

REPORT OF GENERAL FELLOWSHIP EXAMINATION

August/September 2005

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.

This was the second exam under the modified format. This exam included two 2.5 hour written papers comprising of 15 ten-minute short answer questions each. Candidates were required to perform at a satisfactory level in the written before being eligible to sit the oral part of the exam. Two cold cases were included in the OSCE, resulting this time in five interactive stations. This exam also included two independent hot cases, allocated 20 minutes each.

WRITTEN SECTIONS

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. Some references of interest are also provided.

Feedback from examiners indicated that candidates would have been more likely to pass if they organised their answer in a way that demonstrated a broader knowledge, and included additional relevant detail. Some candidates had difficulty demonstrating their priorities, and at times the specific question asked was not answered.

A number of the questions had been asked in previous exams, some in a modified format.

Thirteen out of the forty-one candidates who were required to sit the written passed this overall section.

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

| | |
|------------------------------|---|
| <i>Critically evaluate:</i> | <i>Evaluate the evidence available to support the hypothesis.</i> |
| <i>Outline:</i> | <i>Provide a summary of the important points.</i> |
| <i>List:</i> | <i>Provide a list.</i> |
| <i>Compare and contrast:</i> | <i>Provide a description of similarities and differences (eg. Table form).</i> |
| <i>Management:</i> | <i>Generic term that implies overall plan. Where appropriate, may include diagnosis as well as treatment.</i> |

Paper 1.

1. Describe the anatomy of the tracheobronchial tree, as seen down a bronchoscope inserted via an endotracheal tube.

As the bronchoscope exits the endotracheal tube, the tracheal rings are seen anteriorly. They are deficient posteriorly, where the trachealis muscle runs longitudinally. As the bronchoscope is advanced a narrow antero-posterior ridge (the carina) is seen, where the trachea divides into the right and left main bronchi. The right main bronchus is relatively in line with the trachea, while the left comes off at a greater angle. Advancing down the right main bronchus; the right upper lobe bronchus comes off laterally (3 o'clock) approximately 2 cm past the carina, and divides into the branches to the apical, anterior and posterior segments; the middle lobe bronchus is seen anteriorly (12 o'clock) and divides into the branches to the medial and lateral segments; soon after the apical segment of the lower lobe is seen posteriorly (6 o'clock); then the four basal segments are seen (medial, lateral, anterior and posterior). Pulling back to the trachea, then advancing down the left main bronchus; at approximately 5 cm the left main bronchus divides into the left upper lobe bronchus which is seen laterally (9 o'clock) and the left lower lobe bronchus. The upper lobe bronchus divides into the superior division and the lingular division. The superior division gives rise to two branches, the apicoposterior and anterior segments. The lingula gives rise to the superior and inferior segments. The lower lobe bronchus gives rise to the apical segment of the lower lobe seen posteriorly (6 o'clock), then the three basal segments (lateral, anterior, and posterior).

Fourteen out of forty-one candidates passed this question.

2. A new level three Intensive Care Unit has been built in your hospital. Patients are going to be admitted next week. The Director of Intensive Care Services gives you the job of testing that the gas supplies and suction that have been installed are appropriate and working satisfactorily. How will you do this?

Testing should involve

- Confirmation that the appropriate outlets are at each bed space, with correct labelling, colour coding, and sleeve index system. Bed spaces in a level three ICU are supplied with at least three O₂, two air, and three suction outlets.
- Testing that the correct gas is supplied, and that the gas is pure. Oxygen concentrations should be measured at all gas outlets. This will distinguish between oxygen, air, and another gas such as nitrous oxide or nitrogen. A sniff test assessing for objectionable odours should be performed at medical air outlets only. If a non-respirable gas is present, this testing must be performed by an anaesthetist.
- Tests for flow rate and pressure. Tested using a device that fits the outlet, and incorporates a pressure manometer, a variable flow restrictor, and a flow meter. Static pressure is measured and should be 415 kPa (60 psi) on O₂ and air outlets, and -60 kPa at suction outlets. The flow rate is then set to 40 L/min, and the change in pressure measured. The change in pressure should be < 10 kPa for air and O₂, and < 15 kPa for suction.
- Testing of alarms. Tested by turning off the isolating valve for each supplied gas in turn, and ensuring that visible and audible alarms activate.

References: JFICM policy document IC-1; Australian Standard 2896 1998, Medical gas systems – installation and testing of non-flammable medical gas pipeline systems.

Four out of forty-one candidates passed this question.

3. Outline the differences between a Jefferson fracture, Hangman's fracture and Clay-shoveller's fracture.

Jefferson fracture: burst fracture of the atlas (C1); usually combined anterior and posterior arch fractures; results from axial compression of C1 in circumstances such as diving into water head first

or being thrown against the roof of a car or aircraft; may also result from hyperextension causing a posterior arch fracture. Unstable.

Hangman's fracture: bilateral fracture of the posterior arch of C2 and disruption of the C2-3 junction; neurological injury may result from damage to the posterior longitudinal ligament allowing significant anterior displacement of C2 on C3; results from C-spine hyperextension with vertical compression of the posterior column eg. a car accident victim's head striking the dashboard. Unstable.

Clay-shoveller's fracture: fracture of one or more of the spinous processes of the C6-T3 vertebra; it is an avulsion fracture by the supraspinous ligament of the spinous process caused hyperflexion. Stable.

Fourteen out of forty-one candidates passed this question.

4. Outline the principles of illness severity scoring systems used in the critically ill patient, and using examples outline their relationship to clinical outcome.

Scoring systems stratify groups of critically ill patients by severity, compare groups of patients in research trials, compare ICUs, and predict mortality for individuals and groups. Most measure physiological variables, some measure interventions. Derived by logistic regression from large demographic data sets of critically ill patients. Commonly used systems include:

- APACHE II. Commonly used in Australia to measure patient severity. Uses 12 physiological variables and previous health estimate. Requires measure of worst values in first 24 hours in ICU, so affected if ICU admission delayed. Not reliable for predicting outcome in individuals. Limited by derivation from an historical data set.
- APACHE III. Better outcome predictions by using additional variables and a more recent data set for comparisons. Outcome predictions for Australian patients more accurate.
- GCS. Used to quantify severity of coma. Scale from 3-15. Eye (1-4), Verbal (1-5), and Motor (1-6) components. Key score for outcome prediction after head injury. Affected by alcohol and sedation. Should be scored in non-sedated non-paralysed patients. Important component of other scoring systems eg APACHE 11.
- TISS. System to score patient severity by counting procedures done. Less widely used. Physician dependent, so less useful to compare ICUs.
- SOFA. Organ dysfunction scores. Often a secondary endpoint in research trials.

Twelve out of forty-one candidates passed this question.

5. Compare and contrast the clinical and diagnostic features of ascending polyneuritis (Guillain Barre Syndrome), myasthenia gravis and motor neurone disease.

This could be answered using a table format. Suggestions include the following:

| | ascending, polyneuritis | myasthenia gravis | motor neurone disease |
|-----------------------------|--------------------------------|--------------------------|--|
| weakness | yes | yes | yes |
| reflexes | absent | present | May be increased (eg. amyotrophic lateral sclerosis) |
| characteristic distribution | ascending symmetrical | Eyes & cranial nerves | asymmetrical` |
| progression | acute and recovery | relapsing | progressive |
| fatigue | no | characteristic | no |
| fasciculation | no | no | characteristic |
| increased CSF protein | yes | no | no |
| UMN signs present | no | no | May be present |

| | | | |
|----------------------------------|-------------------------|-----|-------------------------------------|
| | | | (eg. amyotrophic lateral sclerosis) |
| sensory features | often dyesthesia + pain | no | no |
| pain | May be present | no | no |
| delayed nerve conduction | yes | no | no |
| fade + post tetanic facilitation | no | yes | no |
| 'jitter' on EMG | no | no | yes |
| response to anticholinesterases | no | yes | no |
| response to plasmapheresis | May occur | yes | no |

Twenty-three out of forty-one candidates passed this question.

6. Critically evaluate the use and limitations of End-Tidal Carbon Dioxide measurement in Intensive Care practice.

Measurement of ETCO_2 implies the use of a quantitative device, and usually this is one which allows assessment of waveform morphology (ETCO_2 vs time). Specific roles include: confirmation of tracheal placement of artificial airway, pattern recognition of ETCO_2 waveform, use of value of ETCO_2 during cardiac arrest or hypotensive states, prediction of arterial PaCO_2 .

