

FExNet 2026

Collated SAQs: Neurology and Neurosurgery

ANSWER BOOKLET

Model answers for the 22 neurology and neurosurgery SAQs. References cited at the foot of each question. Items marked [core] are required for full marks. Drug doses confirmed with current Stroke Foundation Living Guideline 2024, eTG Therapeutic Guidelines, and ACEM clinical policies.

22 questions • 246 marks

ACEM-aligned format. Sub-questions labelled a) b) c). Mark allocations indicative; references cited in the Answer Booklet. Question and answer indexes are clickable.

Answer Index

Click any entry to jump to its answer. Marks shown right.

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Question 1 | Acute Ischaemic Stroke — Thrombolysis (13 marks)

A 65-year-old right-handed man is brought to your tertiary emergency department by ambulance after his wife found him on the floor at home, unable to speak. Symptom onset was witnessed 90 minutes ago. He has a background of treated hypertension and hypercholesterolaemia. On arrival his observations are: heart rate 95 beats per minute (irregular), blood pressure 175/105 millimetres of mercury, respiratory rate 18 breaths per minute, peripheral oxygen saturation 98 percent on room air, blood glucose 6.8 millimoles per litre. Examination reveals right-sided hemiplegia (arm worse than leg), left gaze deviation, global aphasia, and right-sided facial droop. National Institutes of Health Stroke Scale score is 18. Non-contrast computed tomography of the brain shows early ischaemic changes in the left middle cerebral artery territory but no haemorrhage.

a) List 4 risk factors for ischaemic stroke evident or suggested in this case. (4 marks)

- **Treated hypertension** — hypertensive vasculopathy increases risk of small-vessel and large-vessel infarction **[core]**
- **Atrial fibrillation** (irregular pulse may indicate previously undiagnosed AF — cardioembolic source) **[core]**
- **Hypercholesterolaemia / atherosclerosis** — large-vessel embolic or thrombotic stroke **[core]**
- **Age over 65** — non-modifiable risk factor **[core]**
- Smoking, diabetes, family history, prior TIA / stroke, sleep apnoea, sedentary lifestyle, thrombophilia, prosthetic valves, patent foramen ovale

b) Name the thrombolytic agent and dose used in ischaemic stroke per current Australian guidelines, AND state the time window. (4 marks)

- **Alteplase (recombinant tissue plasminogen activator)** at a dose of **0.9 mg/kg intravenous** (maximum 90 mg total dose) **[core]**
- **10 percent of dose given as bolus over 1 minute**; remaining 90 percent infused over 60 minutes **[core]**
- **Within 4.5 hours of symptom onset** (extended window in selected patients with favourable imaging — penumbra-based selection); outside 4.5 hours requires advanced imaging (CT perfusion / MRI) and individualised decision **[core]**
- Tenecteplase 0.25 mg/kg single bolus is increasingly used (NHF/Stroke Foundation 2024 guideline supports as alternative) **[core]**

c) List 5 absolute contraindications to thrombolysis. (5 marks)

- Intracranial haemorrhage on imaging or history of haemorrhagic stroke; arteriovenous malformation or aneurysm **[core]**
- Active internal bleeding (gastrointestinal haemorrhage in past 21 days, recent major trauma or surgery) **[core]**
- Recent intracranial / spinal surgery, head trauma, or stroke within 3 months **[core]**
- Suspected aortic dissection; suspected infective endocarditis **[core]**
- Severe uncontrolled hypertension (systolic blood pressure greater than 185 OR diastolic greater than 110 millimetres of mercury despite treatment) **[core]**
- Coagulopathy — INR > 1.7, platelets < 100, recent anticoagulation (vitamin K antagonist, DOAC within 48 hours, low-molecular-weight heparin within 24 hours)
- Blood glucose < 2.7 or > 22 mmol/L (correctable)
- Pregnancy is a relative contraindication

References: Stroke Society of Australasia / Stroke Foundation Living Guideline 2024 • National Heart Foundation / Stroke Foundation • eTG (Therapeutic Guidelines, current) • Tintinalli's Emergency Medicine 9e Ch 167 • ACEM clinical policies and statements

Question 2 | Endovascular Clot Retrieval Pathway (11 marks)

You are the on-call emergency consultant at a tertiary trauma and stroke centre. A 62-year-old woman is brought in with right hemiplegia, gaze deviation, and global aphasia. Symptom onset was 3 hours ago. Computed tomography of the brain shows no haemorrhage, with a left middle cerebral artery hyperdense vessel sign and Alberta Stroke Program Early CT score of 8. Computed tomography angiography demonstrates an M1 segment occlusion. The patient has been given alteplase. The interventional radiology team is en route.

a) List 5 inclusion criteria for endovascular thrombectomy per current Australian guidelines. (5 marks)

- **Confirmed proximal large-vessel occlusion** (internal carotid artery, M1 or M2 segment of middle cerebral artery, basilar artery) on computed tomography or magnetic resonance angiography **[core]**
- **Time window: within 6 hours of symptom onset** (extended to 24 hours in selected patients with favourable mismatch on perfusion imaging — DAWN, DEFUSE-3 trials) **[core]**
- **Significant neurological deficit** — National Institutes of Health Stroke Scale score ≥ 6 (some centres lower threshold for anterior circulation; basilar lower threshold) **[core]**
- **Pre-stroke modified Rankin Scale $\leq 1-2$** (functionally independent baseline) **[core]**
- **Alberta Stroke Program Early CT score ≥ 6** or favourable perfusion mismatch profile (small core, large penumbra) **[core]**
- Age generally ≥ 18 ; no upper limit if otherwise well
- No haemorrhage on initial imaging

b) List 3 stakeholder groups to involve when developing a regional clot-retrieval protocol. (3 marks)

- Neurologists and neuro-interventional radiologists (clinical pathway, eligibility, complications) **[core]**
- Ambulance / retrieval services (pre-hospital screening, transport criteria, time-critical bypass to comprehensive stroke centre) **[core]**
- Spoke hospitals — emergency department directors, stroke coordinators (telemedicine support, transfer protocols) **[core]**
- Health-service / executive (resourcing, performance indicators, audit)
- Patients / consumer representatives
- Allied health — physiotherapy, occupational therapy, speech (post-procedure rehabilitation)

c) List 3 information sources to establish current standard of care. (3 marks)

- Stroke Foundation Living Guidelines (2024) — current Australian consensus document **[core]**
- Cochrane systematic reviews on thrombectomy / thrombolysis **[core]**
- Major randomised controlled trials — MR CLEAN, DAWN, DEFUSE-3, EXTEND-IA — published in NEJM, Lancet **[core]**
- Local network audit data — past performance, time-metrics, outcomes
- International guidelines — American Stroke Association, European Stroke Organisation
- ACEM stroke policy and clinical practice statements

References: Stroke Society of Australasia / Stroke Foundation Living Guideline 2024 • National Heart Foundation / Stroke Foundation • NSW Stroke Reperfusion Programme criteria • ACEM clinical policies and statements • DAWN (NEJM 2018), DEFUSE-3 (NEJM 2018)

Question 3 | Anticoagulant-Related Intracerebral Haemorrhage (12 marks)

A 70-year-old man with permanent atrial fibrillation (treated with warfarin), ischaemic heart disease, and hypertension is brought to your emergency department by his daughter, who reports increasing confusion over 1 week. Examination reveals a Glasgow Coma Score of 13 (E3 V4 M6), heart rate 90 beats per minute (irregular), blood pressure 160/95 millimetres of mercury, respiratory rate 18 breaths per minute. Non-contrast computed tomography of the brain shows bilateral hyperdense crescent-shaped collections in the subdural space (the right side larger than the left) with effacement of cortical sulci and 5 millimetres of midline shift. International normalised ratio is 7.1.

a) State the diagnosis AND list 3 supportive imaging features. (3 marks)

- **Acute-on-chronic bilateral subdural haematoma with mass effect [core]**
- Crescentic hyperdense (or mixed-density) extra-axial collections crossing suture lines but NOT the midline (limited by falx) [core]
- Effacement of cortical sulci and overlying gyri; midline shift; ventricular asymmetry; obliteration of basal cisterns if severe [core]
- Mixed densities suggest acute-on-chronic bleeding (layering)

b) State the warfarin reversal regimen with drug, dose, and target endpoint. (5 marks)

