

REPORT OF GENERAL FELLOWSHIP EXAMINATION

AUGUST/SEPTEMBER 2004

This report is prepared to provide candidates, tutors and their Supervisors of training with information about the way in which the Examiners assessed the performance of candidates in the Examination. Answers provided are not model answers but guides to what was expected. Candidates should discuss the report with their tutors so that they may prepare appropriately for the future examinations.

Twenty-eight candidates presented for this examination. Thirteen were successful.

ORAL SECTIONS

Objectives Structured Clinical Examination (OSCE) Section

There were sixteen stations with six rest stations (including one before and after each of the three interactive stations). A systematic approach to the types of investigations examined was more likely to maximise the candidate's score. Candidates should ensure that they take note of the **carefully chosen clinical information** provided when considering their answer. It is imperative that candidates answer the specific question asked (eg. differential diagnosis, "the most likely" = give one, or "list five" means list up to five but **not** more).

Eighteen out of twenty-eight candidates passed the OSCE section overall.

Station:

1. **Rest station.**
2. **Chest X-Rays:** *Candidates were asked to describe the X-ray findings, list possible aetiologies, and suggest relevant further investigations. Examples included bilateral lung infiltrates, gastric dilatation, and a traumatic aortic injury.*

Three out of twenty-eight candidates passed this section.

3. **ECGs:** *Candidates were asked to list abnormalities and potential aetiologies, and provide suggestions regarding management. Examples included myocardial infarction, AV nodal re-entrant tachycardia, atrial flutter with bifascicular block, and hyperkalemia.*

Eleven out of twenty-eight candidates passed this section.

4. **Biochemistry:** *Candidates were asked to describe abnormalities and list possible aetiologies. Examples included hepatic and renal dysfunction, plasmacholinesterase deficiency (homozygous), an elevated osmolar gap, and a normal anion gap (renal tubular) metabolic acidosis.*

Fifteen out of twenty-eight candidates passed this section.

5. **Rest station.**

6. **Procedure station:** *Candidates were expected to provide a systematic approach to the principle of insertion, management and removal of an Intra-Aortic Balloon Pump catheter.*

The scenario provided was as follows:

This 67-year-old male was admitted to the Intensive Care Unit 6 hours ago following emergency coronary artery bypass grafting. He has remained hypotensive (mean arterial pressure of 60 mmHg) and oliguric, despite adequate fluid loading to a right atrial pressure of 15 mmHg and an adrenaline infusion at 20 mg/min.

A recent transoesophageal echocardiogram demonstrates global severe systolic dysfunction and no evidence of pericardial tamponade.

You have been asked to consider inserting an intra-aortic balloon pump by the attending team.

Consider your approach and preparation for this procedure.

Introductory question: *What do you think of the suggestion for inserting a balloon pump in this patient?*

Nineteen out of twenty-eight candidates passed this section.

7. **Rest station.**

8. **Procedure station:** *Candidates were expected to provide a systematic approach to the principles of insertion and management of a Minnesota tube.*

The scenario provided was as follows:

A 50-year-old man, with a history of cirrhosis due to hepatitis C and known gastroesophageal varices, is admitted to the Intensive Care Unit with massive haematemesis and melaena from the endoscopy suite.

Fifteen out of twenty-eight candidates passed this section.

9. **Rest station.**

10. **Communication station:** *Candidates were expected to provide an empathic explanation of the situation, using appropriate body language, and appropriate attention to the needs of the mother. The clinical scenario provided was as follows:*

You are the intensivist in charge of the unit where a 15 year old boy (John) is critically ill having been a pedestrian hit by a motor vehicle. He has sustained severe chest injuries complicated by significant blood loss.

It is now day 3 into his admission, he is sedated and mechanically ventilated. The patient and his mother are both Jehovah's Witnesses and his mother has refused administration of blood products to her son during this admission.

His clinical condition is such that he is now developing end-organ dysfunction and a lactic acidosis associated with a haemoglobin of 23g/L. He has re-commenced bleeding out one of his chest drains, and needs to go to the operating theatre.

Despite all you have done to cope without blood products it is your opinion in conjunction with the surgeons that blood products are required to save his life.

Your legal standing on this matter has been clarified: you are allowed to transfuse this child without consent in order to save his life.

Please enter this room where his mother is situated, update her on the condition of her son and the necessity for a blood transfusion.

Twenty out of twenty-eight candidates passed this section.

11. **Rest station.**

12. **Other X-rays:** *Candidates were expected to describe the X-ray findings and list potential aetiologies. Examples provided included epiglottitis, free intra-peritoneal gas, acute on chronic subdural haemorrhage, infarction of pons/cerebellum and midbrain, and emphysematous destruction of a kidney.*

Eighteen out of twenty-eight candidates passed this section.

13. **Clinical case:** *Material presented regarding management of a hypothermic infant after a drowning episode: a blood gas demonstrating a mixed metabolic and respiratory acidosis, CXRs demonstrating lung infiltrates and pneumothoraces, and equipment (single bottle underwater sealed drain and a suction catheter).*

Twenty-one out of twenty-eight candidates passed this section.

14. **Rest station.**

15. **Clinical case:** *Material presented regarding management of a man with a past history of diabetes, ischaemic heart disease and chronic lymphatic leukemia who presented with hours of severe abdominal and back pain and hypotension: biochemistry (pseudohyperkalaemia), microbiology (oxidase positive non lactose fermenting Gram negative rod), haemodynamics (wrongly calculated SVRI), CXR (ARDS and tension pneumothorax).*

Twelve out of twenty-eight candidates passed this section.