Confirmation of tracheal placement is highly sensitive and specific in the presence of pulmonary blood flow. False negative values may occur with minimal pulmonary blood flow, but should not usually occur with adequate CPR. False positives are very uncommon and short lived (eg. CO_2 in stomach).

Waveform pattern can assist in the diagnosis in particular of expiratory flow obstruction (and gas trapping) and attempts at spontaneous breathing particularly during apnoea testing.

During cardiac arrest, the absolute level of ETCO_2 is proportional to pulmonary blood flow (and hence cardiac output). It may be used to guide cardiac compression, but apart from this it adds little to prognostication (ie. confirms patient that patient likely to die is likely to die). Sudden decreases in ETCO_2 may be indicative of the decrease in pulmonary blood flow associated with pulmonary emboli.

Prediction of PaCO_2 from ETCO_2 is fraught with difficulty. Very few candidates demonstrated an understanding of this area. The major limiting factors are pulmonary blood flow and V/Q balance. Unless these factors are constant, even the trending of the relationship of between PaCO_2 and ETCO_2 unreliable. Unfortunately if the PaCO_2 is important (eg. major head injuries), it must be measured.

Utility in neonates and children may be impaired by small tidal volumes.

Twelve out of forty-one candidates passed this question.

7. Outline your principles of management in the transport of the critically ill patient.

Many candidates failed to mention guidelines, monitoring, handover or documentation.

Two inter-collegiate documents have been published (PS39 and IC-10) and cover the principles of management in detail. Intra-hospital transport requires justification of transport (review of risks vs benefits), availability of appropriate and functional equipment (monitoring and emergency intervention), adequately skilled staff, appropriate pre-departure procedures (including checking of equipment and drugs, and accompanying patient records/investigations), planning of appropriate timing and route, confirmation of appropriate clinical status before transport, appropriate monitoring during transport, assessment of monitoring and equipment at destination, appropriate handover if another team assumes responsibility for care, appropriate documentation of clinical status during transport and some process to facilitate quality assurance. Inter-hospital or pre-hospital transport also includes consideration of mode of transport (distance vs efficiency vs risks of road/fixed wing/helicopter), and potential preventative procedures before transport (e.g. chest

tubes). For all transports, some forms of monitoring are considered mandatory (i.e. pulse oximetry, capnography [if mechanically ventilated], ECG, and blood pressure).

Ten out of forty-one candidates passed this question.

8. Outline the clinical scenarios in which you would consider instituting dialysis in the critically ill.

Dialytic techniques in the critically ill are becoming more widely used. Traditional indications used for acute renal failure, are concerns about fluid overload (actual or to facilitate nutritional support), hyperkalaemia or other uncontrolled electrolyte disorders, metabolic acidosis, hyponatraemia, uraemic symptoms or elevated urea (e.g. 30 mmol/L). As complications associated with techniques have been minimised, dialysis is often initiated earlier (anticipatory, oliguria, lower urea), and even for non-renal indications (including sepsis or septic shock). Dialysis or haemofiltration (e.g. with charcoal filter) can be used to increase the clearance of toxic products from the circulation (e.g. lithium, theophylline, myoglobin). Newer related extracorporeal techniques have also been developed to support liver dysfunction.

Twenty-seven out of forty-one candidates passed this question.

9. List the potential causes of anaemia in critically ill patients, and outline how you would determine which factors were contributory.

Common problems encountered related to the lack of an organised approach (eg. to history, examination and investigation). Blood loss can be occult!

Anaemia in critically ill patients is usually multifactorial. Potential causes can be categorised into decreased production (as a small proportion [approx 1%] of circulating RBCs are destroyed each day), increased destruction, loss of RBCs and haemodilution. Decreased production includes problems with nutrients (eg. iron, folate, B12), disease involving bone marrow (eg. infiltration, myelodysplasia), depressant effects of drugs (eg. chemotherapy) or irradiation, and low levels of stimulatory hormones (eg. EPO in renal failure, thyroid hormones). Increased destruction can occur in haemolytic anaemias: either congenital (eg. thalassaemia major, sickle cell) or acquired (eg. Coomb's positive auto-immune, TTP-HUS, infection with malaria or clostridia etc). Increased RBC loss can occur via injuries, bleeds into viscera or organs (eg. GI tract, GU tract, lungs) and iatrogenic (procedures, blood samples for testing). Dilutional anaemia usually occurs in the context of rapid or extensive non-blood fluid resuscitation.

Evaluation of cause includes obvious but essential role of history (trauma, drugs and therapies, nutrition, chronic disease, infection, review of blood tests and procedures etc) and examination (trauma, sites of potential blood loss [including PR], jaundice, hepato-splenomegaly etc.). Simple investigations include morphological assessment of blood (eg. MCV, blood film: red and white cell morphology), reticulocyte count, electrolytes and renal and liver function tests. More specific tests as indicated include assays for folate/B12/ferritin, indicators of haemolysis (eg. haptoglobin, Coomb's test), Hb electrophoresis, cultures for infection (\pm thick/thin film) etc.

Important causes in ICU, which the candidate should emphasise, include:

- a) blood samples for testing
- b) EPO suppression and lack of marrow responsiveness in sepsis
- c) trauma
- d) stress ulcer bleeds
- e) extracorporeal circuits blood loss
- f) hemodilution from resuscitation
- g) chemo/oncology patient groups

Twenty-six out of forty-one candidates passed this question.

10. Following cardiopulmonary resuscitation for severe asthma in a 6 year old child the following blood gas results are obtained (she remains unconscious, paralysed and mechanically ventilated).

| Barometric pressure = 760 mmHg | | |
|--------------------------------|------|--------------|
| FiO ₂ | 0.5 | |
| pH | 6.65 | 7.35-7.45 |
| pCO ₂ | 212 | 35-45 mmHg |
| pO ₂ | 90 | mmHg |
| HCO ₃ | 23 | 20-30 mmol/L |
| Lactate | 12 | <2 mmol/L |

Please explain these results and outline what action you will take.

Severe acidemia due to a mixed severe respiratory and metabolic (lactate) acidosis. Apparently adequate oxygenation (very low A-a gradient). The elevation in lactate may have been due to tissue hypoxia but the PaO₂ at present might appear adequate. She is likely to have received intravenous adrenaline and possibly salbutamol, both can cause lactic acidosis (due to inhibition of pyruvate dehydrogenase (Day NP et al Lancet 1996;348:219-223) and possibly other effects on glycolytic enzymes, accelerating glycolysis).

Measures to increase alveolar ventilation are urgently required. Evaluation of airway, breathing and circulation (ABC) is the first response. Urgent chest auscultation and observation should be performed. Capnography (+/- laryngoscopy) should be used to confirm intra-tracheal position of ETT. To achieve a PO₂ of 90 with almost zero A-a gradient, the tube must be in the trachea; for the same reason, endobronchial intubation is unlikely but should be excluded. Consider pneumothorax – as this might compromise alveolar ventilation. Any leak should be identified (if the endotracheal tube is un-cuffed it could be replaced with a larger tube or a cuffed tube). Check to make sure the ventilator tubing is not leaking/unattached. The tidal volume and respiratory rate must be checked together with the peak pressure limit (if the patient is being ventilated with a mechanical ventilator). The chest excursion should be observed to ensure that there is a rise during inhalation. If excursion appears inadequate it is appropriate to try an increase in the volume or pressure and observe whether the ventilation improved. The extent of gas trapping needs to be evaluated. If there is significant gas trapping then a reduction of respiratory rate is required (to prolong the expiratory time), however given the current PaCO₂ this may require an increase in tidal volume. An alternative strategy would be to plan for regular 30 second disconnections every 5 minutes or so (particularly if there was associated hypotension).

Fourteen out of forty-one candidates passed this question.

11. A 45 year old man is admitted unconscious to the Emergency Department. His electrolytes are as follows:

| | | |
|---------------------|----------|-------------------|
| Sodium | 119 | 132-144 mmol/L |
| Potassium | 5.5 | 3.1-4.8 mmol/L |
| Chloride | 80 | 93-108 mmol/L |
| Bicarbonate | <5 | 20-30 mmol/L |
| Urea | 10 | 3.0-8.0 mmol/L |
| Creatinine | 105 | 60-120 micromol/L |
| Glucose | 13 | 3.0-5.5 mmol/L |
| Lactate | 8.8 | <2 mmol/L |
| Measured osmolality | 340 | 275-295 mOsm/kg |
| | | |
| Urine ketones | negative | |

Please interpret these results. Outline a differential diagnosis based on the biochemical findings and indicate how you will exclude each.

