REPORT OF GENERAL FELLOWSHIP EXAMINATION

AUGUST/SEPTEMBER 2002

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.

Fifteen candidates presented for this examination. Twelve were successful.

ORAL SECTIONS

Objectives Structured Clinical Examination (OSCE) Section

There were thirteen stations with three rest stations (one before and after each interactive stations). Twelve candidates passed this section. A systematic approach to the types of investigations examined was more likely to maximise the candidate's score.

Station:

- 1. *Chest X-rays* including abnormalities after chest trauma, PA catheter insertion (including anatomy), and tension pneumothorax. A list of abnormal findings was often requested, as were relevant other investigations and associated management. Fourteen out of fifteen candidates passed this section.
- 2. *ECGs* demonstrating ventricular tachycardia, acute myocardial infarction, bifascicular block and complete heart block. The rhythm or a list of abnormal findings was requested, as were relevant causes and associated management Eight out of fifteen candidates passed this section.
- 3. *Biochemistry*. Examples included a hyperosmolar state, obstructive jaundice, and hyponatraemia. The likely diagnoses and/or possible causes were requested, as were formulae for some simple, relevant, calculations. Eleven out of fifteen candidates passed this section.
- 4. *Paediatrics*. Material presented included an extra long un-cuffed endotracheal tube, and a simple device to facilitate emergency airway access. X-rays demonstrated congenital heart disease, and intravascular devices. Additional information including abnormalities and management, or pertaining to the use or complications of the devices were requested. Eight out of fifteen candidates passed this section.

- 5. Arterial Blood Gases including metabolic acidosis with respiratory alkalosis, mixed respiratory and metabolic acidoses, mixed respiratory and metabolic alkaloses, and respiratory acidosis with metabolic alkalosis. A list of abnormal findings was requested (including abnormalities in pH), as was their likely aetiology, and either confirmatory tests or management. Ten out of fifteen candidates passed this section.
- 6. Other X-rays including MRIs, CTs and X-rays demonstrating epiglottitis, cervical disc herniation, subdural haematoma, renal contusion and pancreatitis. A list of abnormal findings was requested. Fourteen out of fifteen candidates passed this section.
- 7. *Miscellaneous Equipment* including a non-invasive blood pressure cuff, an intubating laryngeal mask, a Wright's spirometer and an emergency cricothyrotomy kit. Identification of the device was requested, with additional questions related to use and/or accuracy of the device. Twelve out of fifteen candidates passed this section.
- 8. *Chest X-rays* including multiple trauma, consolidation and pneumothorax. A list of findings was requested (including the multiple devices and tubes), with some question relating to management or differential diagnosis. Five out of fifteen candidates passed this section.
- 9. *Rest station*.
- 10. Procedure station. Clinical scenario was presented which required immediate management of ventricular fibrillation. Seven out of fifteen candidates passed this section. Many candidates were unfamiliar with straight forward issues such as biphasic defibrillators, safe and effective techniques for defibrillation, and ratios of compressions to ventilation.
- 11. Rest station.
- 12. *Communication with an actor* involved discussion of ongoing management of a patient with incurable metastatic disease. Six out of fifteen candidates passed this section. Many candidates need to improve their basic counselling skills.
- 13. Rest station.

Cross Table Viva Section

There were 6 structured Vivas of ten minutes each, and 2 rest stations. There were two minutes provided to read a scenario outside each viva room. 13 out of 15 candidates passed this section. Candidates should be able to provide a systematic approach for assessment and management of commonly encountered clinical scenarios (eg. hypotension, hypoxaemia, endotracheal intubation),. Candidates should also be prepared to provide a reasonable strategy for management of conditions that they may not be familiar with.

The topics included:

• The presence of a relative during cardiac arrest management. Ten out of fifteen candidates passed this section.

- Management of hypotension 10 days after severe burns. Fourteen out of fifteen candidates passed this section.
- Management of lithium toxicity. Nine out of fifteen candidates passed this section.
- Management of severe respiratory failure due to community acquired pneumonia. Ten out of fifteen candidates passed this section.
- Diagnosis and management of hyper-glycaemic, hyper-osmolar, non-ketotic coma. Twelve out of fifteen candidates passed this section.
- Initial and ongoing management of sudden collapse out-of-hospital due to an intracerebral bleed. Thirteen out of fifteen candidates passed this section.