- **Vitamin K (phytomenadione) 10 milligrams intravenous** (slow infusion over 30 minutes) [core]
- **4-factor prothrombin complex concentrate (Prothrombinex-VF) 25-50 IU/kg intravenous**; exact dose per weight and INR (e.g. 50 IU/kg for INR >6) [core]
- **Fresh frozen plasma 10-15 mL/kg intravenous** if prothrombin complex concentrate not available; less effective and slower onset [core]
- **Endpoint: INR ≤1.5 within 30 minutes**; repeat INR at 30 min, 6 h, 24 h post-reversal [core]
- **Tranexamic acid 1 g intravenous bolus** (CRASH-3 evidence for traumatic brain injury within 3 hours) [core]
- Consult haematology if dialysis-dependent or complex coagulopathy

c) List 4 management priorities while awaiting neurosurgical review. (4 marks)

- **Maintain mean arterial pressure 80-100 millimetres of mercury** with cautious antihypertensive (labetalol 10-20 mg intravenous bolus or nicardipine infusion); avoid rapid blood pressure drop [core]
- **Neuroprotective principles** — head-up 30°, normothermia, normocarbica (PaCO₂ 35-40), normoglycaemia (4-10 mmol/L); avoid agitation; avoid hypoxia [core]
- **Neurosurgical consultation** for consideration of operative evacuation versus conservative management; admit to high-dependency / intensive care unit [core]
- **Repeat computed tomography** at 4-6 hours (or sooner if deterioration); serial neurological observations, hourly Glasgow Coma Score, pupillary checks [core]
- Reverse other antiplatelets (consider DDAVP for aspirin if surgery planned)
- Investigate cause of fall / decision for ongoing anticoagulation post-recovery (multidisciplinary)

References: eTG (Therapeutic Guidelines, current) • ANZSBT/HSANZ Prothrombin Complex Concentrate Guideline • ACEM clinical policies and statements • Brain Trauma Foundation Guidelines (4th edition)

Question 4 | Subarachnoid Haemorrhage — Diagnostic Pathway (11 marks)

A 36-year-old woman presents to your emergency department complaining of a sudden, severe occipital headache that began 5 hours ago while she was at the gym. The headache reached maximum intensity within 1 minute of onset (thunderclap) and has been associated with photophobia and one episode of vomiting. She has no significant past medical history. Her vital signs are: heart rate 75 beats per minute, blood pressure 142/85 millimetres of mercury, respiratory rate 16 breaths per minute, peripheral oxygen saturation 98 percent on room air, temperature 36.8 degrees Celsius. Glasgow Coma Score is 15. Neurological examination is non-focal. Non-contrast computed tomography of the brain performed by your registrar has been reported as normal.

a) Describe the Ottawa Subarachnoid Haemorrhage Rule AND state how it is used. (5 marks)

- **Inclusion:** alert patients ≥ 15 years with non-traumatic headache of maximum intensity within 1 hour of onset and no neurological deficit **[core]**
- **Investigate** if ANY of: age ≥ 40 , neck pain or stiffness, witnessed loss of consciousness, onset during exertion **[core]**
- OR thunderclap headache (peak intensity within 1 second), OR limited neck flexion on examination **[core]**
- **Used as a SCREENING tool** — high sensitivity (greater than 99 percent) but limited specificity; ABSENCE of all features rules out subarachnoid haemorrhage **[core]**
- **Presence of any feature** mandates investigation (computed tomography first; lumbar puncture if computed tomography negative and presentation more than 6 hours) **[core]**

b) List 2 next-step investigation options AND a pro and con of each. (4 marks)

- **Lumbar puncture:** **Pro** — gold standard for delayed presentation (greater than 6 hours); xanthochromia detection by spectrophotometry. **Con** — invasive; risk of post-LP headache, traumatic tap; delays definitive diagnosis if positive **[core]**
- **Computed tomography angiography:** **Pro** — non-invasive; identifies aneurysm if subarachnoid haemorrhage diagnosed on lumbar puncture; can detect subtle bleeding in some cases. **Con** — incidental aneurysm rate ~2-3 percent (may not be source); contrast nephrotoxicity, radiation **[core]**
- **Magnetic resonance angiography:** alternative if renal impairment or contrast allergy; longer acquisition time

c) Name the 2 red-cell breakdown products that cause yellow discolouration (xanthochromia) of cerebrospinal fluid. (2 marks)

- **Oxyhaemoglobin** — appears within 1-4 hours of bleed; can also occur with traumatic tap **[core]**
- **Bilirubin** — appears within 12 hours, specific for in vivo haemolysis (NOT seen with traumatic tap, distinguishing feature) **[core]**
- **Methaemoglobin** (later, in chronic bleeds)

References: Ottawa SAH rule (Perry 2013) • eTG (Therapeutic Guidelines, current) • ACEM clinical policies and statements • Tintinalli's Emergency Medicine 9e Ch 167

Question 5 | Subarachnoid Haemorrhage — Management and Complications (12 marks)

A 50-year-old woman has been brought to your tertiary emergency department after a witnessed collapse at work, preceded by complaint of a severe headache. Glasgow Coma Score is now 8 (E2 V2 M4). She has been intubated. Her vital signs are: heart rate 115 beats per minute, blood pressure 200/110 millimetres of mercury, peripheral oxygen saturation 90 percent on fraction of inspired oxygen 0.8. Computed tomography of the brain shows hyperdense material in basal cisterns, sylvian fissures, and ventricular system, consistent with diffuse subarachnoid haemorrhage with intraventricular extension.

a) State the World Federation of Neurosurgical Societies grading scale for subarachnoid haemorrhage AND state the grade for this patient. (5 marks)

- **Grade I:** Glasgow Coma Score 15, no motor deficit [core]
- **Grade II:** Glasgow Coma Score 13-14, no motor deficit [core]
- **Grade III:** Glasgow Coma Score 13-14 WITH motor deficit [core]
- **Grade IV:** Glasgow Coma Score 7-12 (with or without motor deficit) [core]
- **Grade V:** Glasgow Coma Score 3-6. **This patient is Grade IV** (Glasgow Coma Score 8, intubated) [core]

b) List 5 immediate management priorities. (5 marks)

- **Maintain definitive airway with neuroprotective ventilation** — head-up 30°, PaCO₂ 35-40 millimetres of mercury, SpO₂ >94%, deep sedation with propofol and fentanyl [core]
- **Blood pressure control** — target systolic blood pressure less than 160 millimetres of mercury (mean arterial pressure 90-110); labetalol 10-20 mg bolus or nicardipine infusion; AVOID rapid fall (may worsen cerebral ischaemia) [core]
- **Nimodipine 60 mg orally / via nasogastric tube every 4 hours for 21 days** — reduces delayed cerebral ischaemia from vasospasm [core]
- **Urgent neurosurgical consultation** for aneurysm coiling or clipping; computed tomography angiography or digital subtraction angiography to identify source [core]
- **Seizure prophylaxis** — levetiracetam 40 mg/kg loading then 1 g twice daily for 7 days (emerging evidence — used in many centres) [core]
- Treat hyponatraemia (cerebral salt wasting, syndrome of inappropriate antidiuretic hormone secretion) — caution with fluid restriction
- Bedside glucose; treat hyperglycaemia (target 4-10 mmol/L)

c) List 2 acute pulmonary complications of subarachnoid haemorrhage. (2 marks)

- **Neurogenic pulmonary oedema** — catecholamine surge from raised intracranial pressure causes pulmonary capillary leak; presents with bilateral infiltrates, hypoxia [core]
- **Aspiration pneumonia** — from depressed consciousness; treat empirically with ceftriaxone + metronidazole [core]
- Acute respiratory distress syndrome (ARDS)
- Stress-induced cardiomyopathy / Takotsubo with secondary pulmonary congestion

References: WFNS grading system • Stroke Society of Australasia / Stroke Foundation Living Guideline 2024 • ANZICS neurocritical care recommendations • Tintinalli's Emergency Medicine 9e Ch 167

Question 6 | Adult Status Epilepticus (12 marks)

A 35-year-old woman is brought to your emergency department by ambulance after a witnessed prolonged generalised seizure that has been ongoing for 25 minutes. Her medical history is unknown to bystanders. She has received 5 milligrams of intramuscular midazolam by paramedics and 10 milligrams of intravenous diazepam in the resuscitation bay, but she continues to seize. Her vital signs are: heart rate 140 beats per minute, blood pressure 170/95 millimetres of mercury, peripheral oxygen saturation 92 percent on 8 litres oxygen via Hudson mask, temperature 38.5 degrees Celsius. Bedside glucose is 5.6 millimoles per litre.