Results demonstrate an increased anion gap metabolic acidosis with mild hyperglycaemia and hyperosmolar hyponatraemia. The marked anion gap (39.5) is not solely explained by the lactate level, and ketones or renal failure are not present. There is also a large osmolar gap (calculated osmolality = $340 - 261 = 81$), which suggests an additional agent/toxin is causing acidosis and having osmotic effect.

Differential diagnosis includes:

- Methanol: History (“hootch” consumption); measurement of methanol and formate levels often takes time, but negative ethanol may be useful. The lack of renal dysfunction does not exclude methanol.
- Ethylene glycol: History (?suicidal intent), plasma ionised calcium, oxalate crystalluria, Woods lamp examination for fluorescence; unlikely given normal renal function
- Alcoholic ketoacidosis: measure ethanol and plasma beta- hydroxybutyrate. Negative urinary ketones (acetoacetate) might reflect a low redox state, with most of the keto-anion being in the form of beta-hydroxybutyrate, and with a huge amount of acetone and glycerol (plus some ethyl alcohol) causing the osmolar gap. The enormous anion gap would then be a mixture of lactate, beta-hydroxybutyrate and some acetate from ethanol metabolism.
- Pyroglutamic acidosis: History of paracetamol ingestion in the face of liver dysfunction. Measure pyroglutamic acid levels. Less likely as large osmolar gap.
- Salicylic acid: History (?suicidal intent), measure salicylate levels, may have respiratory alkalosis. Less likely as large osmolar gap.

Hypoadrenalism could be considered (hyponatraemia, hyperkalaemia, metabolic acidosis), but on its own does not explain the osmolar gap and the non-lactate component of the anion gap.

DKA is on the differential, but the osmolar gap (acetone, glycerol) is higher than it usually gets, unconsciousness is not normally a feature and needs to be explained separately, and the lactate is unusually high.

Factitious causes of hyponatraemia (hyperlipidaemia etc) might have been mentioned. However, although they will artefactually raise the osmolar gap, they do not increase the anion gap, and they don't cause acidosis or unconsciousness.

Thirty-one out of forty-one candidates passed this question.

The next three questions (12, 13 and 14) related to the following clinical scenario:

A 24-year-old male mountain bike rider crashes into a tree, resulting in a severe hyperextension neck injury, and fractured lower left ribs. He now presents to hospital with shock and a painful distending abdomen.

12. Describe your initial management.

Initial management of trauma should be according to standard protocol.

Initial primary survey and resuscitation should address adequacy of airway (patency, need for ETT) and breathing (eg. excluding tension pneumothorax and major haemo-thorax).

At the review of “circulation” phase, the presence of shock with obvious abdominal signs means urgent surgery is required, with simultaneous insertion of 2 wide bore IVs if not already present, removal of blood for Hb/platelets, cross-match and clotting profile, rapid infusion of 2 litres of fluid [blood if significant previous non-blood resuscitation].

In the time until surgery is organised, it may be possible to perform a supine CXR, pelvic X-ray and/or a FAST (ultrasound) examination/DPL/abdominal CT if able to be kept haemo-dynamically stable. Consideration of angiography if stability maintained and expertise available.

He must be treated with spinal precautions (including for intubation) as it must be assumed that there is an unstable cervical spine, with possible thoraco-lumbar spine injuries.

Attempts should be made to maintain his temperature stable (eg. > 35-36°C). Full secondary survey and specific investigations must be deferred until the haemo-dynamic state is adequately dealt with.
Thirty-seven out of forty-one candidates passed this question.

13. He returns from the operating theatre after a splenectomy. He is haemodynamically stable, but little is known of his other injuries. What is your plan for the next 24 hours?

At this stage stability must be confirmed in other areas as well as haemo-dynamic. Blood pressure goals should consider spinal perfusion pressure if spinal injury is suspected (may be unable to achieve target “normal” MAP in presence of high spinal injury), steroids should be considered in the first 8 hours following injury (“NASCIS II”).

Now is the time to ensure that oxygenation and ventilation are stable; coagulation should be assessed and corrected if abnormal; and temperature should be in target range.

Secondary survey should be completed, including detailed neurologic examination (eg. in an attempt to exclude spinal injury). Spinal precautions should be continued for the interim. The primary X rays should be obtained (CXR, pelvic X-ray, lateral cervical spine) but now additional X-rays should be obtained as indicated (repeat CXR, spinal series ± CTs eg. of head, cervical spine, chest, abdomen). Long bone injuries should be sought and excluded (or treated).

Other specialists should be asked to review patient as indicated (eg. cardiothoracic, spinal).

Antibiotics and tetanus prophylaxis should be prescribed if indicated.

Anti-ulcer prophylaxis should be instituted, and as should pharmacological prophylaxis for DVTs when contraindications subside. Enteral feeding should be started as soon as practical, and glycaemic control should be implemented.

Twenty out of forty-one candidates passed this question.

14. After another 24 hours it is apparent that he has a complete spinal cord lesion at C4. What signs of this lesion are likely to be present?

Tone: Tone may well still be decreased (though with time this will increase, with posturing developing in an upper motor neurone distribution: some flexion of upper limb if incomplete level to C6). Anal tone would be lax with a complete lesion.

Power: Quadriplegia would be expected, with no movement below deltoid. Respiratory muscles may be significantly compromised.

Reflexes: Reflexes may still be absent, though with time will increase. The plantar reflex should be upgoing.

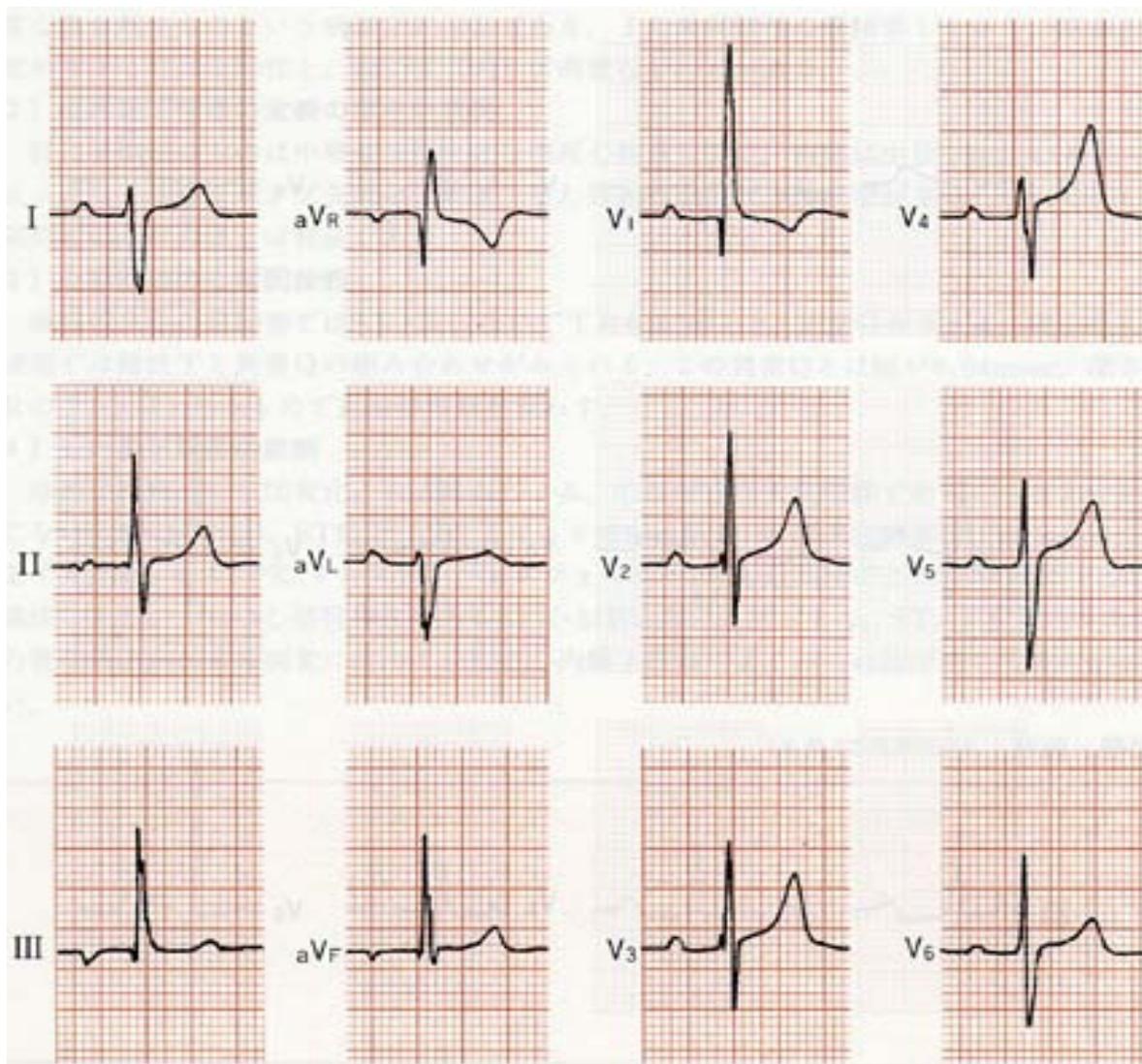
Sensation: A sensory level is expected between C2 to C6, to all modalities (eg. touch, pain, temperature, joint position sense and vibration).