The Clinical Section

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

Only six out of fifteen 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, and a sensible discussion of the signs and their interpretation is required. 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:

- ASD, mitral valve prolapse, and pulmonary hypertension who were all presented as patients with increasing dyspnoea.
- Peripheral neuropathy and transverse myelitis who were presented as patients with difficulty walking, or as "legs feel funny".
- Mixed aortic valve disease, presented as CVS examination in a patient with a fever
- Renal transplant, presented as abdominal examination in a patient with sepsis.
- Hepatosplenomegaly, presented as GIT examination in a patient with recent gastrointestinal haemorrhage.

Many candidates seemed unfamiliar with the use of a sphygmomanometer. Ten out of fifteen candidates passed this section.

Cases encountered as hot cases included patients with:

- Respiratory failure after surgery, presented as failure to wean from ventilation
- Victim of motor vehicle crash, presented as slow to wake
- Immunosuppressed patient, presented as unidentified source of sepsis
- Burns victim, presented as patient to be assessed for potential extubation

Nine out of fifteen candidates passed this section.

WRITTEN SECTIONS

Fourteen out of fifteen candidates passed this section overall.

Long Answer Questions

(Fourteen out of fifteen candidates passed this sub-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. (Thirteen out of fifteen candidates passed this question.)

You are called to see a 49-year old female in the general surgical ward who has become profoundly hypotensive (75/40 on auscultation). She is now 5 days after palliative surgery for a perforated malignant gastric ulcer. She is barely rousable and the pulse oximeter saturation is 85% on face mask oxygen (10L/min).

(a) Please outline your initial management of this patient.

Obvious initial priorities are airway, breathing and circulation, but aware of the fact that there may be some limitations placed on the resuscitative efforts. If no formal documentation is immediately available, it is appropriate to aggressively resuscitate (as usual, without delay) until appropriate information is obtained.

Endotracheal intubation is almost certainly indicated (immediately if unable to protect airway, or after a short period of cardiovascular resuscitation). Rhythm assessment is required to rapidly exclude reversible rhythm disorder. Fluids should be administered (type and amount over time should be discussed), and a vasopressor (bolus \pm infusion) may be appropriate when hypovolaemia has been excluded.

Major differential to be considered includes hypovolaemia and sepsis (abdominal, respiratory) but other causes must be considered (including pulmonary embolus, myocardial infarction, anaphylaxis, adrenal insufficiency etc.).

Early administration of broad spectrum antibiotics &/or corticosteroids should be considered.

(b) Please discuss the timing and nature of any investigations that you would perform.

Timing and the information expected is required. Immediate investigations should include ECG monitoring (for rhythm and ST segment assessment), arterial blood gases (oxygenation, carbon dioxide and acid base status), full blood examination (Hb, WCC) and electrolytes (including renal function and lactate). Blood cultures should be taken as soon as possible. Less urgent (minutes) investigations include chest and abdominal radiographs, ECG, and consideration of further abdominal investigations (eg. CT scan).

More specific investigations may be indicated according to the clinical suspicion. Consider exclusion of pulmonary embolus (CT angiogram, transoesophageal echo), severe myocardial dysfunction (PA catheter, echocardiography), baseline cortisol (before administer corticosteroids).

(c) Please discuss your plan for her definitive care.

At this stage definitive information is required regarding her prognosis and expressed wishes. The palliative operation may have been performed to provide months of more comfortable existence, or to prevent severe discomfort during the last weeks of life.

Priorities for "comfort only" measures or limitations in therapies should be introduced when considered appropriate (with input from family, parent unit etc.).

If appropriate after all information is available, specific treatment to treat the potential underlying causes should be implemented. Specific therapies depend on the diagnosis (drainage/surgery/antibiotics for intra-abdominal sepsis; antibiotics/ventilation for pneumonia; anticoagulation ± surgery for pulmonary emboli; etc.).

Nonspecific supportive care should also be discussed (including DVT prophylaxis, GI bleeding prophylaxis, feeding, pressure area care, support for family etc.

QUESTION 2 (Fourteen out of fifteen candidates passed this question.)

The use of a pulmonary artery catheter in critically ill patients remains controversial.