a) Define convulsive status epilepticus AND state the stepwise pharmacological algorithm. (4 marks)

- **Definition:** continuous seizure activity ≥ 5 minutes OR ≥ 2 discrete seizures without recovery to baseline between (operational definition; older definition used 30 minutes) **[core]**
- **Step 1 (5-10 min):** benzodiazepine — midazolam 0.15 mg/kg IM/IV (e.g. 10 mg) OR diazepam 0.15 mg/kg IV, OR lorazepam 0.1 mg/kg IV (preferred where available) **[core]**
- **Step 2 (15-20 min — refractory):** levetiracetam 60 mg/kg IV (max 4500 mg) over 5-10 minutes — first-line per ESETT/ConSEPT trials; OR phenytoin 20 mg/kg IV over 20 minutes (cardiac monitoring) OR sodium valproate 40 mg/kg IV **[core]**
- **Step 3 (40-60 min — super-refractory):** rapid sequence induction with thiopentone 3-5 mg/kg or propofol 2 mg/kg + rocuronium; ICU admission with continuous EEG; midazolam, propofol, or pentobarbital infusion **[core]**

b) List 5 differential diagnoses for status epilepticus in this previously well woman. (5 marks)

- **Hypoglycaemia** (always exclude with bedside glucose; treat with 10 percent dextrose 100 mL IV if low) **[core]**
- **Central nervous system infection** — meningitis, encephalitis, brain abscess (fever supportive) **[core]**
- **Toxin / drug overdose** — tricyclic antidepressants, isoniazid, theophylline, cocaine, amphetamines, alcohol withdrawal **[core]**
- **Intracranial haemorrhage** — subarachnoid, intracerebral, subdural **[core]**
- **Eclampsia** if pregnant or postpartum < 6 weeks **[core]**
- Electrolyte disturbance — hyponatraemia, hypocalcaemia, hypomagnesaemia
- Brain tumour, neurocysticercosis (especially with travel history)
- Posterior reversible encephalopathy syndrome
- Hyperthermia from heat stroke or serotonin syndrome

c) List 3 serious complications of prolonged status epilepticus. (3 marks)

- Hypoxia and aspiration pneumonia **[core]**
- Rhabdomyolysis with acute kidney injury and hyperkalaemia **[core]**
- Hyperthermia and metabolic acidosis **[core]**
- Cerebral oedema and hypoxic-ischaemic injury
- Cardiac arrhythmias
- Pulmonary oedema (neurogenic)
- Long-term neurological sequelae — memory, cognitive impairment

References: eTG (Therapeutic Guidelines, current) • ACEM clinical policies and statements • ESETT trial (NEJM 2019) • Tintinalli's Emergency Medicine 9e Ch 171

Question 7 | First Adult Seizure (11 marks)

A 27-year-old previously healthy woman is brought to your suburban emergency department after a witnessed first-ever generalised tonic-clonic seizure. The seizure was witnessed by her partner and self-resolved after 5 minutes, followed by 30 minutes of post-ictal confusion. She is now alert and orientated. Her vital signs are: heart rate 105 beats per minute, blood pressure 123/84 millimetres of mercury, peripheral oxygen saturation 99 percent on room air, Glasgow Coma Score 15. Neurological examination is non-focal. Bedside glucose is 5.4 millimoles per litre.

a) List 4 causes for a first seizure to consider. (4 marks)

- **Idiopathic / cryptogenic epilepsy** (diagnosis of exclusion) **[core]**
- **Structural brain lesion** — tumour, vascular malformation, prior stroke, traumatic brain injury **[core]**
- **Drug / toxin** — alcohol withdrawal, stimulants (cocaine, amphetamines), tricyclic antidepressants, isoniazid **[core]**
- **Metabolic** — hypoglycaemia, hyponatraemia, hypocalcaemia, hypomagnesaemia, uraemia **[core]**
- Central nervous system infection — meningitis, encephalitis
- Eclampsia (if pregnant)
- Sleep deprivation, photosensitivity, intercurrent illness in known epileptic

b) List 4 reasons to perform urgent computed tomography of the brain. (4 marks)

- Persistent altered mental status, focal neurological deficit, or post-ictal Todd's paresis **[core]**
- First seizure in adult ≥ 40 years (higher risk of structural lesion) **[core]**
- Recent head injury, history of cancer, or anticoagulant use **[core]**
- Suspected meningitis / signs of raised intracranial pressure (papilloedema, focal signs, decreased Glasgow Coma Score) **[core]**
- Immunocompromised state (HIV, post-transplant)
- Persistent severe headache or focal seizure features

c) State 3 components of safe-discharge advice for a first seizure with normal investigation. (3 marks)

- **Driving restriction** — patient must NOT drive; self-report to relevant licensing authority (Austroads Fitness to Drive — minimum 6 months for non-commercial, 5 years for commercial) **[core]**
- **Safety advice** — avoid swimming alone, operating heavy machinery, working at heights, bathing alone (showers preferred over baths) **[core]**
- **Outpatient neurology referral within 2 weeks** — for outpatient electroencephalography, magnetic resonance imaging, and consideration of antiepileptic drug therapy **[core]**
- Information leaflet / first-aid for further seizures to provide to family and carer
- Clear return-to-emergency-department criteria — further seizure, prolonged post-ictal state, focal neurology

References: eTG (Therapeutic Guidelines, current) • ACEM clinical policies and statements • Austroads Assessing Fitness to Drive guidelines (current) • Tintinalli's Emergency Medicine 9e Ch 171

Question 8 | Bacterial Meningitis (12 marks)

A 30-year-old woman presents to your emergency department with fever, headache, photophobia, and neck stiffness for 5 days. Her symptoms initially started like an upper respiratory tract infection and have not improved despite oral antibiotics commenced by her general practitioner. On arrival her temperature is 38.8 degrees Celsius, heart rate 110 beats per minute, blood pressure 125/72 millimetres of mercury, respiratory rate 22 breaths per minute, Glasgow Coma Score 15. Examination reveals nuchal rigidity, positive Kernig's and Brudzinski's signs, but no focal neurology and no rash.

a) List 5 contraindications to immediate lumbar puncture. (5 marks)

- **Cardiovascular instability / shock** — resuscitate first; do not delay antibiotics [core]
- **Signs of raised intracranial pressure** — papilloedema, focal neurological deficit, decreased Glasgow Coma Score, posturing, Cushing's triad [core]
- **Coagulopathy / thrombocytopenia** — platelets $<50 \times 10^9/L$, INR >1.5 [core]
- **Local infection at lumbar puncture site** (skin sepsis, spinal abscess) [core]
- **Anticoagulant use** — withhold heparin for 12-24 hours, low-molecular-weight heparin for 12 hours; reverse vitamin K antagonist if INR raised [core]
- Spinal cord injury / spinal pathology
- Recent seizure (focal — defer until imaging completed)

b) State the empirical IV antibiotic regimen with rationale. (4 marks)

- **Ceftriaxone 2 g intravenous twice daily** (or cefotaxime 2 g intravenous every 6 hours) — covers *Streptococcus pneumoniae* and *Neisseria meningitidis* [core]
- **+ Benzylpenicillin 2.4 g intravenous every 4 hours** if *Listeria* suspected — pregnancy, age >50 , immunocompromised, alcohol misuse (NB this patient might benefit if specific risk factors) [core]
- **+ Vancomycin 25 mg/kg loading then 15-20 mg/kg every 12 hours** if suspected pneumococcal with cephalosporin resistance (rare in Australia) [core]
- **+ Dexamethasone 10 mg intravenous every 6 hours for 4 days** (give with or just BEFORE first antibiotic dose) — reduces neurological sequelae and mortality in pneumococcal meningitis [core]
- **+ Aciclovir 10 mg/kg every 8 hours** if encephalitis suspected (decreased Glasgow Coma Score, focal signs, vesicular rash)
- Notify public health if meningococcal disease confirmed; post-exposure prophylaxis for close contacts

c) List 3 cerebrospinal fluid features that support bacterial meningitis (typical findings). (3 marks)

- **Polymorph (neutrophil) predominance** (typically >50 percent; counts often $>500 \times 10^6/L$) [core]
- **Elevated protein** (>1 g/L) and **low glucose** (CSF:serum ratio <0.4) [core]
- **Gram stain positive** (60-90 percent sensitivity); culture confirms organism [core]
- Lactate >3.5 mmol/L; bacterial PCR may detect organism in culture-negative cases (especially if antibiotics already given)