Other signs: Warm vasodilated peripheries, Skin venodilation, Priapism, Hypotension, Bradycardia, Tendency to Hypothermia, Rocker-boat respiratory pattern (with increased use of respiratory accessory muscles, and absent intercostals).

Thirty-three out of forty-one candidates passed this question.

15. A blood gas result and an Electrocardiogram are obtained from a 26 year old man who presents with recurrent respiratory failure.

| Barometric pressure = 760 mmHg | | |
|--------------------------------|------|--------------|
| FiO ₂ | 1.0 | |
| pH | 7.46 | 7.35-7.45 |
| pCO ₂ | 54 | 35-45 mmHg |
| pO ₂ | 50 | mmHg |
| HCO ₃ | 37 | 20-30 mmol/L |



Please explain these results. Outline how you would clarify the cardiac status in this patient. Justify your choices.

This man is profoundly hypoxic with a PaO_2 of only 50 mmHg on 100% oxygen ($\text{AaDO}_2=596$ mmHg; $\text{PaO}_2/\text{FiO}_2$ ratio 50).

He is alkalemic, with an elevated bicarbonate (metabolic alkalosis) and an elevated PaCO_2 (higher than predicted = respiratory acidosis)

Electrocardiographic features of 1st degree heart block and RVH: Right axis, R wave in $\text{V}_1 > 5\text{mm}$, R/S in $\text{V}_1 > 1$ and R/S in $\text{V}_6 > 2.5$.

Further information that may help clarify the cardiac status include:

Clinical examination (RV heave, loud P_2 , raised JVP, giant v waves, pulsatile liver, ascites, peripheral oedema).

CXR may show lung disease, and show evidence of pulmonary arterial hypertension (prominent pulmonary arteries with peripheral pruning).

Echocardiogram (TTE vs TOE)- will show RV hypertrophy, may reveal PA pressures if there is some TR (which is usual in pulmonary hypertension). Exclude Ostium primum ASD, Eisenmengers complex.

Pulmonary artery catheter will reveal PA pressures and cardiac output.

V/Q is a poor test to investigate chronic RV hypertrophy.

Twenty-eight out of forty-one candidates passed this question.

Paper 2.

16. List potential adverse drug reactions, and outline how they may impact on your management of the critically ill patient.

This question was best answered using a systematic approach. Many candidates did not address the impact of adverse reactions on management, in particular how to prevent or minimise their occurrence. Reasonable list should include effects of drug alone and drug on drug.

Expected reactions (ie extensions of known pharmacologic effects) are many and should include pharmacologic (eg. compatibility issues), pharmacokinetic (eg. absorption, enzyme induction), pharmacodynamic (eg. innocent bystander organs, competition). Unexpected reactions include idiosyncratic (haematological, hepatic, dermatological), and allergic (mild through to anaphylaxis and anaphylactoid). Management requires detailed drug history: drugs administered (over the counter as well as prescription drugs), alcohol intake, previous drug reactions, conditions that make adverse effects more likely (eg. respiratory depression and sleep apnoea, or severe airways disease). Examination: to look for conditions that may make reactions more likely. Careful prescribing (ie only using drugs when indicated) with attention to potential interactions (including physical incompatibilities etc), and appropriate monitoring (eg. drug levels, organ function).

Twenty-three out of forty-one candidates passed this question.

17. Outline the differences in management of multi-trauma occurring in a 6-year-old child, compared with management of multi-trauma occurring in an adult.

Many candidates missed multiple aspects of management, usually because they did not follow a systematic approach (eg. according to EMST guidelines). Basic principles of management according to EMST guidelines are the same – ie primary survey (ABCDE), resuscitation, secondary survey, re-evaluation, definitive care. However, candidates need to recognise and accommodate the different characteristics of the 6 year old trauma patient:

Mechanism of injury: falls and assaults more likely

Patterns of injury: more likely blunt trauma with multiorgan injury and head injury common

Physiologic and anatomic differences:

- Different airway anatomy
- Large body surface area/volume ratio – implications for exposure and heat loss
- Different normal physiologic values
- Increased cardiovascular reserve – 30% blood volume may be lost before vital signs change; hypotension indicates >45% loss
- Immature skeleton – Incomplete skeletal calcification, with more flexible bones– eg pulmonary contusions without rib fractures common; ligament flexibility and increased head mass makes cervical spine injuries above C4 more likely and Spinal Cord Injury Without Obvious Radiological Abnormality (SCIWORA) may occur.

Assessment:

- History – may be difficult to obtain
- Examination – may need to modify for age - eg modified GCS, but a 6 year old can be scored as per an adult
- Investigations – may require modification – eg uncooperative child may require GA for CT
- Treatment:
- Airway: uncuffed tube, size estimated from age, cervical precautions
- Breathing
- Circulation: IV access may be difficult, consider intraosseous needle. Fluid boluses calculated according to weight (20ml/kg) as are maintenance requirements
- Disability: modified GCS
- Exposure: care to maintain body temperature
- Drug doses calculated according to weight (average 6 year old 20kg)

- Equipment sizes (eg chest drains, urinary catheters, nasogastric) appropriate for size – Broselow tape useful

Other specific issues:

- Psychological issues – patient and parents
- Consent issues
- Potential child abuse
- Consider transfer to a specialist paediatric centre

Twenty-two out of forty-one candidates passed this question.

18. Compare and contrast the pharmacology of noradrenaline, vasopressin and phenylephrine when used as vasopressors in the critically ill.

Noradrenaline is the catecholamine released by postganglionic adrenergic nerves. Direct agonist acting on alpha (vasoconstrictor: arterial and venous) and beta-1 (contractility, pro-arrhythmic) adrenergic receptors. Not absorbed enterally. Rapidly metabolised by COMT and MAO, resulting short (minutes) duration of effect (usually administered as intravenous infusion into central vein at rate of 0.5 to 100 mcg/min). Used clinically to increase blood pressure (usually in the setting of vasodilatory shock).

Vasopressin is a hormone/neurotransmitter with a complex series of effects. Direct action on a number of receptors (V1 (vascular: vasoconstriction), V2 (renal: anti-diuresis), V3 (pituitary), OTR (oxytocin receptor subtypes) and P2 (purinergic). Not absorbed enterally. Rapidly inactivated by trypsin and peptidases, resulting in short (minutes) duration of effect (longer on kidneys as very low concentration are required). Used clinically as treatment for diabetes insipidus (IM, IV or intranasal), and more recently by intravenous infusion (via central vein at rates of 0.01 to 0.1 U/min) to increase blood pressure (usually in the setting of vasodilatory shock) or as a large intravenous bolus providing potent vasoconstriction during cardiac arrest (40 units). Potentiates the action of other vasoconstrictor agents.

Phenylephrine is a synthetic alpha-1 adrenoceptor agonist, similar in structure to adrenaline. Not administered enterally, biotransformation not well described (not metabolised by COMT) but duration of action longer than naturally occurring catecholamines (still minutes). Used clinically for vasoconstrictor effects, usually administered intravenously either in small bolus doses or occasionally as an intravenous infusion (via a central vein at rates of 40 to 180 mcg/min). Refractory hypotension may respond to agents with combined alpha-1 & alpha-2 activity (e.g. noradrenaline).