16. **Haematology:** *Candidates were asked to describe abnormalities and potential aetiologies, and provide suggestions regarding management. Material presented included a hypochromic microcytic anaemia, post-splenectomy changes, a microangiopathic haemolytic anaemia and a leukoerythroblastic blood film.*

Sixteen out of twenty-eight candidates passed this section.

Cross Table Viva Section

There were 8 stations of ten minutes each, with 2 rest stations and 6 structured Vivas. There were two minutes provided to read a scenario outside each viva room. Sixteen out of twenty-eight candidates passed this section. Candidates should be able to provide a systematic approach for assessment and management of commonly encountered clinical scenarios. Candidates should also be prepared to provide a reasonable strategy for management of conditions that they may not be familiar with.

The topics covered, including introductory scenarios and initial questions were:

- **Paediatric**

Scenario: *A 13-year-old girl presents with a one-week history of nausea, dry retching and crampy abdominal pain. She has been up during the night to pass urine and this morning complained of feeling very cold. This morning she became rigid with her eyes staring. This was followed by a brief period of apnoea and cyanosis.*

Her mother drove her to the local hospital where she was noted to be pale and cool peripherally. Her heart rate was 66 bpm with a BP of 100/80.

Introductory question: *Describe your initial management?*

Twenty out of twenty-eight candidates passed this section.

- **Infectious diseases**

Scenario: *You are asked by the Emergency Department to review a 44 year old woman with known hepatitis C. She has presented with abdominal distension, and has not passed urine for over a day. On examination she is drowsy and obviously jaundiced. Her BP is 80/40 and she has a heart rate of 110.*

Introductory question: *What is your initial approach?*

Eleven out of twenty-eight candidates passed this section.

- **Metabolic**

Scenario: *A 70-year-old female has been transferred from a regional hospital with a 2-week history of profuse diarrhoea. She has a Glasgow Coma Score of 15 but looks unwell with a dry tongue. Her temperature is 38°C, her pulse is 130/min, and her blood pressure is 110/70. The pulse oximeter reads 98% on oxygen via facemask of 6 L/minute.*

Her serum biochemistry is as follows:

TEST	RESULT	UNITS	RANGE
<i>Sodium</i>	<i>123</i>	<i>mmol/L</i>	<i>136-146</i>
<i>Potassium</i>	<i>7.0</i>	<i>mmol/L</i>	<i>3.5-5.2</i>
<i>Chloride</i>	<i>108</i>	<i>mmol/L</i>	<i>98-109</i>
<i>Bicarbonate</i>	<i>12</i>	<i>mmol/L</i>	<i>20-33</i>
<i>Urea</i>	<i>28</i>	<i>mmol/L</i>	<i>3.0-8.0</i>
<i>Creatinine</i>	<i>0.22</i>	<i>mmol/L</i>	<i>0.06-0.12</i>
<i>Glucose</i>	<i>4.3</i>	<i>mmol/L</i>	<i>3.0-6.5</i>
<i>Albumin</i>	<i>23</i>	<i>G/L</i>	<i>35-50</i>

Introductory Question: *What would be your initial management of this patient?*

Eighteen out of twenty-eight candidates passed this section.

- **Trauma**

Scenario: A 51 year old man is transferred to Intensive Care from the Emergency Medicine Department. He had been struck by a car while riding a motor bike. He was hypotensive on arrival in Emergency (systolic 70 mm Hg) but became normotensive after 1L crystalloid. He has not been intubated and is breathing supplemental oxygen. Examination and extensive imaging have revealed the following injuries:

- Closed head injury. GCS 12 on scene and now 15. CT head shows L occipital contusions, intraventricular and subarachnoid blood. CT cervical spine normal. Thoraco-lumbar spine plain films show no fracture or malalignment.
- Closed fracture R humerus and R radial head.
- Bilateral rib fractures, R haemopneumothorax, small L haemothorax and R pulmonary contusions.
- Splenic injury with small amount of free fluid.
- Bilateral renal contusions.

An arterial line has been inserted. There is an indwelling urinary catheter, and he is passing 80 mL/hr of lightly blood-stained urine. A right-sided intercostal catheter has been inserted and is swinging, draining small amounts of blood stained fluid, but not bubbling. The surgeons have elected to manage the splenic injury non-operatively.

Introductory question: What factors do you consider when deciding whether to intubate and ventilate?

Ten out of twenty-eight candidates passed this section.

- **Neurological**

Scenario: You are asked to review an 84-year-old semi-retired farmer on the general ward. He was admitted to the general ward complaining of weakness, predominantly of his upper limbs, which had progressed over the previous 12 hours.

He says that he first noticed that he was unable to undo his shirt buttons, then he couldn't lift his arms. Now he says it is becoming difficult to move his legs in bed.

Introductory question: What further history and examination of this patient would assist you to establish a diagnosis?

Twenty-four out of twenty-eight candidates passed this section.

- **Respiratory**

Scenario: A 36-year-old female presents to the Emergency Department with a 2 week history of worsening shortness of breath. She has a past history of asthma and schizoaffective disorder treated with olanzepine.

On arrival in ICU she looks distressed and is uncooperative. She is tachypnoeic, tachycardic and hypertensive.

Her ABG on mask CPAP

PEEP	5cm H ₂ O	
FiO ₂	1.0	
PaO ₂	51 mmHg	
PaCO ₂	46 mm Hg	35 – 45
pH	7.32	7.35 – 7.45
HCO ₃	24 mmol/L	20 - 30

Introductory question: What is your immediate management?