References: eTG (Therapeutic Guidelines, current) • ANZ College of Emergency Medicine clinical guidelines • ACEM clinical policies and statements • Tintinalli's Emergency Medicine 9e Ch 175

Question 9 | Viral Encephalitis (10 marks)

A 45-year-old man is brought to your emergency department with 3 days of fever, headache, and progressive confusion. He had a brief generalised seizure in the ambulance. On arrival, his temperature is 38.7 degrees Celsius, heart rate 105 beats per minute, blood pressure 130/80 millimetres of mercury, respiratory rate 22 breaths per minute, peripheral oxygen saturation 96 percent on room air. Glasgow Coma Score is 12 (E3 V3 M6) with no focal neurological deficit but disoriented in time and place. There is no rash, neck stiffness mild.

a) List 4 features distinguishing encephalitis from meningitis. (4 marks)

- **Altered mental state / consciousness** predominates in encephalitis (parenchymal involvement) — cognitive change, behavioural abnormality, hallucinations **[core]**
- **Seizures and focal neurological deficits** common in encephalitis (uncommon in meningitis) **[core]**
- **Neck stiffness less prominent** in encephalitis (meningeal inflammation less severe), although meningoencephalitis is common **[core]**
- **Magnetic resonance imaging changes** — encephalitis often shows temporal lobe / limbic involvement (HSV); meningitis shows leptomeningeal enhancement **[core]**
- Cerebrospinal fluid in viral encephalitis: lymphocytic pleocytosis (10-1000 cells), mildly raised protein, normal glucose

b) State the empirical management AND list 3 investigations. (4 marks)

- **Aciclovir 10 mg/kg intravenous every 8 hours** (renal dose adjustment); start empirically before lumbar puncture if HSV encephalitis suspected (do NOT delay) **[core]**
- **Empirical antibiotic cover** as for bacterial meningitis (ceftriaxone 2 g BD + benzylpenicillin if Listeria risk) until lumbar puncture results available **[core]**
- **Lumbar puncture** (after CT to exclude raised intracranial pressure given decreased GCS) — cell count, protein, glucose, Gram stain, culture, viral PCR (HSV-1, HSV-2, VZV, enterovirus, parechovirus, JC virus); send paired serum **[core]**
- **Magnetic resonance imaging brain** with contrast — temporal lobe abnormalities support HSV encephalitis (more sensitive than CT) **[core]**
- Electroencephalography — focal slowing or epileptiform discharges over temporal lobes
- HIV testing, autoimmune encephalitis screen (NMDA receptor, LGI1, GABA-B antibodies)

c) List 2 considerations for autoimmune encephalitis (non-infective). (2 marks)

- **Anti-NMDA receptor encephalitis** — young women, psychiatric symptoms, dyskinesias, seizures, autonomic instability; associated with ovarian teratoma — perform pelvic ultrasound **[core]**
- **Treatment** — high-dose corticosteroids (methylprednisolone 1 g IV daily for 5 days), intravenous immunoglobulin or plasma exchange; second-line: rituximab, cyclophosphamide; neurology / neuro-immunology consultation **[core]**
- LGI1, CASPR2, GABA-B antibody-mediated encephalitis

References: eTG (Therapeutic Guidelines, current) • ACEM clinical policies and statements • Tintinalli's Emergency Medicine 9e Ch 175 • Australian Encephalitis Consortium guidelines

Question 10 | Acute Vertigo — Central versus Peripheral (12 marks)

A 60-year-old male with type 2 diabetes mellitus and treated hypertension presents to your emergency department with a 4-hour history of severe rotatory vertigo (described as the room spinning), nausea, and multiple episodes of vomiting. He feels unsteady on his feet and is unable to ambulate. His blood pressure is 175/95 millimetres of mercury; other vital signs are within normal limits. There is no preceding upper respiratory tract infection or recent head injury. He has had no previous episodes of vertigo.

a) Complete the table — list 3 peripheral and 3 central causes of vertigo. (6 marks)

- **PERIPHERAL — Benign paroxysmal positional vertigo (BPPV — brief positional, brief duration) [core]**
- **PERIPHERAL — Vestibular neuritis** (post-viral, days of severe vertigo with preserved hearing) **[core]**
- **PERIPHERAL — Ménière's disease** (episodes with tinnitus, hearing loss, fullness) **[core]**
- **CENTRAL — Cerebellar / brainstem stroke** (infarct or haemorrhage in posterior circulation; AICA, PICA territory) **[core]**
- **CENTRAL — Vertebrobasilar TIA [core]**
- **CENTRAL — Migrainous vertigo** (younger patients with migraine history); demyelination (multiple sclerosis); brain tumour **[core]**
- Labyrinthitis (peripheral but with hearing loss); ototoxicity; perilymphatic fistula

b) Describe the HINTS-plus examination AND state the interpretation indicating a central cause. (4 marks)

- **HI — head-impulse test:** a **CORRECTIVE** saccade with head turning indicates peripheral lesion; a **NORMAL** test (no corrective saccade) is concerning for **CENTRAL** cause **[core]**
- **N — nystagmus:** vertical, torsional, or direction-changing nystagmus indicates **CENTRAL**; horizontal unidirectional nystagmus that does not change direction with gaze is peripheral **[core]**
- **TS — test of skew:** vertical misalignment of eyes on alternate cover test (skew deviation) indicates **CENTRAL [core]**
- **Plus: hearing loss** (new-onset sensorineural hearing loss) is concerning for AICA-territory infarct (NOT a peripheral feature in this context) **[core]**
- **Any one of: Normal HI / direction-changing or vertical nystagmus / Skew deviation = CENTRAL** (more sensitive than early MRI for stroke)

c) List 2 indications for advanced imaging (magnetic resonance imaging) in this patient. (2 marks)

- **HINTS-plus suggesting central cause** (in this 60-year-old with vascular risk factors, low threshold) **[core]**
- **Focal neurological signs —** cranial nerve palsy, dysarthria, dysphagia, ataxia, weakness, loss of pain/temperature on the face or contralateral body **[core]**
- Failure of conservative management of presumed peripheral vertigo over 24-48 hours
- Severe headache, neck pain (consider vertebral artery dissection)

References: HINTS-plus (Kattah 2009) • eTG (Therapeutic Guidelines, current) • ACEM clinical policies and statements • Tintinalli's Emergency Medicine 9e Ch 169

Question 11 | Acute Migraine and Cluster Headache (11 marks)

A 33-year-old woman presents to your emergency department with a recurrent severe headache. She describes the pain as throbbing, unilateral on the right side, severity 9/10, with associated nausea, vomiting, and photophobia. She has had similar episodes in the past, occurring approximately once per month, lasting 24-48 hours. She is currently 10 hours into the present episode. Her vital signs are normal. Neurological examination is non-focal.

a) List 4 features supporting migraine. (4 marks)

- **Recurrent episodic headache lasting 4-72 hours** with previous similar episodes [core]
- **At least 2 of: unilateral, pulsating, moderate-severe intensity, aggravated by physical activity** (POUND criteria) [core]
- **Associated with at least 1 of: nausea or vomiting, photophobia and phonophobia** [core]
- Aura preceding the headache (visual, sensory, speech) in migraine with aura [core]
- Family history of migraine
- Trigger identification — stress, hormonal, specific foods (chocolate, red wine, aged cheese)

b) List 5 first-line treatments for migraine, each from a different drug class, with dose. (5 marks)

- **Paracetamol 1 g intravenous** over 15 minutes (or 1 g orally) — simple analgesic [core]
- **Aspirin 900 mg orally** OR ibuprofen 600 mg orally — non-steroidal anti-inflammatory [core]
- **Sumatriptan 6 mg subcutaneous** OR zolmitriptan 5 mg intranasal — triptan (serotonin 5-HT_{1B/1D} agonist) [core]
- **Metoclopramide 10 mg intravenous** OR prochlorperazine 12.5 mg intramuscular — antiemetic + antimigraine [core]
- **Chlorpromazine 12.5 mg intravenous** (fluid pre-load; observe for hypotension, extrapyramidal effects) — phenothiazine [core]
- **Ergotamine** orally (fewer trials in acute ED setting)
- **Dexamethasone 8 mg intravenous** (reduces recurrence)
- Avoid opioids (poor evidence, dependence risk)

c) List 2 features distinguishing cluster headache from migraine. (2 marks)