Thirty-eight out of forty-one candidates passed this question.

19. Outline the limitations of CT scanning in the assessment of traumatic brain injury.

Many candidates restricted their answers to limitations of the scan itself, and did not consider other clinical issues related to putting a critically ill patient into a CT scanner. Candidates should consider asking themselves “why don’t we perform more of this investigation?”.

Physical limitations include:

- patient size,
- usually distant from resuscitation area, thus patient needs to be moved,
- some patients may require GA for the investigation when they otherwise wouldn’t have had a GA,
- difficulty monitoring and attending to patient during scanning (especially if intubated and ventilated and “sick”).

Clinical limitations include:

- may be other priorities (eg urgent laparotomy which precludes early CT)
- interpretation is difficult/impossible if other previous IV contrast Xray investigation
- normal CT head doesn’t exclude underlying injury (eg diffuse axonal injury, vascular injury, ischaemia, hypoxic injury) – so may need to repeat it within 24 hrs

- CT head findings do not correlate with ICP value (unless CT findings of herniation – and then ICP bound to be too high and too late a detection)
- CT findings are not generally good predictors of patient outcome (though may be useful in some situations eg the Marshall score [used to prognosticate outcome], and the presence of traumatic SAH on CT which portends a poor prognosis).
- poor visualisation of posterior fossa and brainstem.

Twenty out of forty-one candidates passed this question.

20. Outline the role of regional anaesthetic techniques in the management of pain in the critically ill.

Many candidates provided long lists of regional techniques, but did address the issues of when to use and when not to use a technique. Consider asking “why don’t we perform more epidurals in our patients?”.

Advantages of regional anaesthetic techniques include

- reduced narcotic use to achieve analgesia– less respiratory depression, especially in chest injury or high risk of respiratory failure (elderly, COPD, etc)
- less ileus (reduce risk of aspiration, tolerance of enteral feeds, etc)
- less interference with mental status (harder to attribute obtundation to drugs or injury)
- reduces use of non narcotics, eg NSAIDS (renal impairment, platelet function); tramadol (confusion in elderly); paracetamol – all just adjuncts anyway and less efficacious than regional in severe pain; ketamine – hypertension, tachycardia, dissociative effects, etc)

Disadvantages (general)

- often redundant in sedated, ventilated patient
- not proven in critically-ill to be any better in terms of outcome in critically ill patients – thus not a lot of strong evidence to support use in critically ill over above alternatives
- problems with local anaesthetic toxicity fairly uncommon with newer agents given by infusion (eg ropivacaine via epidural) – but some other regional blocks (eg brachial plexus catheters, pleural catheters, etc can get to higher dosages and greater risk of toxicity)
- may still need narcotic adjuncts
- technical expertise required
- difficulty covering multiple sources of pain
- sympathetic blockade, problems with coagulopathy, need for patient positioning, anatomical landmarks may be difficult
- catheters over longer term => risk of infection. Also confused patients more likely to dislodge them
- monitoring of blockade in uncooperative patient may be impossible
- removal with DVT prophylaxis may be an issue

Disadvantages (local)

- related to sites of placement – eg vascular injection, pneumothorax, other neuro injury, etc, etc. Also neuro blockade in presence of “uncleared” neurological injury and following plastic surgery for nerve injury.

Sixteen out of forty-one candidates passed this question.

21. “The absence of evidence of effect does not imply evidence of absence of effect”. Please explain how this statement applies to evaluation of the medical literature.

Candidates were expected to think more broadly than just the “power” of a study. Consider:

No evidence - never asked the question. Low level evidence. **Physiological data only. Animal data only.** Ethical barriers to conducting the definitive study. Unanswerable for logistic reasons. Restrospective / case series only. **Poorly designed existing studies** (related to blinding, allocation

concealment, loss of follow up, intention to treat, uniform management apart from intervention., appropriate stats methods etc.). Meta-analysis pitfalls - significant disagreements with subsequent RCT. Type 2 error - false acceptance of null hypothesis - inadequate power - small single centre studies

Eleven out of forty-one candidates passed this question.

22. Outline your principles of management of status epilepticus.

Diagnosis: status epilepticus as > 5 minutes generalised convulsive, non-convulsive, (no return of consciousness), simple partial [Definition 2 or more convulsions with no recovery in between, or continuous convulsion > 30 min (alternative more recently accepted definition is > 5 min)]

Support: Airway, Breathing, Circulation.

Control: using hierarchy of drugs: benzodiazepine (midazolam) + phenytoin loading, propofol, barbiturate (phenobarbitone loading, thiopentone infusion), isoflurane, others. EEG to confirm, avoid paralysis.

Restore: therapeutic prophylaxis drugs if appropriate - check levels. Consider add newer generation agent in difficult cases.

Look for and treat cause:

History of epilepsy, Anti-convulsant compliance, Check and correct biochemical disturbance eg Na (appropriate speed), hypoglycaemia, low Ca⁺⁺, severe azotemia.

Look for toxins (TCA, theophylline, amphetamine and other recreational drugs, salicylate, glycols, alcohols, hydrocarbons etc).

Diagnose infective, hypoxic, vascular, metabolic or structural (trauma, neoplasm), physical (hyperthermia) cause - CT, LP, MR, porphyrins.

Treat CNS viral and bacterial infection empirically until excluded.

Eclampsia specific management including LSCS, Mg, BP control.

Don't forget factitious epilepsy - look for atypical features, check lactate, EEG, reflexes etc.

Consider drug withdrawal.

Treat complications - aspiration, rhabdomyolysis, hyperthermia.

Fourteen out of forty-one candidates passed this question.

23. List the potential adverse effects of endotracheal intubation, and briefly outline how they can be minimised.

The answers provided by the candidates were very disappointing. Endotracheal intubation is so fundamental to Intensive Care practice that a high standard was expected in this question to obtain a pass mark. A list of the major complications and some suggestions regarding prevention were required. Very few candidates included myocardial ischemia, elevation of ICP, the potential for spinal cord injury in the presence of an unstable spine, or even failed intubation. Few candidates listed pre-oxygenation as potentially helpful in preventing hypoxia.

Potential adverse effects included:

Hypoxia, Failed intubation, Oesophageal intubation, Endobronchial intubation, Aspiration, Bronchospasm, Structural damage (including Cord injury/False passage), Foreign body aspiration, Bacteraemia, Hypertension/tachycardia/arrhythmias/myocardial ischaemia, Raised ICP, Hypotension/exacerbation of shock state, Other drug side-effects, Sputum retention / pneumonia, Sub-glottic stenosis, Tracheo-oesophageal fistula.

None of the forty-one candidates passed this question.

24. Outline the principles involved in the care of the organ donor.

Principles include:

Early identification

Discuss with transplant coordinator

Establish family rapport early

Diagnose brain death correctly

Establish presence of condition causing brain death. Exclude confounders (sedation, paralysis, endocrine, metabolic, temperature) - use vascular imaging if necessary. Satisfy legal criteria for organ donors relevant to the jurisdiction

Non-coercive sensitive family discussion re opportunity for donation

High availability. Answer questions

Initiate tissue typing, viral screen, further organ function tests

Maintain extra-cerebral physiological stability

Ventilatory - oxygenation, normocapnia, lung protective strategies. Circulatory - monitoring, filling, noradrenaline, vasopressin. Normothermia. Diagnose and treat diabetes insipidus (DDAVP/vasopressin, free water). Steroid and T3 replacement

Facilitate family time at bedside

Ensure aftercare of donor family

Transplant co-ordinator. Limited anonymous information available. Further family meeting offered
Few candidates considered that the donor could be either living related, or a non-beating heart donor.

Nine out of forty-one candidates passed this question.