Eight out of twenty-eight candidates passed this section.

The Clinical Section

The Clinical Section was conducted at the Royal Melbourne Hospital, Melbourne.

Thirteen out of twenty-eight candidates passed this combined section. Candidates should listen carefully to the introduction given by the examiners and direct their examination accordingly. Patients were presented as problem solving exercises. For maximal marks, candidates should demonstrate a systematic approach to examination, clinical signs should be demonstrated, and a reasonable discussion regarding their findings should follow. Exposing the patients should be limited to those areas that are necessary for that component of the examination, and in keeping with the modesty requirements of the patients.

Cases encountered as cold cases included patients with:

- recent valve surgery, scleroderma, pulmonary fibrosis, mitral valve prolapse, mitral stenosis, Parkinson's disease, pulmonary hypertension, polycystic kidney disease etc.

Thirteen out of twenty-eight candidates passed this section.

Cases encountered as hot cases included patients with:

- multiple trauma, chest trauma, chronic inflammatory demyelinating polyneuropathy, out-of-hospital cardiac arrest, vasculitis with renal failure, respiratory failure, renal sepsis, cerebral haemorrhage, hypoxic cerebral injury, cardiogenic shock after cardiac surgery

Sixteen out of twenty-eight candidates passed this section.

Comments documented at the time of the clinical examination suggested that common problems encountered related to examination technique, detection of clinical signs, interpretation of clinical signs, identification of clinically significant issues and factual knowledge.

WRITTEN SECTIONS

Sixteen out of twenty-eight candidates passed this overall section.

It is imperative that candidates answer the specific question asked. A structured, orderly response considering all aspects of management is required. Writing should be legible to allow candidates to gain optimal marks.

This guide below is meant to be an information resource and the views of a practising intensivist. It is not written under exam conditions and does not provide ideal answers, but it does include the type of material that should be included in a good answer.

Comments documented about performance in the written sections suggested common problems encountered related to factual knowledge, ability to recognize clinically significant issues, ability to prioritise, and exam technique.

Long Answer Questions

Seventeen out of twenty-eight candidates passed this section.

The questions release information piecemeal and incompletely as in the clinical situation. Specific issues in the specific setting were expected to be addressed rather than broad generalities. The examiners apportioned marks according to difficulty and required time within each question. An organised/systematic approach is expected.

QUESTION 1

You are called to see a 16-year-old girl in the Emergency Department. She was brought in by ambulance after being found unconscious by her parents. She was last seen alive and well 12 hours ago. Several empty bottles of tablets were found beside her.

(a) *What is your initial management?*

Initial management is to assess vital signs (airway, breathing and circulation), institute appropriate monitoring (ECG, pulse oximeter) and institute whatever immediate supportive management is required. Early supportive management of the airway and breathing may require endotracheal intubation (eg. significant hypoxia, GCS < 9, not protecting airway, respiratory acidosis), and circulation will normally require intravenous fluids and/or vasopressors (ie. intravenous \pm central venous access). History of presentation (including nature of tablets found and other medications she would have access to), past history of medical problems (including treatment and allergies) and time course of presentation are essential (from whoever can provide the most information). Examination allows search for toxidromes (pupils, sweating, heat rate etc), focal neurological signs (which may suggest an alternate diagnosis) and any complications of unconsciousness including aspiration, pressure areas etc.) Early investigations would include blood gases (oxygenation, ventilation, acidosis), electrolytes (especially K), blood glucose and paracetamol levels (treatable problem). Other specific investigations may be indicated (eg CK, Creatinine, phosphate if concerned about rhabdomyolysis; osmolality for osmolar gap etc.). It would be reasonable to consider a head CT if there were concerns about the neurological state. Decontamination and antidotes are considered in subsequent parts of this question.

(b) *What is the role of decontamination of the digestive tract?*

The role of decontamination of the digestive tract is controversial. This does not refer to Selective Decontamination of the Digestive tract (SDD) which is a form of antimicrobial prophylaxis. The induction of emesis is not favoured. The routine use of gastric lavage and/or activated charcoal has lost favour in the majority of overdose situations because of the limited evidence of benefit, and the possibility of harm (eg. aspiration or trauma). There are some situations where either or both of these techniques should be considered: early presentation (eg. < 1 hour) or presence of a drug which would delay gastric emptying, and presence of toxic drug in high quantities (eg. lethal dose) especially if in a slow release form. Administration of charcoal does not absorb small highly ionised chemicals (eg. metals, electrolytes, acids and alkali). Additional techniques such as repeated activated charcoal (and/or cathartics eg. sorbitol) or whole bowel irrigation (eg. with polyethylene glycol balanced electrolyte solution) may be considered (especially with slow release preparations). Rarely is surgical removal required.

(c) *What “antidotes” are available for patients after drug overdose?*

Many antidotes are available but obviously their relevance depends on the clinical scenario and the specifics of the drugs ingested. Specific antidotes for commonly used agents (eg. naloxone for opioids, flumazenil for benzodiazepines, beta-agonists for beta-blockers, Ca for calcium channel blockers, protamine for heparin, atropine for organophosphates, and physostigmine for anticholinergics). Less commonly used specific antidotes include: digibind for digoxin, and desferrioxamine for iron. Other indirectly acting antidotes include: Fresh Frozen Plasma and Vitamin K for warfarin, N-acetyl cysteine for paracetamol, glucagon for beta- and calcium channel blockers, glucose for insulin, ethanol for methanol, sodium bicarbonate for tricyclic antidepressants and praloxime for organophosphates.