- **Cluster headache:** severe unilateral periorbital pain (excruciating, 'suicide headache'), shorter duration (15 min to 3 h), occurring in clusters with episode-free periods, more common in men [core]
- **Autonomic features** on the side of pain — ipsilateral conjunctival injection, lacrimation, nasal congestion / rhinorrhoea, ptosis, miosis (Horner's), facial sweating, restlessness / agitation [core]
- First-line acute treatment — high-flow oxygen 100 percent at 12-15 L/min and sumatriptan 6 mg subcutaneous (NOT triptan in basilar / hemiplegic migraine)

References: eTG (Therapeutic Guidelines, current) • ACEM clinical policies and statements • Tintinalli's Emergency Medicine 9e Ch 165 • International Classification of Headache Disorders

Question 12 | Hypertensive Encephalopathy (11 marks)

A 60-year-old woman presents to your emergency department complaining of a severe gradual-onset headache, blurred vision, and new-onset confusion. Her past medical history includes treated essential hypertension and chronic kidney disease (estimated glomerular filtration rate 35 millilitres per minute). Her vital signs are: heart rate 60 beats per minute, blood pressure 220/130 millimetres of mercury, respiratory rate 20 breaths per minute, peripheral oxygen saturation 96 percent on room air, temperature 37.0 degrees Celsius, Glasgow Coma Score 13 (E3 V4 M6). Computed tomography of the brain shows symmetric vasogenic oedema in the parieto-occipital region but no haemorrhage.

a) Define hypertensive emergency, urgency, AND state the diagnosis here. (3 marks)

- **Hypertensive emergency** = severe hypertension (typically systolic >180 OR diastolic >120 millimetres of mercury) WITH evidence of acute target-organ damage (encephalopathy, stroke, ACS, pulmonary oedema, aortic dissection, AKI, eclampsia) **[core]**
- **Hypertensive urgency** = severely elevated blood pressure WITHOUT acute target-organ damage (typically asymptomatic; treated over 24-48 hours with oral agents) **[core]**
- **This patient: posterior reversible encephalopathy syndrome (PRES) secondary to hypertensive emergency** — vasogenic oedema in posterior circulation territories, often associated with acute hypertension, renal failure, immunosuppression **[core]**

b) List 4 antihypertensive options with dose, route, and one advantage of each. (4 marks)

- **Labetalol 20 mg intravenous bolus** (repeat every 10 min, max 300 mg) OR infusion 20-160 mg/h — combined α/β blockade; rapid onset, predictable, useful in pregnancy **[core]**
- **Nicardipine infusion 5-15 mg/h intravenous** — calcium channel blocker; smooth titration, no major heart rate effect; useful in renal impairment **[core]**
- **Hydralazine 5-10 mg intravenous bolus every 20 min**; effective but causes reflex tachycardia (combine with β -blocker) **[core]**
- **Glyceryl trinitrate infusion 5-200 mcg/min intravenous** — useful in pulmonary oedema and acute coronary syndrome contexts; tolerance with prolonged use **[core]**
- Sodium nitroprusside (rarely used now — cyanide toxicity risk in renal impairment)
- Esmolol — short-acting; useful for aortic dissection where rate control is paramount

c) State 4 management priorities AND state the blood pressure target. (4 marks)

- **Blood pressure target:** reduce mean arterial pressure by no more than 20-25 percent in the first hour, then to ~160/100 over the next 6-8 hours, then towards normotensive over 24-48 hours; **avoid rapid fall** (cerebral and renal hypoperfusion) **[core]**
- **Continuous arterial-line blood pressure monitoring** in resus / high-dependency unit; intermittent neurological assessment **[core]**
- **Investigate end-organ damage** — 12-lead electrocardiogram, troponin, urea and electrolytes, urinalysis (proteinuria, haematuria), funduscopy (papilloedema, haemorrhages, exudates) **[core]**
- **Consider underlying causes** — secondary hypertension (renal artery stenosis, pheochromocytoma, primary aldosteronism), medication non-compliance, stimulant use **[core]**
- Magnetic resonance imaging brain to confirm PRES (symmetric T2/FLAIR hyperintensity in parieto-occipital regions)
- ICU / HDU admission; medical / nephrology / cardiology follow-up

Question 13 | Guillain-Barré Syndrome (12 marks)

A 26-year-old previously well woman presents to your emergency department with a 10-hour history of gradual onset of bilateral lower-limb weakness, paraesthesia, and low back ache. She has recently returned from a two-week holiday in Spain, during which she had a self-limiting diarrhoeal illness which she attributed to food poisoning. Her vital signs are: heart rate 100 beats per minute, blood pressure 130/80 millimetres of mercury, respiratory rate 36 breaths per minute (shallow), temperature 37.0 degrees Celsius. On examination, she has bilateral symmetric lower-limb weakness with absent ankle and knee reflexes.

a) List 4 differential diagnoses. (4 marks)

- **Spinal cord compression** (transverse myelitis, epidural abscess, haematoma, demyelination) **[core]**
- **Myasthenia gravis** (fluctuating weakness, oculobulbar features, ptosis) **[core]**
- **Botulism** (descending flaccid paralysis, cranial nerves affected first; food source) **[core]**
- **Tick paralysis** (Australia — Ixodes holocyclus); recent bushwalk, scalp tick **[core]**
- Heavy metal poisoning (arsenic, lead, thallium)
- Hypokalaemic periodic paralysis
- Acute intermittent porphyria
- Lyme disease, neurosyphilis

b) List 4 features on examination supporting Guillain-Barré syndrome. (4 marks)

- **Symmetric ascending lower-motor-neurone weakness** — distal predominance initially, ascends proximally over hours to days **[core]**
- **Areflexia / hyporeflexia** in affected limbs **[core]**
- **Sensory symptoms** — paraesthesia / numbness in glove-and-stocking distribution; back pain common **[core]**
- **Autonomic instability** — labile blood pressure, tachycardia, bradycardia, urinary retention, ileus **[core]**
- Bulbar weakness and respiratory muscle weakness in 30-40 percent (Miller Fisher variant — ophthalmoplegia, ataxia, areflexia)
- No fever (distinguishes from myelitis)

c) List 4 monitoring / management priorities (with specific bedside parameters). (4 marks)

- **Bedside spirometry — forced vital capacity** every 2-4 hours; intubate if forced vital capacity <15-20 mL/kg, OR rapid decline (e.g. >30 percent in 24 h), OR maximum negative inspiratory pressure / negative inspiratory force less than -20 cm H₂O **[core]**
- **Continuous cardiac and blood pressure monitoring** — autonomic instability (arrhythmia, lability) **[core]**
- **Specific therapy: intravenous immunoglobulin 0.4 g/kg/day for 5 days OR plasma exchange** (5 sessions over 1-2 weeks); equally effective; combination not additive; corticosteroids NOT effective **[core]**
- **Lumbar puncture** — albuminocytological dissociation (raised protein with normal cell count) — present 50 percent at 1 week; nerve conduction studies — demyelination **[core]**
- Venous thromboembolism prophylaxis — low-molecular-weight heparin
- Pain management; pressure-area care; psychological support
- Intensive care unit / high-dependency unit admission for monitoring of respiratory and autonomic function

References: eTG (Therapeutic Guidelines, current) • ACEM clinical policies and statements • Tintinalli's Emergency Medicine 9e Ch 173 • Cochrane GBS reviews

Question 14 | Myasthenic Crisis (11 marks)

A 36-year-old woman with known myasthenia gravis (treated with pyridostigmine 60 milligrams orally every 4 hours) presents with progressive weakness, diplopia, dysphagia, and increasing shortness of breath over 24 hours. She has had a recent upper respiratory tract infection. On examination, she has bilateral ptosis, weak neck flexion, and difficulty swallowing her saliva. Her vital signs are: heart rate 110 beats per minute, blood pressure 130/85 millimetres of mercury, respiratory rate 32 breaths per minute (shallow, paradoxical breathing), peripheral oxygen saturation 92 percent on room air, temperature 37.4 degrees Celsius. Forced vital capacity is 12 millilitres per kilogram.

a) Distinguish myasthenic crisis from cholinergic crisis (3 features). (3 marks)

- **Myasthenic crisis:** weakness from INSUFFICIENT acetylcholine receptor stimulation; precipitated by infection, stress, missed pyridostigmine dose, medications (aminoglycosides, fluoroquinolones, β -blockers, magnesium); no muscarinic excess **[core]**
- **Cholinergic crisis:** weakness from EXCESSIVE acetylcholine (overdose of pyridostigmine); muscarinic features — **SLUDGE** (salivation, lacrimation, urination, defaecation, gastrointestinal upset, emesis), miosis, bradycardia, fasciculations **[core]**
- **Edrophonium (Tensilon) test** — improvement in myasthenic crisis, worsening in cholinergic crisis (now rarely used; clinical context plus serial assessment preferred) **[core]**
- **This patient = myasthenic crisis** (recent URTI, no muscarinic features, weak with no SLUDGE)

b) State 4 management priorities for myasthenic crisis. (4 marks)