25. Outline the principles of management of superior vena caval obstruction.

Principles of management include:

Diagnose it clinically

History - dyspnoea, head fullness, cough, lines, tumour

Examination - plethoric cyanosed facies, periorbital oedema, exophthalmos, conjunctival injection, fundal venous engorgement, raised non-pulsatile JVP, lymphadenopathy, Pemberton's sign, dilated arm and chest collaterals

Look for associated features

Central airway compression, recurrent laryngeal involvement, phrenic nerve paralysis, Horner's syndrome, cardiac tamponade, pleural effusion

Confirm by investigation and look for cause

Thoracic neoplasm (usually bronchogenic Ca or Non Hodgkin's Lymphoma), retrosternal thyroid, mediastinal fibrosis (post infection), thrombosis from intravascular device, aneurysm

High resolution CT is the most useful investigation. Also consider CXR, bronchoscopy/biopsy, echocardiograph, mediastinoscopy/biopsy, Magnetic Resonance Imaging

Peripheral tissue diagnosis often successful - node biopsy, sputum cytology, Bone Marrow biopsy

Treat obstruction

Steroids, Deep X-Ray Therapy, chemotherapy, surgery when indicated. Anticoagulation and thrombolytic Rx for acute catheter related thrombosis.

Support as necessary

Initial vascular access - IVC territory. Prepare for peri-operative/anaesthesia risks - CVS collapse (tamponade), central airway obstruction, laryngeal dysfunction, associated respiratory dysfunction (pleural and pulmonary involvement)

Few candidates considered the significant risk of sedating/anaesthetising patients with a mediastinal mass.

Seven out of forty-one candidates passed this question.

26. Critically evaluate the role of anti-arrhythmic drugs in the management of cardiac arrest.

Several antiarrhythmic drugs are recommended in the ARC guidelines for use in VF/pulseless VT cardiac arrests and for bradycardia/asystole. However no drugs have been shown to improve long-term survival after cardiac arrests. Basic and advanced life support, early access to defibrillation and treatment of reversible causes take priority.

Guideline recommended drugs that should be considered include:

Lignocaine 1-1.5mg/kg, Amiodarone 300mg, Magnesium 5 mmol and atropine (1-3 mg).

Lignocaine is a class 1 antiarrhythmic, sodium channel blocker and has been traditionally used in VF/ pulseless VT cardiac arrest and while it is listed as first line in the ARC guidelines, the evidence for its use is limited. It should be given as a bolus for refractory VF/VT and occasionally can be used when the patient has recurrent VF/VT to prevent recurrence. Prophylactic use in AMI not complicated by arrhythmia is not recommended as there is some evidence that it may worsen overall prognosis.

Amiodarone is a complex antiarrhythmic drug with effects on sodium, potassium and calcium channels and alpha and beta blocking effects. It is an effective antiarrhythmic agent for both supraventricular and ventricular arrhythmias and it also causes less cardiac depression than other antiarrhythmics. It thus has some advantage over lignocaine. It is toxic to the tissues if it extravasates and is recommended for central venous administration but administration into an antecubital vein in the cardiac arrest situation is acceptable. Bolus injection of 300mg can be followed by 150 mg if no effect and can be followed by infusion. Amiodarone has been shown to be better than placebo and lignocaine in terms of survival to hospital admission after out of hospital cardiac arrest due to refractory VF.

Magnesium is recommended by the ARC particularly for: Torsades de points, digoxin toxicity, and demonstrated hypokalemia/hypomagnesemia. It can be given as a 5mmol bolus which can be repeated and followed by infusion. There are no clinical studies using magnesium in this setting but it has been demonstrated to be a useful antiarrhythmic in postoperative cardiac surgical patients (Level 1 evidence).

Atropine is recommended by the ARC for use in severe bradycardia and in asystole. There are no controlled or randomised studies supporting its use. It can be given in 1 mg boluses up to 3 mg.
Five out of forty-one candidates passed this question.

27. Outline the diagnostic features of pseudomembranous colitis and list the likely causes in patients in Intensive Care.

Diagnostic features include: Watery Diarrhoea, Bloody diarrhoea, Pseudomembranes (may be passed with stool or may be visible on bowel mucosa on colonoscopy), Recent or current course of antibiotics, Abdominal tenderness, fever, increased WCC. Clostridium difficile infection can be asymptomatic.

Diagnosis confirmed by detection of clostridium difficile toxins (A &/or B) in stool (toxin present in 95% of patients with pseudomembranous colitis).

Other features on investigations: Plain AXR - mucosal thickening, "thumbprinting", or colonic distension; CT abdo – wall thickening, irregular bowel wall margin, pericolonic stranding, ascites. Features of complications include: electrolyte disturbances (low K, normal anion gap acidosis due to bicarbonate loss), hypoalbuminaemia, dehydration, toxic megacolon, perforation, pneumoperitoneum, possibly progressing to shock MOF.

Likely causes in patients in Intensive Care: Clostridium difficile infection; Overgrowth of clostridium due to eradication of other organisms; Antibiotics – particularly reported following clindamycin, cephalosporins (particularly 3rd generation), ampicillin/amoxycillin but can occur after any (less likely with ticarcillin/clavulanate, aminoglycosides, quinolones). More likely following shock and decreased gut perfusion, renal failure and in the old and debilitated or in patients with immunocompromise such as haematological malignancy or HIV infections.

Thirty out of forty-one candidates passed this question.

**The following three questions (28, 29 and 30) relate to the following clinical scenario:
A 65 year old woman with chronic airways disease presents with acute respiratory failure.**

28. Outline how you would establish the precipitating cause of her acute respiratory failure.

History: consider

- Duration of respiratory failure – is it acute deterioration on a normal functional background or acute on chronic?;
- setting (in community or hospital); any trauma/surgery/anaesthesia/procedure related;
- respiratory depressant drug use;
- fever/sweats/cough/sputum production;
- history of others developing respiratory infection or epidemics;
- recent travel especially overseas;
- history of DVT/PE, malignancy, cigarette smoking,
- recent chest pain or symptoms of heart failure;
- medication use related to potential anaphylaxis or upper airway oedema;
- is there a septic or SIRS process generating a metabolic acidosis that this patient's respiratory system cannot deal with?

Examination: consider

- Level of consciousness
- presence of stridor or wheeze
- cyanosis indicative of oxygenation failure
- barrel chested / pursed lips / nasal flaring indicating hyperinflation
- tracheal deviation indicating severe collapse or PTX;
- subcutaneous emphysema;
- flap indicative of hypercapnia;
- ?new heart murmur or other signs indicative of heart failure;
- signs of non-respiratory sepsis (eg abdomen) or SIRS generating a severe metabolic acidosis;
- focal limb oedema.

Investigation: consider

- ABG – assess oxygenation/ventilation/acid-base status (metabolic and respiratory)
- Spirometry – obstructive or restrictive airflow pattern
- Hb – is there polycythaemia due to chronic severe disease or severe anaemia contributing decreased O₂ delivery?
- ECG – is there RHF or myocardial ischaemia?
- CXR – collapse / PTX / pneumonia / heart size / pulmonary oedema / hyperinflation / effusion / trauma / malignancy / airway compression.
- Sophisticated investigations like thoracic CT are not necessarily appropriate in the acute setting unless suspecting a PE.
- Possible use of V/Q scanning.

Twenty-seven out of forty-one candidates passed this question.

29. Outline how you would determine the severity of her underlying airways disease.

History: consider – exercise tolerance; ADLs; home O₂ use; home CPAP/NIV use; respiratory medication use and compliance; steroid use; need for heart failure medication; frequency of hospitalisations or previous mechanical ventilation.

Examination: consider – steroid skin; cachexia / nutritional assessment; plethora secondary to polycythaemia.

Investigations: consider – previous ABGs (degree of hypoxaemia/hypercapnoea/metabolic compensation); Electrolytes: especially tCO₂ indicative of bicarbonate compensation of chronic hypercapnoea; previous spirometry (FEV₁/FVC - degree of emphysema/hyperexpansion/evidence of left or right heart failure); formal Pulmonary Function Tests (DLCO/flow-vol loops); ECG (?chronic right heart strain pattern); Hb (polycythaemia secondary to chronic hypoxaemia).

Twenty-four out of forty-one candidates passed this question.

30. Outline your principles of management of her mechanical ventilation during her stay in Intensive Care.

Principles of management include:

- NIV better than intubation (if possible).
- Do no harm – if IPPV consider I:E ratio / RR / TV or insp. pressure settings / flow pattern of breath to avoid dynamic hyperinflation and barotrauma.
- Supported spontaneous ventilation preferred to fully ventilated IPPV if possible.
- High enough mechanical ventilatory support to avoid respiratory muscle fatigue balanced out to avoid generating respiratory skeletal atrophy.
- Extubate sooner rather than later if safe to do so and be prepared to support with NIV post-extubation.
- Assess cough, airway protection and sputum load when considering extubation or use of NIV.
- Supplemental oxygen and PEEP to appropriate levels for adequate oxygenation (eg. PO₂ 55mmHg in some patients).
- Ventilation to get CO₂ to appropriate levels (may not necessarily mean normalising CO₂ to 40; ?allow permissive hypercapnoea).
- Discontinue futile therapies if prognosis hopeless and deemed ethically appropriate with understanding & agreement of patient or appropriate surrogate.