(d) *Discuss her ongoing (definitive) management.*

Definitive management of this girl includes specifics related to the drugs involved (eg. antidotes listed above for paracetamol or tricyclic antidepressants; continuation or otherwise of decontamination techniques) or the presence of any intercurrent diseases (eg. rhabdomyolysis). General supportive care would include attention to pressure areas, nutrition, thromboprophylaxis, and nosocomial infections. Specific care would be directed to parents/relatives, and psychiatric assessment is required early to facilitate appropriate psychiatric management.

Nineteen out of twenty-eight candidates passed this section.

QUESTION 2

A 45-year-old intellectually handicapped man is admitted to your Intensive Care Unit for airway management. He was nasally intubated for evacuation of a large dental abscess, which had caused airway compromise.

(a) *Describe how you would assess him for extubation.*

Readiness for extubation requires an assessment of factors that necessitated intubation in the first place, and standard criteria. Standard criteria would include:

- adequacy of oxygenation (usually on low level of FIO₂ [eg. 0.4] and PEEP [eg. 5]),
- ventilation (minimal respiratory supports eg. low level of pressure support [eg. ≤ 10] or tube compensation; some other ventilatory indices may be used [eg. VE < 10 L/min, tidal volume :respiratory rate ratio, maximal inspiratory force [negative pressure]],
- protection of airway (adequate cough ± gag),
- ability to clear secretions (sputum production and cough), and
- appropriate neurological state (usually/preferably obeys command, orientated).

Specifics for this man would also include:

- an assessment of the airway swelling (supraglottic) via direct questioning (limited) and direct or indirect visualisation(laryngoscopy, endoscopy). Discussion with treating surgical team critical, especially with regard to timing, as swelling likely to increase over the first 48 hours. Uncommonly need more formal imaging.
- acceptable neurological state given his intellectual handicap (limited ability to understand and/or co-operate may alter threshold for the previously mentioned criteria).

- (b) ***Within 24 hours he has become febrile, and has developed hypotension and bilateral large pleural effusions. Describe your management of these problems.***

The development of a fever within 24 hours of an evacuation of a large dental abscess is not unexpected (infection/inflammation). It would be reasonable to repeat cultures (especially of blood and available sputum) but the antibiotic therapy started to cover the expected causative organisms should not need to be altered. Non-infective causes of fever are possible at this early stage but are less likely. Other sites of infection (seeded from the oral source are possible [eg. osteomyelitis, endocarditis]).

Hypotension should be treated on its merits and could be due to any of or a combination of: hypovolemia (relative/absolute), cardiogenic (ischaemia, arrhythmia [tachy- or brady-]), obstructive (pulmonary emboli, pericardial collection, tension pneumothorax, large pleural collections) or distributive/vasodilatory (sepsis, anaphylaxis, sedation [removal of endogenous catecholamines, or direct effects]). Management depends on the specific causes but requires a systematic approach (including careful clinical examination, assessment of fluid status \pm more invasive assessments [echocardiography, PA catheter or other assessment of cardiac output]).

New, large, bilateral pleural effusions are unusual and should be confirmed on more than an Xray appearance (eg. ultrasound, CT scan). Definitive treatment would be drainage via intercostal tube insertion (which would also allow sampling of fluid to be sent for microscopy and culture, protein and electrolytes, and cytology). Specific causes to be considered can be divided into transudative (eg. congestive cardiac failure, low albumin, constrictive pericarditis, ascites) and exudative (eg. pneumonia, intra-abdominal abscesses, oesophageal rupture, chylothorax). Treatment needs to also address the underlying cause.

- (c) ***Over the next 48 hours he develops increasing jaundice, with severe derangement of his Liver Function Tests. What are the likely causes, and how are you going to manage this problem?***

The potential causes of jaundice and abnormal LFTs within the first 72 hours are many. The pattern of elevation may help the diagnosis (eg. hepatocellular pattern [elevated transaminases, but minor elevation of Alkaline Phosphatase], cholestatic [minor elevation of transaminases]), and a systematic approach is helpful. Most likely causes include infection (systemic sepsis, mild hepatitic/intravascular cholestasis, liver abscess, acalculous cholecystitis), drug induced (cholestatic/hepatitic), haemodynamic/shock (ischaemic hepatitis) or haemolysis (sepsis, early destruction of transfused blood). Pre-existing intercurrent diseases (hepatitis, gall stones) could also be present. Management depends on the specific/likely aetiology. A careful history (including drug history [eg. high dose of paracetamol before presentation]) and clinical examination (eg. signs of right heart failure, chronic liver disease, abdominal pain) followed by specific liver function tests to delineate the pattern of abnormality (including alkaline phosphatase [AP], gamma glutamyl transpeptidase [GGT] and/or conjugated/unconjugated bilirubin). More specific blood tests may be indicated (eg. haemolysis screen or viral serology). Imaging of right upper quadrant with ultrasound (to assess obstruction &/or stones) would usually be indicated (\pm other imaging eg. nuclear medicine or CT scan). After addressing the specific aetiology, further treatment would be largely supportive (with awareness of effects on drug metabolism).

Fourteen out of twenty-eight candidates passed this section.

Short Answer Questions

Fourteen out of twenty-eight candidates passed this section.

1. *List the causes and outline your management of a patient with methaemoglobinaemia.*

Methaemoglobin = altered state of haemoglobin where ferrous ions (Fe²⁺) of haem are oxidised to the ferric state (Fe³⁺), which are unable to bind oxygen. Usual level < 1.5%. Results in appearance of cyanosis despite normal arterial PaO₂.