- **Definitive airway and ventilation** — intubation (forced vital capacity <15 mL/kg, or rapidly declining; bulbar weakness with aspiration risk); rapid sequence induction with **rocuronium 1.2 mg/kg (NOT suxamethonium** — unpredictable response in myasthenia) **[core]**
- **Hold pyridostigmine** (avoid exacerbating respiratory secretions during ventilation) once intubated; restart post-extubation **[core]**
- **Specific immunotherapy:** intravenous immunoglobulin 0.4 g/kg/day for 5 days OR plasma exchange (5 sessions); both equally effective for crisis **[core]**
- **High-dose corticosteroids** — methylprednisolone 1 g/day intravenous (may transiently worsen weakness in first week — start in monitored setting, often after IVIg / plasma exchange) **[core]**
- Treat precipitant — infection (cultures, antibiotics — AVOID aminoglycosides, fluoroquinolones, macrolides where possible)
- Neurology consultation; intensive care unit admission
- Avoid contraindicated medications (full list available; consult pharmacist)

c) List 4 medications to AVOID in myasthenia gravis. (4 marks)

- **Aminoglycosides** (gentamicin, tobramycin) **[core]**
- **Fluoroquinolones** (ciprofloxacin, levofloxacin) **[core]**
- **Macrolides** (azithromycin, erythromycin) **[core]**
- **β -blockers** (metoprolol, propranolol) **[core]**
- Magnesium (intravenous; oral usually safe)
- Calcium-channel blockers
- Suxamethonium (unpredictable, prolonged paralysis)
- Penicillamine, immune-checkpoint inhibitors
- Hydroxychloroquine, chloroquine

References: eTG (Therapeutic Guidelines, current) • ACEM clinical policies and statements • Tintinalli's Emergency Medicine 9e Ch 173

Question 15 | Cauda Equina Syndrome (12 marks)

A 52-year-old man with a history of metastatic prostate cancer presents to your emergency department with a 24-hour history of severe lower back pain radiating bilaterally into both legs, urinary retention, and saddle anaesthesia. On examination, he has bilateral lower-limb weakness (Medical Research Council 3/5), decreased sensation in the perineal region, and reduced anal tone. Bladder scan reveals 800 millilitres of retained urine.

a) List 4 features of cauda equina syndrome. (4 marks)

- **Bilateral lower-limb weakness or radiculopathy** in dermatomal distribution (L4-S5) [core]
- **Saddle (perineal) anaesthesia** — S2-S5 distribution, perineum, buttocks, posterior thighs [core]
- **Urinary retention or incontinence** with overflow; reduced bladder sensation [core]
- **Reduced anal tone** on rectal examination; absent anal wink and bulbocavernosus reflexes [core]
- Faecal incontinence
- Sexual dysfunction
- Severe back pain

b) List 4 emergency department management priorities. (4 marks)

- **Urgent magnetic resonance imaging of the lumbar spine** (whole spine if metastatic disease) — definitive diagnosis; identifies level and cause [core]
- **Urgent neurosurgical (or spinal surgical) consultation** — for surgical decompression (target within 24-48 h to preserve neurological function) [core]
- **Urinary catheterisation** for retention; document residual volume and ongoing output [core]
- **High-dose corticosteroids** if metastatic cord compression — **dexamethasone 16 mg intravenous loading dose**, then 8 mg twice daily; reduces oedema [core]
- Adequate analgesia — opioid titrated; non-steroidal anti-inflammatory if no contraindication
- Investigate underlying cause — bloods (FBC, U&E, LFTs, PSA in this case), tumour markers; consider CT for staging if metastatic
- Radiation oncology consultation for palliative radiotherapy in metastatic disease

c) List 4 differential diagnoses for cauda equina syndrome. (4 marks)

- **Lumbar disc herniation** (most common in non-malignant cases — central / paracentral L4-S1) [core]
- **Spinal metastases / tumour** (particularly prostate, breast, lung, myeloma, lymphoma) [core]
- **Epidural abscess** — fever, IV drug use, diabetes, immunocompromise [core]
- **Epidural haematoma** — anticoagulation, post-spinal procedure [core]
- Spinal stenosis with acute decompensation
- Trauma — fracture or dislocation
- Transverse myelitis
- Cauda equina from vascular insult (rare)

References: eTG (Therapeutic Guidelines, current) • ACEM clinical policies and statements • Tintinalli's Emergency Medicine 9e Ch 274 • NICE Cauda equina syndrome guidelines

Question 16 | Bell's Palsy and Differentials (10 marks)

A 38-year-old man presents to your emergency department with sudden-onset right-sided facial weakness that he noticed on waking this morning. He is unable to close his right eye fully, has drooping of the right side of his mouth, and difficulty drinking. He has no other neurological symptoms, no headache, no recent illness, no rash, no recent travel. Examination confirms a complete right-sided facial weakness (House-Brackmann grade VI) involving both upper and lower face, including loss of the forehead wrinkle and weak eye closure. The remainder of his neurological examination is normal.

a) List 3 features distinguishing peripheral 7th nerve palsy from a central (upper-motor-neurone) lesion. (3 marks)

- **Forehead involvement** — peripheral (lower-motor-neurone) lesions affect the WHOLE side of the face including forehead; central lesions SPARE the forehead due to bilateral cortical innervation of the upper face **[core]**
- **Bell's phenomenon** — visible upward rolling of the eye on attempted closure (in peripheral lesion the eye does not fully close) **[core]**
- Other central signs — hemiparesis, dysarthria, hemisensory loss, visual field defect — absent in isolated peripheral lesion **[core]**
- Hyperacusis, taste alteration (if lesion proximal to chorda tympani / nerve to stapedius) — peripheral
- Vesicles in ear / palate — Ramsay Hunt syndrome (varicella zoster reactivation)

b) List 4 causes of peripheral 7th nerve palsy other than idiopathic Bell's palsy. (4 marks)

- **Ramsay Hunt syndrome** — varicella zoster reactivation (vesicles in ear or palate; treat with high-dose aciclovir + steroid) **[core]**
- **Lyme disease** (Borrelia) — particularly in endemic areas; bilateral facial palsy common **[core]**
- **Otitis media / cholesteatoma** — spreading infection **[core]**
- **Tumour** — parotid gland (NB facial nerve traverses parotid), acoustic neuroma, skull-base tumour; gradual progression **[core]**
- Trauma — temporal bone fracture
- Sarcoidosis, vasculitis, multiple sclerosis
- HIV seroconversion
- Diabetes mellitus

c) State 3 components of management AND state the natural history. (3 marks)

- **Prednisolone 50 mg orally daily for 10 days** if presenting within 72 hours of onset (Cochrane evidence — improves complete recovery rate) **[core]**
- **Eye protection** — artificial tears during the day, lubricating ointment at night, eye taping at night to prevent exposure keratitis **[core]**
- **Antiviral (valaciclovir 1 g three times daily for 7 days)** — combination with steroid considered in severe cases (Cochrane evidence equivocal but commonly used in House-Brackmann grade IV-VI) **[core]**
- **Natural history:** 70 percent complete recovery within 3 weeks; 85 percent improved by 3 months; 10-15 percent persistent deficit (synkinesis, weakness, contracture)
- Outpatient review at 1-2 weeks; ENT / neurology referral if no improvement at 3-4 weeks

References: eTG (Therapeutic Guidelines, current) • ACEM clinical policies and statements • Tintinalli's Emergency Medicine 9e Ch 174 • Cochrane Bell's Palsy reviews

Question 17 | Delirium in the Elderly (12 marks)

An 82-year-old woman from a residential aged-care facility is brought to your emergency department by ambulance with increasing confusion and agitation over the past 48 hours. The carers report she is combative, intermittently disorientated, and visually hallucinating. She has a history of treated hypertension, atrial fibrillation (on apixaban), and type 2 diabetes mellitus. Her premorbid Mini-Mental State Examination two weeks ago was 24/30. Her vital signs are: heart rate 105 beats per minute, blood pressure 145/85 millimetres of mercury, respiratory rate 22 breaths per minute, peripheral oxygen saturation 95 percent on room air, temperature 37.8 degrees Celsius.