Nineteen out of forty-one candidates passed this question.

ORAL SECTIONS

Sixteen candidates were invited to sit the oral sections of the examination. Twelve of these candidates were approved.

Objectives Structured Clinical Examination (OSCE) Section

There were sixteen stations with six rest stations (including one before and after each of the five 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).

Fifteen out of sixteen candidates passed the OSCE section overall.

Station:

1. Clinical case.

Candidates were asked to describe the X-ray findings, interpret arterial blood gases and an ECG, and suggest relevant further management. Questions included:

"A 64 year old man is referred to the Intensive Care Unit with hypoxaemia 5 days post-lobectomy for lung carcinoma.

This is his Chest X-ray on admission to ICU. List the findings."

"On admission to ICU, he is NOT in respiratory distress, is afebrile with a normal white cell count and is otherwise stable. This is his arterial blood gas:

| | | | |
|-------------------|------|--------|-----------|
| FiO ₂ | 0.5 | | |
| PaO ₂ | 66 | mmHg | |
| PaCO ₂ | 43 | mmHg | 35-45 |
| HCO ₃ | 26 | mmol/l | 20-30 |
| pH | 7.41 | | 7.35-7.45 |

What measures could be used to improve his respiratory status?"

Potential problems to be identified included: intercostal catheters, pneumothorax, mediastinal shift, collapse/consolidation, pleural fluid and subcutaneous emphysema; Sinus tachycardia, P pulmonale, Right axis deviation and Right ventricular hypertrophy.

Seven out of sixteen candidates passed this station.

2. Other Xrays.

Candidates were asked to describe the X-ray findings, list possible aetiologies, and suggest relevant further investigations or treatment. Introductory questions included:

"This is an abdominal radiograph of a man with abdominal pain and septic shock. Describe any abnormalities present and list three precipitating life-threatening causes."

"A 50 year old man was admitted to ICU following major surgery. Post operatively, he persistently complains of bilateral ankle pain. Bilateral ankle x-rays are performed Describe the significant radiological abnormality. His pre-operative chest radiograph is found , what obvious abnormality has been missed?"

"This is the CT brain scan of a man who presents with sudden loss of consciousness. Please describe the abnormalities."

"This is the abdominal radiograph of a 30 year old diabetic woman with loin pain and septic shock. Describe any abnormalities present."

Findings to be identified included: air in portal venous system, hypertrophic pulmonary osteoarthropathy, subarachnoid haemorrhage, air in bladder and renal tissue emphysema.

Eleven out of sixteen candidates passed this station.

3. Clinical case 2.

Case presented regarding investigation and management of a patient with burns (including arterial blood gas). Introductory material and initial questions were:

"A 52-year-old man is rescued from a house fire. He sustained burns to his body and was deeply unconscious at the scene. On arrival in the Emergency department, he was promptly intubated and ventilated. He was resuscitated with 3 litres of Hartmann's solution and underwent a primary and secondary survey. Relevant clinical findings prior to transfer to your intensive care unit were: Orally intubated (9.0 endotracheal tube); Ventilated (SIMV: FiO₂ 1.0); Blood pressure 90/50 mmHg, heart rate 130 bpm.

Urinary catheterisation drained 500mL clear urine, and 10 mL in the preceding hour.

Glasgow Coma Score (prior to sedation): 3/15.

Remainder of clinical examination is normal: Normal chest examination. Normal abdominal examination. No abnormalities detected on cervical spine, chest and pelvic X-rays. No long bone fractures.

He has been sedated with fentanyl and midazolam. He has received tetanus immunoprophylaxis. The burns have been washed with cold water and dressed with silver sulphur diazine (SSD). His burnt body surface area has been recorded on a body chart."

"What is the estimated burnt body surface area from the burn chart (and show how you arrive at this)?"

“Prescribe a fluid regimen for the next 48 hours for this patient (and show your calculations).”

Fifteen out of sixteen candidates passed this station.

4. Chest Xrays.

Candidates were asked to describe the X-ray findings. Candidates were expected to comment on the presence and position of devices/foreign bodies, even if they were positioned correctly.

Introductory questions included:

“This the chest radiograph of an infant who is desaturating. Please list the abnormalities.”

“This child underwent rigid bronchoscopy for inhaled foreign body. He is to be air-lifted to a tertiary hospital for care. Please list findings on this chest radiograph.”

“This wheelchair bound woman deteriorated after a procedure. Please list the findings on this chest radiograph.”

“This is the routine chest radiograph after cardiac surgery. Please list the findings.”

“This patient deteriorated after a procedural intervention. Please list the findings on this chest radiograph.”

Findings to be identified included: endobronchial intubation and right upper lobe collapse, pneumothorax and intercostal catheter, kypho-scoliosis and misplaced nasogastric tube, and misplaced pulmonary artery and pigtail catheters.

Fifteen out of sixteen candidates passed this station.

5. Equipment station.

Candidates were expected to describe or discuss advantages or problems with devices presented. Examples included a closed suction device, a “Flexitip” laryngoscope, a metered dose inhaler & a nebuliser, and a chest drainage bottle. Introductory questions included:

“What is this device? What are the proposed advantages of this system?”

“What is this piece of equipment? What is its purpose?”

“What are these 2 pieces of equipment? Compare and contrast these 2 devices.”

“What is this device? Describe the 3 different compartments and their functions.”

Fourteen out of sixteen candidates passed this station.

6. Rest station.

7. Procedure station 1.

Candidates were expected to demonstrate that they could safely direct management of a cardiac arrest, including defibrillation. Introductory material was:

“You have been called to a cardiac arrest on a general medical ward of your hospital. A 55 year old lady was admitted with chest pain and subsequently had a sudden loss of consciousness. The anaesthetic resident and coronary care nurse are at the bedside when you arrive. You will be running her cardiac arrest management.”

Fourteen out of sixteen candidates passed this station.

8. Rest station.

9. Clinical examination (cold case) 1.

Clinical cases presented included patients with Marfan’s syndrome and AVR, mitral stenosis, and pulmonary fibrosis. Introductions included:

“has noticed palpitations and dyspnoea. Please examine cardiovascular system”

“has shortness of breath. Please examine respiratory system”.

“attends cardiology outpatients and has worsening shortness of breath. Please examine cardiovascular system”

Common problems identified were related to poor exam technique, poor interpretation of clinical signs, and failure to recognise clinically significant issues.

Thirteen out of sixteen candidates passed this station.

10. Rest station.

11. Communication station

As for communication stations in general, candidates were expected to provide an empathic explanation of the situation, using appropriate body language, and appropriate attention to the needs of the daughter. Other factors looked for included delineation of next-of-kin, expressed wishes, clear plan of management etc. The clinical scenario provided was as follows:

“You have been asked to consider admission to the ICU of an 86 year old woman, Flavia Arcadia. She has presented with confusion, fever and hypotension thought to be due to urosepsis as microscopy has shown Gram negative bacilli in her urine. Despite fluids she remains oliguric and her creatinine is now 300 micromol/L with a K⁺ of 5.4 mmol/L. Her JVP is clearly elevated, and there are basal crackles heard.

The medical team has started to discuss management options, but her daughter wants ‘everything done.’ You have one ICU bed left on Friday evening running into a long weekend. There are two HDU beds available.

You meet the daughter at the bedside as you finish examining the patient.”

Six out of sixteen candidates passed this station.

12. Rest station.

13. Clinical examination (cold case) 2.

Clinical cases presented included patients with hepatomegaly and chronic liver disease.

Introductions included:

“intermittent abdominal pain. Please examine abdomen”

“complains of occasional abdominal pain. Please examine abdomen”.

Common problems identified were related to poor exam technique, poor interpretation of clinical signs, and failure to recognise clinically significant issues. Candidates should ensure that they look for associated signs (eg. scars, fistulae), and perform a gentle initial abdominal examination before deeper palpation.