(a) What potential benefits are associated with its use?

Potential benefits relate to the information that is provided. These include:

- Estimates of left-heart filling pressures. Clinical assessment is notoriously unreliable. Allows better assessment of true filling pressures, in particular in the presence of pulmonary or right heart dysfunction.
- Measurement of pulmonary arterial pressures. Clinical assessment is unreliable. Allow titration of therapies to improve right heart function (nitric oxide, GTN, oxygenation, ventilation etc).
- Measurement of core temperature. Useful assessment of true core temperature.
- Measurement of cardiac output. Gold standard for measurement (more accurate than clinical assessment).
- Measurement of mixed venous oxygen saturation. Allows assessment of global oxygen extraction, and facilitates management directed towards this endpoint (eg. fluids, inotropes, sedation etc.)
- Measurement of right heart pressures. Allows titration of specific management.
- Calculation of derived variables (eg. SV, SVR) which may provide further direction for management.
- Some extra features may be available. Consider ability to calculate right ventricular ejection fraction, and to measure cardiac output and mixed venous oxygen saturation continuously.

(b) What potential complications are associated with its use?

Potential complications are multiple, some of which are rare and life threatening, others are more subtle, may affect morbidity, and are far more common. Some reference to magnitude of importance of various potential complications should be made. Consider:

- Additional cost of catheter and flush lines, exposure to heparinised (usually) catheter, ± requirement for additional staff and/or monitoring equipment
- Problems associated with delays in instituting management while awaiting completion of insertion

- Problems associated with the venepuncture (including damage to surrounding structure at risk [dependent on site] eg. nerves, arteries, veins, lung etc).
- Problems associated with the passage [insertion or removal] (including malposition, arrhythmias)
- Problems associated with the catheter in situ (including trauma to valves, infection, air embolus)
- Problems predominantly associated with balloon inflation (including pulmonary artery rupture, air embolus)
- Problems associated with the information obtained or its interpretation (including limitations of various assumptions relating pressure [eg. PAOP] and preload [eg. LVEDV], errors in calculating derived indices, treatment based on erroneous information)

(c) In what groups of patients do you think that it should be used?

The answer should represent a combination of the candidate's knowledge of the literature, and their experience/expertise. There is very little data to support the routine use of PA catheters in any particular group of patients. Specific reference to situations where it has not been proven to be of benefit may be of value, but has not been asked for specifically. Some justification (eg. risk benefit analysis) for the groups of patients is required.

Expected groups of patients may include:

- those with combination organ dysfunction (eg. cardiac and lung), with conflicting priorities
- those who are not responsive (or respond abnormally) to small amounts of inotropic/vasopressor support
- those where additional information may not be readily obtainable (eg. no echocardiography service)
- those undergoing cardiac surgery (often restricted to those with impaired LV function)
- those requiring cardiovascular optimisation for high risk non-cardiac surgery.

Short Answer Questions

(Twelve out of fifteen candidates passed this sub-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.

1. List the possible causes, and outline your principles of management of hyperthermia in the Intensive Care patient.

(Nine out of fifteen candidates passed this question.)

• Causes of hyperthermia (? specific temperature definition: eg. Core temperature > 38 °C) include: infection (bacteria, virus etc), inflammatory response (burns, pancreatitis etc), exertion (status epilepticus, posturing, delirium), auto-immune conditions (arthritis, inflammatory bowel disease), endocrine disorders (eg. hyperthyroidism/thyroid storm), malignancy (esp. haematological), drug associated (eg. overdose with cocaine, salicylates; withdrawal states eg. from alcohol, opiates; and occasionally drug fever) and unusual but requiring specific therapy: malignant hyperthermia (MH) and neuroleptic malignant syndrome (NMS).