a) List 4 features distinguishing delirium from dementia. (4 marks)

- **Onset:** delirium = acute (hours to days); dementia = insidious (months to years) **[core]**
- **Course:** delirium = fluctuating ('sundowning' or hour-to-hour change in conscious state); dementia = stable / slowly progressive **[core]**
- **Conscious state / attention:** delirium = impaired (hyperactive, hypoactive, or mixed); dementia = preserved until late stage **[core]**
- **Reversibility:** delirium = reversible with treatment of underlying cause; dementia = progressive, generally irreversible **[core]**
- Perceptual disturbances (visual hallucinations) and psychomotor abnormalities common in delirium, uncommon early in dementia (except Lewy body)
- Delirium has identifiable precipitant; dementia does not

b) List 5 diagnostic categories for organic delirium AND give an example of each (be specific to this patient). (5 marks)

- **Infection:** urinary tract infection (most common in elderly), pneumonia, sepsis, cellulitis, central nervous system infection **[core]**
- **Metabolic / endocrine:** hyponatraemia, hypercalcaemia, uraemia, hepatic encephalopathy, hypoglycaemia, thyroid dysfunction **[core]**
- **Drug-related:** anticholinergics, benzodiazepines, opioids, alcohol withdrawal, polypharmacy, recent medication change; review medications including over-the-counter **[core]**
- **Cardiovascular / vascular:** acute coronary syndrome, congestive cardiac failure, arrhythmia, stroke / transient ischaemic attack, hypoperfusion **[core]**
- **Intracranial pathology:** subdural haematoma (anticoagulated and falls), ischaemic stroke, intracerebral haemorrhage, tumour **[core]**
- Trauma — recent fall with occult head injury
- Pain (untreated) and constipation / urinary retention (common reversible causes in elderly)
- Environmental — sleep disturbance, sensory impairment, ICU psychosis

c) List 3 immediate management priorities specific to this delirious patient. (3 marks)

- **Investigate and treat underlying cause** — bedside glucose, urinalysis with culture, FBC, U&E, LFTs, calcium, magnesium, TSH, blood cultures if febrile, ECG, CXR; CT head if focal signs or suspicion of intracranial pathology (anticoagulant + fall risk) **[core]**
- **Non-pharmacological measures first** — quiet environment, family / carer presence, consistent staff, glasses and hearing aids, orientation cues, pain control, treat constipation / retention **[core]**
- **Pharmacological sedation as last resort** — olanzapine 2.5-5 mg orally / wafer (preferred in elderly over haloperidol given lower QTc / Parkinsonism risk); avoid benzodiazepines (worsen delirium except in alcohol withdrawal) **[core]**

- Multidisciplinary review — geriatrics, social work, delirium team, occupational therapy
- Communicate with family, carer, and clear documentation

References: *eTG (Therapeutic Guidelines, current)* • *ACEM clinical policies and statements* • *Tintinalli's Emergency Medicine 9e Ch 165*

Question 18 | Ventriculo-Peritoneal Shunt Malfunction (11 marks)

An 18-year-old male with a known history of childhood hydrocephalus (treated with ventriculo-peritoneal shunt inserted at age 10, last revised 3 years ago) is brought to your small rural emergency department by his parents. They report he has had increasing headache and vomiting for 2 days and is now confused. Examination reveals: temperature 37.3 degrees Celsius (per axilla), heart rate 114 beats per minute (regular), blood pressure 140/70 millimetres of mercury, Glasgow Coma Score 14 (E3 V5 M6). The nearest tertiary neurosurgical centre is 150 kilometres away.

a) List 4 differential diagnoses related to his shunt. (4 marks)

- **Shunt obstruction** — proximal (ventricular catheter blocked by tissue / blood / debris) or distal (peritoneal catheter blocked / migrated) **[core]**
- **Shunt infection** (typically presents <6 months post-revision) — classically *Staphylococcus epidermidis* or *aureus* **[core]**
- **Disconnection or fracture** of the shunt tubing **[core]**
- **Over-drainage / slit-ventricle syndrome** — excessive cerebrospinal fluid drainage causes orthostatic headache, ventricular collapse **[core]**
- Distal complications — pseudocyst, abdominal abscess, bowel perforation
- Subdural collection from over-drainage

b) List 4 investigations with rationale. (4 marks)

- **Computed tomography of the brain** — compare to previous imaging; ventricular size (enlarged = obstruction; collapsed = over-drainage); position of catheter tip **[core]**
- **Shunt series radiographs** (skull, chest, abdomen) — tracks the entire shunt to identify disconnection, fracture, migration **[core]**
- **Shunt tap** (by neurosurgeon — aseptically aspirate from reservoir / valve) — measures intracranial pressure, obtains cerebrospinal fluid for cell count, Gram stain, culture **[core]**
- **Full blood count, C-reactive protein, blood cultures** — infection workup **[core]**
- Magnetic resonance imaging if CT inconclusive (avoid if metallic valve incompatible)
- Abdominal ultrasound for distal pseudocyst

c) State 3 management priorities given the remote setting. (3 marks)

- **Telephone consultation with on-call neurosurgical team** at receiving tertiary centre; arrange retrieval; do not delay transfer for definitive imaging if high suspicion **[core]**
- **Treat raised intracranial pressure** — head-up 30°, intravenous mannitol 0.5-1 g/kg OR 3 percent saline 5 mL/kg if rapid deterioration; analgesia and anti-emetics; consider intubation with neuroprotective RSI if Glasgow Coma Score deteriorating **[core]**
- **Empirical antibiotics** if shunt infection suspected — vancomycin 30 mg/kg + ceftriaxone 2 g intravenous (or per local antibiogram); avoid lumbar puncture (risk of herniation; cerebrospinal fluid above blockage may not reflect ventricular fluid) **[core]**
- Continuous neurological observations during preparation and transport
- Avoid blind ventricular tap by non-neurosurgeon

References: eTG (Therapeutic Guidelines, current) • Tintinalli's Emergency Medicine 9e Ch 175 • ACEM clinical policies and statements

Question 19 | Spinal Epidural Abscess (11 marks)

A 48-year-old man with a history of intravenous drug use presents to your emergency department with 7 days of progressive severe back pain, fever, and now lower-limb weakness. On examination, he has exquisite tenderness over the L3 spinous process, fever 38.6 degrees Celsius, heart rate 110 beats per minute, blood pressure 105/65 millimetres of mercury. Bilateral lower-limb weakness (Medical Research Council 3/5) with hyperreflexia and bilateral up-going plantar responses, and a sensory level at L1. He is haemodynamically stable but clearly in significant discomfort.

a) List 4 risk factors for spinal epidural abscess. (4 marks)

- **Intravenous drug use** (this patient) — haematogenous spread, often *Staphylococcus aureus* [core]
- **Diabetes mellitus** — impaired immunity, vasculopathy [core]
- **Immunocompromise** — HIV, post-transplant, chemotherapy, chronic steroid use [core]
- **Recent invasive spinal procedure** — epidural anaesthesia / steroid, lumbar puncture, spinal surgery [core]
- Distant infection (skin, dental, urinary tract, endocarditis) with haematogenous spread
- Spinal trauma; chronic alcohol use; chronic kidney disease

b) State 4 immediate management priorities. (4 marks)

- **Urgent magnetic resonance imaging of the whole spine with gadolinium contrast** — definitive investigation; identifies abscess level, extent, and cord compression [core]
- **Empirical intravenous antibiotics** — cover *Staphylococcus aureus* including MRSA: **vancomycin 25 mg/kg loading then 15-20 mg/kg every 12 hours**, plus **ceftriaxone 2 g intravenous** or cefepime; ideally after blood cultures and aspirate [core]
- **Urgent neurosurgical consultation** for decompression and abscess drainage — definitive surgery within 24 hours of neurological deterioration; aim to preserve function [core]
- **Investigate source** — blood cultures (at least 2 sets), urinalysis, echocardiography (rule out endocarditis), skin examination [core]
- Multidisciplinary care — orthopaedics, infectious diseases, neurosurgery; intensive care unit admission if septic
- Adequate analgesia; venous thromboembolism prophylaxis

c) List 3 features of the classical triad AND state the diagnostic challenge. (3 marks)

- **Back pain** [core]
- **Fever** [core]
- **Neurological deficit** [core]
- **Diagnostic challenge:** complete triad present in only ~13 percent of cases at presentation; early diagnosis often delayed; high index of suspicion in risk-factor patients essential to preserve function