Six out of sixteen candidates passed this station.

14. Rest station.

15. Procedure station 2.

Candidates were expected to demonstrate that they could safely insert a pulmonary artery catheter. Marks were allocated under headings of “Patient preparation”, “preparation of catheter for insertion”, “insertion of the catheter”, and “confirmation of placement and calibration”.

Introductory material was:

“A 62 year old man has cardiogenic shock. A dobutamine infusion of 7 mcg/kg/min is running. He is intubated and ventilated, on 50% O₂ and PEEP 10 cm H₂O. He is lightly sedated on morphine and midazolam, but rouses to voice and is interactive. You have decided to insert a continuous cardiac output oximetric pulmonary artery catheter in to the right internal jugular vein. Describe exactly how you will go about this.”

Some candidates had difficulty in reproducing expected pressure waveforms.

Twelve out of sixteen candidates passed this station.

16. Rest station.

Cross Table Viva Section

There were 6 stations of ten minutes each for structured Vivas. There were two minutes provided to read an introductory scenario (which includes the initial question) outside each viva room. This same information is also provided inside each Viva room. 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.

Feedback from examiners suggested that common problems encountered included.

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

- **Evidence Based Medicine**

“The SAFE study was recently published in the New England Journal of Medicine. SAFE was a large clinical trial comparing albumin and saline for resuscitation of intensive care patients in Australia and New Zealand. SAFE found no difference in mortality between the two groups.

The SAFE study had many features which caused readers to consider it of high quality and for clinicians to believe that the findings were likely correct.

What features must you look for in the DESIGN of ANY clinical trial to determine whether you should accept the results as correct and apply them to your patients?”

Areas covered poorly included concealment, blinding, baseline risk for sample size calculation, and adjustment for baseline variables.

Thirteen out of sixteen candidates passed this section.

- **Paediatrics**

“A 14 year old girl presents with a history of chronic renal failure due to Haemolytic Uraemic Syndrome 6 years ago.

She had a failed renal transplant and is currently managed on nightly peritoneal dialysis.

Recently she developed shortness of breath and underwent echocardiography which demonstrated a fractional shortening of 12% and evidence of clots in her atrium and required admission to PICU for management.

Discuss the management of Haemolytic Uraemic Syndrome in children.”

“Discuss the potential complications of PD in children/ weigh up the relative risks of PD vs CVHDF”.

Nine out of sixteen candidates passed this section.

- **Musculoskeletal: rhabdomyolysis**

Scenario

“A 62 year old male patient, with a past history of recently diagnosed ischaemic heart disease, treated with aspirin and simvastatin, was admitted for overnight ventilation to the intensive care unit after total cystectomy and formation of ileal conduit for extensive TCC of the bladder.

20 hrs after admission your resident shows you his blood results, which demonstrate the following:

| | | |
|---------------|--------------|-----------------|
| Na | 135 mmol/l | (137-145) |
| K | 6.2 mmol/l | (3.8-4.9 serum) |
| Cl | 103 mmol/l | (98-106) |
| Bicarb | 16 mmol/l | (22-32) |
| Urea | 5.6 mmol/l | (3-8) |
| Creatinine | 0.212 mmol/l | (0.05-0.12) |
| Urate | 0.58 mmol/l | (0.15-0.50) |
| Phosphate | 3.40 mmol/l | (0.7-1.4) |
| Calcium | 1.61 mmol/l | (2.15-2.60) |
| Albumin | 36 g/l | (33-47) |
| Total protein | 62 g/l | (62-83) |
| Bilirubin | 10 µmol/L | (<20) |
| ALP | 85 U/l | (40-110) |
| LDH | 4876 U/l | (100-200) |
| ALT | 698 U/l | (5-45) |
| AST | 2423 U/l | (10-45) |

What is the likely diagnosis?”

“What are the supporting biochemical features?”

Ten out of sixteen candidates passed this section.

- **Respiratory/ventilation**

“You receive a young patient involved in a high-speed motor vehicle accident. He has fractures of his femur and humerus. He has returned from the operating theatre following a negative, exploratory laparotomy. He has had a hypoxaemic arrest in the operating theatre. Bilateral intercostal catheters were inserted and he returns to ICU intubated, hand ventilated with SaO₂ 75% on FIO₂ 1.0, pulse 100 bpm and SBP 108 mmHg on an adrenaline infusion. His first arterial blood gas demonstrates:

| | | | Normal Range |
|-------------------------------|-------------|-------------------------------|--------------|
| FIO ₂ | 1.0 | FIO ₂ | 0.21 |
| pH | 6.84 | pH | 7.35-7.45 |
| PaO ₂ | 39 mmHg | PaO ₂ | 75-100 mmHg |
| PaCO ₂ | 70 mmHg | PaCO ₂ | 35-45 mmHg |
| HCO ₃ ⁻ | 11.7 mmol/L | HCO ₃ ⁻ | 23-26 mmol/L |
| AG | 27 | AG | <20 |

Please interpret this arterial blood gas and the most likely reasons for the derangement?”

“His first chest radiograph only demonstrates bilateral diffuse infiltrates.
How would you manage his ventilatory settings to improve his gaseous exchange? ”

Fourteen out of sixteen candidates passed this section.

- **Neurology**

“A 75 year old man is admitted to your unit from the Emergency Department following admission for dysphagia, dysphonia and fluctuating consciousness.

During a period of drowsiness, he was said to have had a seizure and aspirated, following which he was intubated and ventilated.

Prior to admission to the intensive care unit, he underwent a head CT scan that was reported as normal, with no evidence of intracranial mass lesions, haemorrhage or infarction.

On arrival in the intensive care unit, he is noted to be afebrile, blood pressure 190/120, pulse rate 80/min.

Oxygen saturation is 98%, he is ventilated with an FIO₂ of 0.5.

What is your initial approach for the assessment and management of this patient?”

“Initial examination and investigations are unremarkable. What is your differential diagnosis and initial plan?”

Areas that were poorly covered included post-seizure management, and the potential for CNS infection.

Eleven out of sixteen candidates passed this section.

- **Gastrointestinal**

“A 39 year old male with a history of heavy alcohol intake is admitted to the emergency department with an acute massive upper GI haemorrhage.

He is hypotensive (BP 60/40), tachycardic (HR 140/min), combative, confused and agitated. He proceeds to have another 1 litre haematemesis in front of you, together with profuse malaena.

Outline your initial management of this patient.”

“What is the differential diagnosis?”

Fifteen out of sixteen candidates passed this section.

The Clinical Section: Hot cases

The Clinical Section (hot cases) was conducted at the Alfred Hospital, Melbourne.

Nine out of sixteen candidates passed this combined section (nine out of sixteen passed the hot cases overall, and eleven out of sixteen passed the cold cases overall). Candidates should listen carefully to the introduction given by the examiners and direct their examination accordingly. Patients were usually 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. The twenty minutes available for each case provides ample opportunity to discuss related investigations and plans of management.

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.

Candidates must show appropriate courtesy and respect to patients.

Cases encountered as hot cases included patients with:

- Difficulty to wean after chest trauma (introduced as “isolated chest trauma. Why difficult to wean?”)
- Extubation after a stroke (introduced as “admitted following a stroke. He was extubated 6 days ago, but required re-intubation within 3 hours. Fasted overnight for consideration of extubation. You are taking over care today. Please examine and determine what problems are and how you want to manage them.”)
- Weaning after cardiac surgery (introduced as “cardiac surgery 12 days ago. Slow to wean and confused post-op. Readmitted after asystolic arrest. You are taking over care. Please examine and determine what medical issues exist and how you would manage them.”)
- respiratory failure and bone marrow transplant (introduced as “10 days of increasing shortness of breath, 3 months post BMT for AML. Arrived in the unit last night. Please examine respiratory system and suggest a diagnostic and management plan”).
- sepsis (introduced as “presented with respiratory distress and shock 8 days ago after a 3 day prodrome of fever and malaise. Please examine and focus on possible sources for sepsis.”)
- haemodynamically unstable after cardiac surgery (introduced as “post-CABG who is haemodynamically unstable day 1 post-op. Please examine”)
- Intracerebral haemorrhage
- Out-of-hospital cardiac arrest

Comments documented at the time of the clinical examination suggested that common problems encountered related to poor examination technique (eg. erratic/disorganised), detection and interpretation of clinical signs, and identification of clinically significant issues.

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