- Principles of management include: treatment of underlying cause, and consideration of whether specific temperature lowering therapy is required. Obvious specific therapies include antimicrobial therapy, chemotherapy (including corticosteroids). MH requires urgent removal of exposure to triggering agent, dantrolene (eg. 2.4 mg/kg IV and repeat according to protocol), aggressive cooling and fluid resuscitation. NMS requires removal of responsible drugs (eg. phenothiazines, butyrophenones), symptomatic treatment and consideration of other specific therapies (eg. dantrolene, bromocriptine etc).
- Mild to moderate elevations of temperature are generally not thought to be harmful. Lowering of temperature (independent of the cause) may be beneficial in some circumstances (eg. for comfort), and may be indicated to avoid potential harm in other circumstances (eg. stroke, head injury, hypoxic injury). Aggressive management of temperature should be undertaken if temperature exceeds 39°C in children under 3 (increased risk of seizures) or 41°C in others (concern regarding long term effects on brain, rhabdomyolysis etc). Methods used may be simple (paracetamol, aspirin) or more complex (sponging through to ice packs and cooling blankets).

2. Critically evaluate the significance of tidal volume in the management of patients undergoing mechanical ventilation in Intensive Care.

(Seven out of fifteen candidates passed this question.)

There has been much interest in the use of low tidal volumes (eg. 6-9 mL/kg) in critically ill patients. The recent ARDSnet study confirmed a suspicion that the use of lower tidal volumes (6 vs 12 mL/kg) has significant benefits in those patients with Acute Lung Injury or ARDS (bilateral infiltrates and P/F ratio of < 300, within first 36 hours). Predicted body weight was used (calculated from height and sex). Many previous studies had not shown such a benefit (perhaps due to smaller differences in plateau pressures between groups). In patients with "normal" lungs or those that do not meet entry criteria for the ARDSnet study, there is no evidence to suggest a benefit to the low tidal volume approach. On the contrary, the intermittent use of high tidal volumes (such as sighs or recruitment manoeuvres) has been shown to achieve short term benefits (improved P/F ratios, decreased shunt, open up collapsed areas) in patients with early ARDS or atelectasis. The global application of lower tidal volumes may well result in worse oxygen exchange unless counterbalanced with higher levels of PEEP (or intermittent recruitment manoeuvres).

3. Outline how you would assess a patient for potential difficulty with endotracheal intubation.

(Fourteen out of fifteen candidates passed this question.)

- History: of previous difficulty with intubation, infections/swelling affecting mouth or neck, problems with mouth opening or neck movement (arthritis, cervical spine injury), problems with teeth (especially caps/crowns, law wiring etc.).
- Examination (multiple components) consider:
 - o teeth (maxillary anterior to mandibular; length of upper incisors; ability to prognath mandible; inter-incisor distance [need > 3 cm])
 - Pharynx (ability of visualise uvula and tonsillar pillars; height and narrowness of palate).
 - \circ Mandibular space (thyromental distance ≥ 3 fingerbreadths [6 cm]; compliance and distensibility of submandibular space).
 - o Length of neck (qualitative: short neck more difficult eg. syndromes).
 - o Thickness of neck (qualitative: thick neck decreases ability to align planes).
 - o Range of motion (of head and neck: eg. sniffing position)
- Consider also the ability to assess potential difficulties by actually having a look with a laryngoscope.

4. Outline the factors you would consider in making a cost-benefit analysis of introducing a new component of care into your Intensive Care unit.

(Five out of fifteen candidates passed this question.)

Any component of care could be assessed (eg. staffing levels, equipment, new techniques or drugs).

- Strength of evidence supporting the new component of care (eg. more than one adequately powered prospective randomised clinical trial). Internal validity of trials (adequacy of methodology).
- External validity of trials or other supporting information (ie. ability to extrapolate to the patients that you are managing).
- Ability to accurately identify those patients who would benefit from new component of care. Accurate identification of patients prospectively decreases costs by decreasing the number of patients who will need to be treated but who will not benefit (or may even be harmed).
- Magnitude of outcome benefit found (eg. number needed to treat to achieve specific outcome). Consider survival to hospital versus 30 day survival versus 12 month survival.
- Additional costs that may be generated by achieving that outcome (eg. costs of hospitalisation or other care, incurred after survival). Comparison with costs generated (or saved) by alternative strategy.
- Source of funding for costs should be considered. Special grant (above and beyond current budget) or would any additional costs be paid from existing budget (requiring cost cutting in other areas).

5. Outline the techniques you would use to control intra-cranial pressure in a patient with a severe closed head injury.

(All fifteen candidates passed this question.)

Management priorities will be determined by the exact clinical scenario, though the general principles are consistent. Consider recommendations (eg. Brain Trauma Foundation).