Causes of methaemoglobinaemia: congenital (eg. cytochrome b5 reductase deficiency, haemoglobin M disease), acquired (commonest cause overall; due to exposure to any of a number of toxins/drugs eg. aniline dyes, benzene derivatives, chloroquine, dapsone, plicocaine, metoclopramide, nitrites [including nitroglycerin and nitric oxide], sulphonamides).

Management: includes confirmation of diagnosis (co-oximetry ± specific assay), and history of exposures (including toxins and drugs). Congenital cases usually need no more than avoidance of precipitants. Acquired cases need cessation of exposure to precipitants, but in severe cases may require additional specific treatment. Methylene blue (1-2 mg/kg over 5 minutes, may need to be repeated) provides an artificial electron acceptor to facilitate reduction of MetHb via the NADPH-dependent pathway. Response to methylene blue cannot be followed by co-oximetry (detects methylene blue as MetHb). Alternative agent (eg. ascorbic acid) may be given if methylene blue is contraindicated (eg. G6PD deficiency). Rarely, severe cases (eg. MetHb > 50%) may require exchange transfusion or hyperbaric oxygen.

Six out of twenty-eight candidates passed this section.

2. *Outline your approach to the management of rapid atrial fibrillation in the critically ill patient.*

Management of atrial fibrillation requires consideration of urgency of treatment, reversal of potentially reversible causes, rate control, rhythm control and risks of thromboembolism. In the acute setting either rate control or reversion to sinus rhythm may provide haemodynamic benefits. Reversion to sinus rhythm is reasonable if atrial thrombi not expected (AF or more than 48 hrs duration or unknown duration). The use of trans-oesophageal echocardiography in excluding atrial thrombi is still uncertain (as not all thrombi identified). If reversion would add risks of thromboembolism then rate control and anticoagulation is preferred. In the presence of haemodynamic instability synchronised cardioversion (before or after administration of drugs/electrolytes) should be considered. If reversion is desired, correction of electrolytes (K and Mg) and specific drugs may be successful (eg. one of amiodarone [especially if impaired LV function], flecainide, procainamide, ibutilide or propafenone). If rate control only is desired then calcium channel blockers, beta-blockers or digoxin can be considered. Many critically ill patients are resistant to rate control with digoxin. Beta-blockers, calcium channel blockers and digoxin can be harmful if the rapid AF is due to Wolff-Parkinson-White syndrome.

Specific reversible causes may include drugs (eg. beta-agonists), mechanical stimuli (eg. guidewire, or catheters) and systemic disorders (eg. thyrotoxicosis, sepsis). Published guidelines (ILCOR, AHA) are available.

Twenty-five out of twenty-eight candidates passed this section.

3. ***Outline your approach to the evaluation and treatment of a cardiac surgical patient who returns to your Intensive Care Unit with temporary atrial epicardial pacing wires and problems with atrial pacing.***

Evaluation of problems with atrial pacing requires careful evaluation of the rhythm strip (and/or ECG), and systematic examination of pacing leads (from patient to pacemaker, including ensuring atrial wires are connected to atrial port of pacemaker). Specific problems to be excluded include:

- excessive sensitivity to electrical activity (resulting in inappropriate/excessive inhibition of atrial pacing). Excessive sensitivity is usually due to settings on the pacemaker, and may be confused with return of spontaneous atrial activity (including AF). Treatment is to increase the absolute value of sensitivity (making it harder to inhibit).
- relative insensitivity to electrical activity (resulting in atrial pacing when not appropriate). Insensitivity is due to the specific setting of sensitivity (including deliberate setting of AOO mode). Treatment is to decrease absolute value of sensitivity (making it easier to inhibit).
- inability to capture (resulting in no atrial activation). Inability to capture is usually due to some specific mechanical problem including: wires no longer connected to atrium [potentially activating ventricle, diaphragm or nothing at all], wires not tightly connected to cable, cable not connected to correct port, or setting of output too low relative to requirements. Treatment is to tighten and confirm all external connections, then increase output if possible. Bipolar leads may be tried in reverse positions, or attempt to convert to unipolar pacing. Positioning of patient may also facilitate capture (short term solution). Other specific treatments to be considered include treatment of underlying arrhythmias/bradycardias with appropriate medications.

Seventeen out of twenty-eight candidates passed this section.

4. ***Compare and contrast the roles of parametric and non-parametric tests in analysing data, including examples of types of data and appropriate tests.***

Parametric tests are used to compare different groups of continuous variables when the data is normally (or near-normally) distributed. Non-parametric tests do not make any assumptions about the distribution of data. They focus on order rather than absolute values, and are used to analyse data that is abnormally distributed (eg. significantly skewed) or data which represent ordered categories but may not be linear (eg. pain scores, ASA score, NYHA score). Commonly used parametric tests include the unpaired t-test (comparing 2 different groups with continuous variables [eg. age in males/females) and variations of the ANalysis Of VAriance (ANOVA: comparing multiple groups with continuous variables [eg. PaO₂:FIO₂ ratio in Medical/Surgical/Trauma patients). Commonly used non-parametric tests include the Mann-Whitney U test (comparing 2 different groups with continuous variables [eg. ICU stay in males/females]) and the Kruskal-Wallis test (comparing continuous variables in more than 2 groups [eg. pain score with PCA/epidural/s-c morphine]).

