgency: elective vs emergency (? opportunity for pre-optimisation)
o Effect of surgical pathology: e.g., blood loss in fractured NOF, GCS in subdural, CVS status in sepsis
o Site of surgery and likely duration
• **Underlying physiological status**
o ***CVS***:

Poor handling of CVS stress & fluid excess / deficit

• ↓CO, ↓stroke volume, ↓ventricular compliance, ↓baroreceptor sensitivity
• ↑cardiac conduction defects, ↑arrhythmias, ↑systolic BP, ↑SVR rigid vasc
Systolic HF (↓myofib-contraction), Diastolic HF (↓myofib-relaxation)
Exercise capacity falls 1 MET per 7 years without training
o ***RS****:*
↑risk of hypoxia; faster desaturation; ↑risk of aspiration
• ↓FRC, ↑closing capacity, V/Q mismatch ↓RV
• Loss of reflex response to ↓O2 and ↑CO2; ↓Larynx protection, weaker swallow.
o Renal / Hepatic*: ↑drug potency, delayed drug onset / offset, delayed drug clearance*
• ↓functioning glomeruli, ↓RBF, ↓GFR (↓1% per yr > 40) ↓renal drug clearance
• ↓vasopressin sensitivity, ↓ability to concentrate urine (280 cp 400mosmol/l)
• ↓Functional liver mass, ↓hepatic blood flow, ↓hepatic excretion of drugs.
o ***Cognitive****:* Age is a major risk factor for POCD/delirium
o *CNS:*
• Decreased> neuronal density (↓18% at 80 yr), CMRO2, CBF
• Autoregulation and response to CO2 retained.
• higher functions and long term memory retained, short term memory and processing decreased.
o ***Temp control: prone to hypothermia****.*
• Lean body mass, 25% decrease in resting energy expenditure.
• Sensitivity of cutaneous thermoreceptors, autonomic control of a-v shunts
• Onset of shivering and non-shivering thermogenesis (decreased adrenoreceptor sensitivity).
o ***GI and endocrine:***
• Decreased gastric emptying.
• Reduced ability to mount stress response, abnormal glucose response, poor glycogen reserves.
o *Blood* - decrease in: Hb, proteins, platelets, clotting factors, immune response.
Musculoskeletal thin friable skin and mucous membranes …..easily damaged or torn . Arthritic changes predispose to nerve/ spine trauma with suboptimal positioning

Filler

<u>Consequences for anaesthesia</u>
• **Pre-optimisation**
• **Drugs:** Need to be rapidly excreted; less dependence on renal / hepatic elimination, e.g., propofol, atracurium, remifentanil, sevoflurane. Decrease drug dose (& MAC by ⅓ at 80 yr)
• **Regional techniques** improve mental and respiratory function immediate post-op. **Reduce** segmental dose requirement for spinals, epidurals. Greater risk of nerve injury in elderly**.**
• **Prevent hypothermia;** warm all fluids, forced air warming, reduce exposure.
• **Care with fluid balance,** not too much saline or water – invasive monitoring/SVV?TOE
• **Mechanical ventilation;** volume v pressure controlled.
• **Head and neck movement** during intubation. Positioning and friable skin.
• **Monitoring of CNS to try to avoid POCD: ?** cerebral oximetry ?BIS