- Ensure simple reversible causes are not present (elevate head, maintain head in central position with no venous occluding tapes, adequate sedation, treatment of seizures, adequate volume status, adequate oxygenation, arterial carbon dioxide not elevated).
- Consider exclusion of reversible mass lesion (CT or repeat CT).
- Drain CSF from ventricle (if drain in situ).

Further techniques that could be considered at this point include: further decrease in arterial carbon dioxide (to 30-35 mmHg), mannitol (keeping euvolaemic and osmolarity < 320 mOsm/L), additional sedation (including barbiturates) \pm paralysis (decrease straining against ETT/ventilation), hypertonic saline, induced hypothermia, decompressive craniectomy, (? hypertensive therapy, further hyperventilation).

6. Outline the techniques you would use to determine the prognosis in a comatose survivor of a cardiac arrest.

(Seven out of fifteen candidates passed this question.)

The major determinants of survival after a cardiac arrest are cardiac (arrhythymias and myocardial function) and neurological. Accuracy of assessment of prognosis of both factors increases with time. No techniques have 100% positive predictive value, or more importantly 100% negative predictive value.

- Cardiovascular techniques of most value are the response to therapy (including thrombolysis or angioplasty) and echocardiography.
- Neurological survival is best predicted by neurologic examination (again increasing certainty with time). Early poor prognostic signs (eg at 24 hours post-arrest) are fixed,

unreactive pupils and extensor or absent motor response to painful stimuli (if not paralysed or deeply sedated). Brain death criteria are rarely met. Further refinement of prognosis may be achieved with investigations such as Somato-Sensory Evoked Potentials or EEG. CT is notoriously unreliable. MRI will detect more abnormalities, as it is a more sensitive test (though studies relating appearance to outcome are lacking).

7. List the causes of hyponatraemia in the intensive care patient population, and outline your management of hyponatraemia.

(Nine out of fifteen candidates passed this question.)

Causes are numerous. Lists should include:

Factitious: contaminated by hypotonic intravenous fluid

Isotonic: pseudohyponatraemia [hyperlipidaemia, hyperproteinaemia]

Hypertonic: eg. hyperglycaemia, mannitol

Hypotonic:

- water retention: SIADH, inappropriate antidiuresis [eg. hypovolaemia, cardiac failure, pain, post-operative, renal failure], psychogenic polydipsia, TURP syndrome
- salt depletion: adrenocortical failure, diuretic excess

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Management includes diagnosis and, if appropriate, specific treatment of underlying cause. Most patients are asymptomatic, with plasma Na > 120. Initial treatment with water restriction and isotonic saline is usually sufficient. More aggressive therapy (eg. hypertonic saline) is indicated if Na < 110, or if patient is symptomatic (eg. confusion, coma, seizures). Relationship of rate of correction of Na and risk of osmotic demyelination (central pontine myelinolysis) is controversial, but appears reduced if rate of correction of Na is less than 10-12 mmol/L (ie. \leq 0.5 mmol/hr). Desmopressin (dDAVP) may be required to slow the rate of water excretion. Consider even administration of sterile water to lower sodium if rising too quickly.

8. Outline the clinical manifestations, appropriate investigations, and treatment of acalculous cholecystitis.

(Twelve out of fifteen candidates passed this question.)

Clinical presentation is variable. Symptoms/signs include fever, leukocytosis with a left shift, abdominal pain, right upper quadrant mass, hyperbilirubinaemia, increased alkaline phosphatase and serum transaminases.

Additional investigations (assuming full blood count and liver function tests have already been performed) should include: ultrasonography (usually diagnostic), erect abdominal radiograph, and blood cultures. A radioisotope (HIDA) scan may be useful if diagnosis id still unclear and time permits.

Treatment involves broad spectrum antibiotics, though the definitive treatment is drainage. Percutaneous drainage (via ultrasound guidance) may be performed if the patient is too sick to transport, otherwise invasive techniques (laparoscopic or open) may be considered.

9. Compare and contrast the pharmacology of lignocaine, magnesium and amiodarone when used in the treatment of ventricular tachycardia.

(Six out of fifteen candidates passed this question.)