Nine out of twenty-eight candidates passed this section.

5. ***Critically evaluate the role of albumin containing solutions in the management of the critically ill patient.***

The role of albumin containing solutions in the critically ill is becoming clearer with time, but is still controversial. Earlier meta-analyses of heterogeneous trials had suggested increased mortality with albumin administration. The recently published SAFE study confirmed that 4% albumin administration was “safe” when compared with normal saline in those critically ill patients who required fluid resuscitation, but did not suggest any specific

indications. The specific predetermined and stratified subset of patients where there is still significant doubt is in patients with multiple trauma where there seemed to be worse outcomes in the albumin group (in a post-hoc analysis thought mainly in those patients with severe head injury). Two prospective RCTs have demonstrated specific situations where albumin may actually be of benefit: improved oxygenation in hypo-proteinemic patients with acute lung injury (Martin CCM 2002), and improved mortality in patients with spontaneous bacterial peritonitis (Sort NEJM1999).

Twenty-three out of twenty-eight candidates passed this section.

6. *Outline the causes, and principles of management of Electro-Mechanical Dissociation (Pulseless Electrical Activity).*

Electro-mechanical dissociation refers to a clinical state in which the patient has an ECG compatible with a normal output but has no palpable pulse. Various ways have been proposed to assist practitioners to remember the sort of conditions that could be responsible for EMD (eg. 10 step zigzag sequence [Kloeck 1995], 4Hs and 4Ts [ILCOR 2000]). Specific conditions that should be considered (history, examination, and investigation, with specific management) include:

- Hypoxia (ensure 100% oxygen),
- Hypovolaemia (administer fluids, stop haemorrhage, clamp bleeding vessels),
- Hypo/hyperthermia (ensure adequately warmed if severely hypothermic, or cooled [eg. with dantrolene for malignant hyperpyrexia])
- Hypo/hyper-kalemia and other metabolic disorders (exclude abnormalities in K [low: give K; high: give Ca, HCO₃, consider insulin/glucose], Mg [low: give Mg; high: give Ca], Ca [low: give Ca]; severe acidosis: consider HCO₃)
- Tamponade (drain pericardial collection, release ventilation induced intra-thoracic pressure)
- Tension Pneumothorax (needle thoracostomy then chest tube),
- Toxins/Poisons/Drugs (consider all recently administered drugs for allergy and/or anaphylaxis [adrenaline, fluids, oxygen, remove hapten], excessive vasodilatation or cardiac depression [consider antidotes: isoprenaline {betablockers}, Ca {Ca channel blockers}, HCO₃ for Na channel blockers {especially tricyclic anti-depressants})
- Thrombosis Pulmonary/Coronary (consider thrombolytics, urgent surgery)

Twenty-four out of twenty-eight candidates passed this section.

7. *Outline the way in which you would evaluate the aetiology of metabolic alkalosis in the critically ill.*

Evaluation of causes of metabolic alkalosis requires a systematic approach involving history, examination and some specific investigations. Categories of aetiology include loss of hydrogen ions (gastrointestinal, renal), intracellular shift of hydrogen ions, administration of alkali, and contraction alkalosis. History and examination will reveal, documented fluid losses (vomiting & gastric losses, laxative induced diarrhoea), volume depletion (loss of bicarbonate free fluids), administered drugs (mineralocorticoids, diuretics, and antacids in renal failure), alkali (bicarbonate, lactate, citrate etc) and recent hypercapnia. Investigations may reveal hypokalemia (with hydrogen shifting into cells), hypochloremia and urinary findings may include excessive potassium excretion (reabsorbing hydrogen), alkaline pH (increased bicarbonate) and inappropriately elevated chloride excretion (diuretic therapy, hypokalaemia).

Eleven out of twenty-eight candidates passed this section.

8. *Outline the causes, consequences and management of adrenal insufficiency in the critically ill.*

Causes of adrenal insufficiency in the critically ill can be categorised as primary (ie. diseases of the adrenal gland), secondary (interference with pituitary secretion of ACTH) and tertiary (interference with hypothalamic excretion of CRF). Primary causes include autoimmune (may have vitiligo), haemorrhage (eg. with sepsis and/or anticoagulant therapy), emboli, sepsis and adrenal vein thrombosis. Secondary causes include destruction of pituitary by tumour/cellular inflammation, infection, head trauma, and infarction. Tertiary causes include abrupt cessation of high-dose corticosteroids, and any process that interferes with the hypothalamus (tumours, infiltration, irradiation). The stress of critical illness can unmask adrenal insufficiency in patients at risk

Consequences include shock (which may be refractory), abdominal tenderness, myalgias & arthralgias, nausea and vomiting, volume depletion, fever, and confusion. Electrolyte disturbances include hyperkalemia, and hyponatremia and hypoglycemia.

Management needs to commence before diagnosis is confirmed. Administration of corticosteroids (eg. hydrocortisone 100 mg or dexamethasone [4mg]; dexamethasone interferes least with cortisol assays associated with low or high dose short synacthen tests), fluid resuscitation (reversal of hypovolaemia and electrolyte abnormalities), and treatment for underlying causative and/or co-existing diseases (including sepsis) The diagnosis and treatment of stress induced impairment of the hypothalamic-pituitary-adrenal axis (functional adrenal insufficiency) remains controversial.

Eighteen out of twenty-eight candidates passed this section.