References: eTG (Therapeutic Guidelines, current) • ACEM clinical policies and statements • Tintinalli's Emergency Medicine 9e Ch 274 • IDSA Guidelines

Question 20 | Carotid Artery Dissection (9 marks)

A 35-year-old previously fit woman presents to your emergency department with sudden-onset severe right-sided neck pain associated with right Horner's syndrome (right partial ptosis, miosis, anhidrosis), headache, and pulsatile tinnitus that started while she was at her gym this morning. She had a recent viral illness 1 week ago. Her vital signs are within normal limits. Neurological examination reveals only the Horner's syndrome with no other focal deficits.

a) List 3 features supporting carotid artery dissection. (3 marks)

- **Acute ipsilateral neck pain** — often severe, often in the upper neck; with or without headache [core]
- **Horner's syndrome** (partial — ptosis and miosis WITHOUT anhidrosis if internal carotid only; anhidrosis indicates broader sympathetic involvement) [core]
- **Pulsatile tinnitus, transient ischaemic attack, or stroke symptoms** in carotid territory (amaurosis fugax, hemiparesis) [core]
- Younger patient (typical age 30-50)
- Often preceded by minor neck trauma (chiropractic manipulation, sport, coughing) or with connective tissue disorder (Marfan, Ehlers-Danlos)
- Cranial nerve palsies (IX, X, XII)

b) State the imaging modality of choice AND describe expected findings. (3 marks)

- **Computed tomography angiography of head and neck** — first-line; rapid; high sensitivity and specificity [core]
- **Findings:** irregular eccentric narrowing or 'string sign' of the internal carotid artery; intramural haematoma (crescentic eccentric mural thickening); pseudoaneurysm; complete occlusion in some cases [core]
- **Magnetic resonance imaging / magnetic resonance angiography** — alternative; shows intramural haematoma on T1 fat-suppressed sequences [core]
- Digital subtraction angiography is gold standard but rarely needed for diagnosis

c) State 3 management priorities. (3 marks)

- **Antithrombotic therapy** — aspirin 100 mg orally daily OR therapeutic anticoagulation (LMWH bridging to warfarin) for 3-6 months — trials show equivalent stroke prevention; balance bleeding risk in dissecting vessel [core]
- **Neurology / neurosurgery / vascular consultation** — multidisciplinary input; endovascular intervention (stenting) for haemodynamically significant lesions or ongoing thromboembolism [core]
- **Avoid neck manipulation, vigorous exercise, lifting, Valsalva** until follow-up imaging at 3-6 months confirms healing [core]
- Pain management; investigate underlying connective tissue disorder if young / multiple dissections
- Repeat imaging at 3-6 months to assess healing — most heal with conservative therapy

References: AHA Cervical Artery Dissection Statement • eTG (Therapeutic Guidelines, current) • ACEM clinical policies and statements • Tintinalli's Emergency Medicine 9e Ch 167

Question 21 | Behavioural Change with Organic Cause (11 marks)

A 60-year-old man is brought to your emergency department by ambulance after motorists reported him running among traffic with abnormal behaviour. He is agitated and disoriented. He has a known history of type 2 diabetes mellitus (on metformin and gliclazide) and hypertension. He has no known psychiatric history. Vital signs: heart rate 115 beats per minute, blood pressure 165/95 millimetres of mercury, respiratory rate 24 breaths per minute, peripheral oxygen saturation 96 percent on room air, temperature 37.6 degrees Celsius, capillary glucose 3.2 millimoles per litre.

a) List 6 historical features that would support an organic cause for the patient's presentation. (6 marks)

- Acute onset of altered behaviour (hours to days) without prior psychiatric history **[core]**
- Age >40 with first-presentation behavioural change **[core]**
- Visual hallucinations or perceptual disturbance (more common in organic / delirium than functional psychosis) **[core]**
- Fluctuating level of consciousness or attention **[core]**
- Recent illness, infection, head injury, drug / alcohol use, fall **[core]**
- Comorbid medical conditions and medications (diabetes — hypoglycaemia in this case; anticholinergics, opioids, sedatives, alcohol) **[core]**
- Disorientation to time, place, person
- Cognitive impairment / decline; abnormal vital signs

b) List 3 investigations with rationale relevant to this patient. (3 marks)

- **Bedside capillary blood glucose** (already 3.2 — hypoglycaemia is a treatable and life-threatening cause of altered behaviour); treat with 50 mL 50 percent dextrose intravenous **[core]**
- **Computed tomography of the brain** if no clear cause from initial workup — exclude intracranial pathology (stroke, haemorrhage, mass) **[core]**
- **Septic screen** — full blood count, C-reactive protein, blood cultures, urinalysis, chest radiograph; consider lumbar puncture if encephalitis / meningitis suspected **[core]**
- Electrolytes, urea, creatinine, calcium, magnesium, thyroid function — metabolic causes
- Liver function tests (hepatic encephalopathy); ammonia
- Toxicology screen — urine drug screen, ethanol; consider salicylate, paracetamol level if overdose concern

c) List 2 drug options for chemical sedation if verbal de-escalation fails AND the patient remains a danger. (2 marks)

- **Droperidol 10 mg intramuscular** (or 5 mg in elderly) — preferred per ACEM position statement; faster onset than haloperidol; less QT prolongation than originally feared **[core]**
- **Olanzapine 10 mg intramuscular / wafer** (5 mg in elderly) — less extrapyramidal effect; consider if second-line **[core]**
- Midazolam 5-10 mg intramuscular (or intravenous if access) — consider in combination if not responding to single agent; respiratory depression risk
- Ketamine 4-5 mg/kg IM (per ACEM statement on extreme behavioural disturbance — last resort, requires intensive monitoring)
- Continuous monitoring (airway, sedation depth, SpO₂, blood pressure) post-sedation

References: eTG (Therapeutic Guidelines, current) • ACEM clinical policies and statements • ACEM Acute Behavioural Disturbance Statement

Question 22 | Idiopathic Intracranial Hypertension (9 marks)

A 29-year-old obese woman (body mass index 38) presents to your emergency department with a 3-week history of progressively worsening headache, transient visual obscurations, and pulsatile tinnitus. She has no significant past medical history but recently started a course of doxycycline for acne. On examination she has bilateral papilloedema on fundoscopy, a Glasgow Coma Score of 15, and otherwise normal neurological examination. Vital signs are normal. Computed tomography of the brain is unremarkable.

a) List 3 risk factors for idiopathic intracranial hypertension. (3 marks)

- **Female sex, obesity, and reproductive age** (90 percent of cases) **[core]**
- **Drugs** — tetracyclines (especially doxycycline), oral contraceptive pill, vitamin A / retinoids, lithium, corticosteroid withdrawal **[core]**
- **Endocrine** — Addison's disease, Cushing's syndrome, hypoparathyroidism, hypothyroidism **[core]**
- Chronic kidney disease, anaemia
- Cerebral venous sinus thrombosis (must exclude first)

b) Describe the diagnostic workup. (3 marks)

- **Magnetic resonance imaging brain WITH magnetic resonance venography** — exclude secondary causes (cerebral venous sinus thrombosis, mass lesion); may show empty sella, distended optic nerve sheaths, transverse sinus stenosis **[core]**
- **Lumbar puncture with opening pressure measurement (in lateral decubitus position)** — greater than 25 cm H₂O confirms raised intracranial pressure; cerebrospinal fluid composition **NORMAL [core]**
- **Visual fields and ophthalmology consultation** — assess visual function and papilloedema severity **[core]**

c) State 3 components of management. (3 marks)

- **Cease offending drug** — discontinue doxycycline; review oral contraceptive pill, retinoids **[core]**
- **Acetazolamide 250-500 mg orally twice daily** (titrated up to 1 g BD as tolerated) — reduces cerebrospinal fluid production; first-line medical therapy **[core]**
- **Weight loss** — significant and sustained weight loss is the most important long-term intervention; multidisciplinary approach (dietitian, exercise, bariatric surgery in selected cases) **[core]**
- Therapeutic lumbar puncture (drain to opening pressure of ~10-15 cm H₂O) if symptomatic or visual deterioration
- Surgical interventions for refractory cases — optic nerve sheath fenestration (preserves vision), ventriculo-peritoneal shunt, transverse sinus stenting
- Neurology and ophthalmology follow-up

References: eTG (Therapeutic Guidelines, current) • ACEM clinical policies and statements • Tintinalli's Emergency Medicine 9e Ch 165