• Lignocaine: Class I (membrane stabilising) antiarrhythmic agent. Sodium channel blockades results in decreased action potential duration and shortened refractory period. Rapidly distributed to all body tissues. Approximately 65% protein bound; elimination half-life 1.6 hours (80% metabolised in liver). Adverse effects: lightheaded, hypotension, cardiovascular collapse, heart block, confusion and convulsions. Dosage 1 to 1.5mg/kg with subsequent boluses (up to 3 mg/kg total), followed by infusion (1-4 mg/min, at decreasing dose, up to 24 hours).

- Magnesium (as sulphate or chloride): second most abundant intracellular cation. Depresses
 neuronal activation. Widely distributed, duration of action about 30 minutes. Filtered by
 kidneys, but most is reabsorbed. Adverse effects include: nausea, flushing, CNS depression,
 coma, and heart block. Dose 5 mmol bolus (which may be repeated), followed by infusion
 of 20 mmol over 4 hours.
- Amiodarone: Class III antiarrhythmic. Prolongs action potential duration, and prolongs refractory period of atrial, nodal and ventricular tissues. Highly protein bound with very high apparent volume of distribution (6 L/kg); accumulates in adipose tissue and highly perfused organs. Half-life (with chronic dosing) is 14 to 59 days, mainly excreted via the liver and bile. Adverse effects: hypotension/circulatory collapse, bradycardia, sinus arrest, nausea and flushing. Torsades de pointes can be induced. Hyper- or hypo-thyroidism can be induced. Multiple other potential organ dysfunctions with more chronic use (including some potentially fatal). Dosage 5 mg/kg which can be repeated, and followed by an infusion (15 mg/kg/hr).

10. Outline the diagnostic features, complications and treatment of patients with meningococcal sepsis.

(Ten out of fifteen candidates passed this question.)

- Acute systemic meningococcal disease is usually manifest as meningitis &/or meningococcaemia. The diagnostic features include: history of sudden onset of fever/nausea/vomiting/headache/myalgias (sometimes intense), with rapid progression. Examination may reveal hypotension, tachycardia, diaphoresis, and discrete petechiae (initially 1-2 mm diameter; may coalesce). Shock is often profound with extreme vasoconstriction. Blood cultures and CSF cultures are often positive.
- Complications include refractory shock, disseminated intravascular coagulation (including bleeding and major vessel thrombosis), cerebral oedema, and myocardial dysfunction.
- Treatment is with immediate antibiotics. High dose penicillin (2 million units every 2 hours for adults) or chloramphenicol or 2nd or 3rd generation cephalosporins (according to sensitivities). Supportive care for shock (vasopressors and fluids) and other complications (eg. DIC, ARDS etc). Other unproven therapies may include plasmapheresis or activated protein C.

11. Outline the clinical manifestations, appropriate investigations and treatment of hypothyroidism in Intensive Care.

(Eleven out of fifteen candidates passed this question.)

- Hypothyroidism is very common in the ageing population, many unrecognised. Many clinical manifestations are specifically related to either generalised metabolic slowing (fatigue, delayed relation of deep tendon reflexes, bradycardia, depressed nervous system, and hypothermia) or accumulation of matrix glycosaminoglycans (coarse hair and skin, enlarged tongue, non-pitting oedema [myxoedema]). Other manifestations include pericardial effusion, hypertension, hypercholesterolaemia, respiratory muscle weakness, impaired gut motility, and normochromic normocytic anaemia. In some situations (usually obvious), hypothyroidism occurs as a result of treatment for hyperthyroidism or after thyroid surgery.
- Investigations should confirm diagnosis and detect complications (eg. hyponatraemia and lipid abnormalities). Confirmatory tests reveal high serum TSH and a low free T4. Uncommonly secondary or tertiary hypothyroidism (inappropriately low level of TSH for T4). Study of other pituitary or hypothalamic function may be required ± imaging.
- Specific treatment involves replacement of thyroid hormone (usually as T4 50 200 mcg/day). Elderly, especially with heart disease require a more gradual introduction (eg. 25 mcg). Intravenous T3 (5-20mcg initially) may also be used in the treatment of myxoedema

coma. Other treatment involves supportive care (ventilation, fluid and electrolyte management, temperature control) and corticosteroids (eg. hydrocortisone 100 mg tds) in severe cases until adrenal insufficiency excluded.