9. *Outline the causes, consequences and management of Vancomycin Resistant Enterococcus in the critically ill patient.*

Enterococci are intrinsically resistant to many antibiotics, but acquired resistance has more recently become a major problem. A genetic modification in the bacteria occurs, presumably as a result of exposure to vancomycin (more widespread recent use, including for penicillin resistant pneumococcus and its oral use for clostridium difficile). Resistance is readily transmitted between strains, with risk factors identified being previous treatment with antimicrobials (especially vancomycin, cephalosporins, and broad-spectrum antibiotics), increased length of stay, renal insufficiency, enteral tube feeding, prevalence of VRE colonised patients in the unit, and residents of long-term care facilities.

Consequences are determined by the presence of infection (UTI, bloodstream including endocarditis, and rarely respiratory infection), or just colonisation (main consequence being requirement for isolation and associated factors). Patients usually have significant pre-existing co-morbidities.

Management involves specific antibiotics if infected rather than colonised (depend on sensitivities: regimens may include one or more of ampicillin, tetracyclines, teicoplanin, quinolones, and quinupristin-dalfopristin), infection control related to the patient (isolation [avoiding direct contact], aggressive infection control, limiting broad spectrum antibiotics if possible, surveillance of patient until clear).

Nine out of twenty-eight candidates passed this section.

10. *Outline the factors associated with the accuracy of central venous pressure measurement by a central venous catheter.*

Accuracy of central venous pressure measurements depend on a number of factors. These include placement of device (tip in RA, RV, femoral vein etc), levelling (usually to phlebostatic axis), zeroing (zero means atmospheric pressure), calibration (measurement

above zero is accurate when compared with gold standard [was mercury sphygmomanometer]), damping (not over or under, assessed by square wave or balloon bursting, prefer coefficient approximately 0.7). Frequency response of the system (intrinsic plus additional tubing) may significantly impact on damping (prefer shorter and stiffer tubing). Running averages also significantly alter ability to interpret spontaneous readings or variability associated with intra-thoracic pressure (better with printed waveform). Water column measurement is rarely done.

Seventeen out of twenty-eight candidates passed this section.

11. *Compare and contrast the pharmacology of ketamine, morphine and dexmedetomidine when used for analgesia in the critically ill.*

Ketamine is a non barbiturate general anaesthetic, produces a state of “dissociative anaesthesia” with profound analgesia. Pharmaceuticals: racemic mixture, clear liquid in ampoule with 200mg in 2mL. Pharmacokinetics: initial rapid redistribution ($T_{1/2}$ 10 to 15 minutes) representing anaesthetic action, followed by beta phase half life of about 2.5 hrs. 2-50% protein bound. Volume of distribution 1.8 L/kg, 90% excreted by urine (mainly after extensive hepatic metabolism to less active metabolites, only 4% unchanged). Can be administered IV, IM or SC. Pharmacodynamics: onset of action within 30 seconds and duration of analgesia approximately 30 minutes (profound analgesia of shorter duration). Relative preservation of respiratory reflexes (except at higher dosages), can increase BP and ICP, and result in involuntary movements and emergent reactions. Anaesthetic doses 1-2 mg/kg, but analgesia can be obtained with lower doses (eg. 10-20 mg; 0.1-0.3 mg/kg) or by low dose infusion (eg. 0.1 mg/kg/hr). Value if need short periods of profound analgesia. Morphine is an opioid analgesic which activates predominantly mu opioid receptors. Pharmaceuticals: clear liquid in ampoule with 10 (or 15) mg in 1 mL. Pharmacokinetics: initial rapid redistribution, followed by more prolonged elimination phase half life of about 2 hrs. 35% protein bound. Volume of distribution 3.3 L/kg, 90% excreted by urine (mainly after hepatic metabolism to active metabolite morphine-6-glucuronide which has a longer half life). Can be administered IV, IM or SC. Pharmacodynamics: rapid onset of action when injected intravenously and duration of analgesia dose (up to hours). Effects significantly prolonged with hepatic or renal dysfunction. Adverse effects include hypotension, sedation, and significant depression of respiratory and gastrointestinal function, and rarely “biliary” spasm. Antagonist exists: naloxone. Dosage: 10 mg IM, or 1-2 mg boluses (eg. with PCA) and infusion of 1-5 mg/hr. Dexmedetomidine is a relatively selective alpha-2 adrenoreceptor agonist (providing its sedative and analgesic effects). Pharmaceuticals: expensive, clear liquid in ampoule with 200mcg in 2 mL. Pharmacokinetics: initial rapid redistribution (six minutes), followed by more prolonged elimination phase half life of about 2 hrs. 94% protein bound. Volume of distribution 1.5 L/kg. Near complete hepatic metabolism to inactive metabolites which are then excreted in the urine. Administration only by IV infusion (load of 1 mcg/kg, followed by 0.2 to 0.7 mcg/kg/hr). Effects may be prolonged with hepatic or renal dysfunction. Predominant adverse effects include hypotension, bradycardia (including sinus arrest) and dry mouth. Predominant use is for profound sedation for short periods (eg. 24 hours).

Fifteen out of twenty-eight candidates passed this section.

12. *List the possible causes of an altered swallowing reflex in a critically ill patient, and outline how you would assess this.*

Swallowing is a complex reflex and requires an oral preparatory phase, and oral voluntary phase, a pharyngeal phase and an oesophageal phase. A myriad of potential causes exist. Possible causes of altered swallowing include: drug induced (eg. anti-cholinergic, neuroleptics), mechanical (eg. trauma from Trans-Oesophageal Echocardiography or

endotracheal intubation; presence of tracheostomy; rarely pre-existing structural problems eg. diverticula/pouches), infectious (eg mucositis), metabolic (eg. thyrotoxicosis), myopathic (eg. specific or non-specific neurological syndromes effecting bulbar function) and neurological (eg. stroke, severe head injury, Guillain-Barre syndrome etc.).