12. Outline the causes, and the principles of management of lactic acidosis in the critically ill. (Eleven out of fifteen candidates passed this question.)

- Causes can be divided into increased lactate production (including enhanced pyruvate production, reduced pyruvate conversion to CO2 & water or glucose, or preferential conversion of pyruvate to lactate), and diminished lactate utilisation.
- Most causes in the critically ill are due to the many causes of tissue hypoperfusion [Type A] (resulting in increased production and decreased utilisation), or decreased utilisation due to liver disease (especially with use of lactate containing fluids in renal replacement therapy). Other common causes include seizures, beta-2 adrenergic agonists (eg. adrenaline and salbutamol), metformin (uncertain mechanism) and post-cardiac surgery. Consider also dlactic acidosis associated with the short bowel syndrome.
- Principles of management include correcting hypoperfusion (fluids, inotropes, vasopressors), and if possible, correction of underlying disorder (treat seizures, shivering, glucose abnormalities, etc.) and removal of offending drugs (including metformin, adrenaline, renal replacement fluid).

13. Outline your approach to the pain management of a pedestrian (hit by a car) who has significant chest injuries.

(Nine out of fifteen candidates passed this question.)

It may be very difficult to obtain adequate analgesia in patients with significant chest injuries. The various options available may be limited by associated injuries, in particular the presence of a closed head injury, an uncleared cervical or thoraco-lumbar spine, a coagulopathy or renal injury. The options available may also be limited by the area in which the patient will be managed, though these patients should be managed in at least a high dependency unit. Patient sensitivities or allergies, and past illnesses (eg. bleeding ulcer) may also restrict choices.

The options available which should be discussed are multiple and include combinations of:

- simple parenteral opioids (infusion, boluses, PCA), with the use of adjuvant agents (tramadol, NSAIDs, paracetamol, codeine)
- regional techniques (including epidural analgesia with local anaesthetics and/or opioids, interpleural local anaesthetics or intercostal blocks).

14. Outline the way you would calculate and how you might use the following features of a diagnostic test: sensitivity, specificity, positive predictive value and negative predictive value. (Nine out of fifteen candidates passed this question.)

Disease

Sensitivity = proportion of patients with disease detected by positive test = A/(A+C)Specificity = proportion of patients without disease detected by negative test = D/(B+D)Positive predictive value = proportion of patients with positive test who have disease = A/(A+B)Negative predictive value = proportion of patients with negative test who do not have disease = D/(C+D)

Very high sensitivity means few false negatives. Very high specificity means few false positives.

15. List the potential causes of delayed awakening in a patient after a prolonged stay in Intensive Care, and outline how you would determine what factors were contributory. (Fourteen out of fifteen candidates passed this question.)

- Potential causes include: prolonged effects of sedative drugs, metabolic encephalopathy
 (especially renal or hepatic failure), endocrine problems (especially hypothyroidism),
 systemic sepsis, and a myriad of specific neurological problems (eg. status epilepticus,
 raised intracranial pressure, intracranial haemorrhages, severe Guillain Barre, critical illness
 polyneuropathy). Residual muscular paralysis must be excluded.
- Sedative drugs may have a prolonged effect because of altered kinetics (including context sensitive half-time, or decreased biotransformation or excretion eg. renal or hepatic failure) or altered dynamics (potentiation of effect by other drugs or organ failure, sensitivity to effect of usual dosage).

Assessment of contributory factors may be a complex process. Important steps include:

- Detailed history of neurological state, drugs administered, previous neurological problems
- Careful examination (in particular neurological, but also for signs of other chronic diseases).
 Detailed neurological exam should include global CNS assessment (including ability to
 move eyes or poke out tongue if no other apparent motor responses: locked in syndrome,
 severe myoneuropathy), and search for focal signs (pupils, tone, movement, reflexes). Nerve
 stimulator should be used to assess residual paralysis.
- Biochemical investigations for severity of electrolyte imbalance, creatine kinase, renal and hepatic dysfunction (including ammonia), and to exclude treatable endocrine disorders (including T4/TSH).
- Consider use of specific reversal agents (eg. naloxone and flumazenil [may need multiple ampoules]).
- May require other specific investigations (but put into context, and not done as a routine). Such investigations include CT scan of head, MRI, EEG, EMG and lumbar puncture.

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

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