Assessment is via history (previous problems, recent procedures and medications) and examination (local mechanical and bulbar neurological problems, systemic diseases and systemic neurology). Specific procedures may involve watching attempts at swallowing (eg. speech therapist \pm dye or different consistencies of food, looking for signs of aspiration etc.), or more sophisticated techniques including naso-endoscopy (mainly anatomic assessment), and video-fluoroscopy or barium swallow (both providing a functional assessment).

Twenty out of twenty-eight candidates passed this section.

13. *List the factors that would make you suspect Severe Acute Respiratory Syndrome in a patient with pneumonia, and outline your management strategy.*

SARS refers to a respiratory syndrome now known to be due to an infection with a novel coronavirus (SARS virus). Both the WHO and the CDC have published criteria for defining cases of SARS. The simpler WHO definition of a suspected case is someone who has fever ($>38^{\circ}\text{C}$), with cough or difficulty breathing, and either close contact with a person diagnosed as SARS or travel/residence (within 10 days of symptoms) in an area with recent local transmission of SARS. The CDC case definition adds radiographic findings in patients with respiratory illness without known aetiology. Patients often have non-specific symptoms (eg. malaise, headache and myalgias) but not gastrointestinal or neurological findings or a rash. SARS is still predominantly a diagnosis of exclusion.

Management: Prevention of disease transmission is crucial. Patients should be isolated in negative pressure rooms, and health care workers should wear masks (eg. N-95 respirator) to prevent airborne and droplet infection, and gowns/gloves/protective eyewear to prevent contact transmission (www.cdc.gov/ncidod/sars/ic.htm). Health care workers should be excluded from work if they develop symptoms within 10 days of exposure to a patient with SARS. No specific antiviral agents have been shown to be beneficial, though a number of antiviral agents and interferon have been tried (usually in combination with corticosteroids). General supportive care is the mainstay of treatment. As this is a diagnosis of exclusion, standard care (including antibiotics) for a severe respiratory illness should be considered. Confirmation of the disease is via antibodies to SARS virus or SARS RNA assays facilitates.

Eighteen out of twenty-eight candidates passed this section.

14. *A large bore catheter for renal replacement therapy has been accidentally inserted into the carotid artery of a man with multiple organ failure (including a coagulopathy) due to systemic sepsis. The location of the catheter was only discovered after it had been sutured in place. List the potential complications, and outline how you are going to deal with this problem.*

Arterial puncture is a well recognised but uncommon complication of central venous catheter insertion. The potential complications include all those associated with venous/arterial puncture, as well as specific ones associated with the large hole in the artery. Damage to associated structures (nerves [eg. vagus], pleura, oesophagus and trachea!) can result in specific problems (either directly or indirectly from compression [eg. haematoma]). A large bore catheter in a blood vessel can result in air embolus (worse if arterial) or even embolus of atheromatous material (stroke risk). Specific problems related to the arterial site include: toxicity of inadvertently administered drugs (before actual position recognised), higher risk of significant haematoma and blood loss (augmented by coagulopathy especially

if removed/dislodged). Referral to surgeons with vascular experience is essential to facilitate definitive management because of the size of the hole in the artery (suture repair, patch repair etc). If surgical repair is not considered indicated, prolonged pressure for haemostasis has associated potential problems (carotid body, distal flow), and haematoma formation likely.

Eighteen out of twenty-eight candidates passed this section.

- 15. *A 62-year-old woman is still not awake 6 hours after clipping of a cerebral aneurysm for a Grade 1 Sub-Arachnoid Haemorrhage. List the potential causes and outline your management strategy.***

Potential causes of delayed awakening early after surgical clipping of a SAH include specific neurological causes (rebleeding, cerebral infarction/ischaemia [including intra-operative technical problems, hypotension]; too early for vasospasm), metabolic causes (including hypothermia, hypo- or hyper-natraemia and hypo- or hyper-glycaemia, hyper- or hyper-capnia) and pharmacological causes (including prolonged effects of sedatives [relative or absolute] and muscle relaxants [not reversed or prolonged/excessive effects: including suxamethonium apnoea]).

Management strategy requires exclusion of treatable causes prioritised according to their urgency. Early consultation with the treating neuro-surgical team is critical. Clinical history and examination reveal details of drugs used (including amounts and timing of doses), temperature, ventilation, haemodynamics, and identifies specific surgical issues/problems. Specific investigations that should be considered range from bedside (eg. nerve stimulator to assess residual neuromuscular blockade, or BIS monitor to assess EEG) and simple blood tests (eg. blood gases [oxygenation and exclude significant abnormalities in ventilation], electrolytes [especially Na] and glucose), to more complex and invasive (eg. repeat head CT [to exclude re-bleed, ischaemia] or angiography). These latter investigations would be organised in concert with the treating neuro-surgical team.

Twenty-three out of twenty-eight candidates passed this section.

The following “Glossary of terms” was provided for the candidates:

Critically evaluate:	Evaluate the evidence available to support the hypothesis.
Outline:	Provide a summary of the important points.
Most likely:	Give the single (one) most likely.
List:	Provide a list.
Compare and contrast:	Provide a description of similarities and differences (eg. table form).

Dr Peter Morley
Chairman, Court of Examiners,
Chairman, Fellowship Examination Committee

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