REPORT OF GENERAL FELLOWSHIP EXAMINATION

APRIL/MAY 2004

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

Twenty-two candidates presented for this examination. Seventeen were successful.

ORAL SECTIONS

Objectives Structured Clinical Examination (OSCE) Section

There were fourteen stations with four rest stations (including one before and after each of the two interactive stations). Twenty-one candidates passed this section. 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 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).

Station:

1. ***Rest station***

2. ***ECGs***. Examples included electrical alternans, complete heart block, ventricular pacing, QT prolongation, and axis deviations.

   Twenty out of twenty-two candidates passed this section.

3. ***CXRs***. Examples included pneumothorax, raised dome of diaphragm, pneumopericardium, fractured, widened mediastinum, subglottic tracheal narrowing, azygos lobe, hyperinflated lung fields.

   Fifteen out of twenty-two candidates passed this section.

4. ***Monitoring***. Examples included central venous catheter, arterial catheter for determination of transpulmonary thermodilution and pulse contour analysis determination of cardiac output, bladder catheter, temperature probe, and transcranial doppler.

   Twenty out of twenty-two candidates passed this section.

5. ***Clinical case***. Material presented included a head CT scan (with subdural haematoma, local mass effect, contusion and hydrocephalus); a blood gas (with an increased A-a gradient, and a non-anion gap metabolic acidosis); an ECG (with sinus bradycardia, a prolonged QTc, and inverted T waves), a CSF sample (with decreased rbc/wbc ration), and a short synacthen test (with a normal baseline but a blunted rise at 30 min and 60 min).

   Eighteen out of twenty-two candidates passed this section.

6. ***Rest station***

7. ***Procedure station***. Candidates were expected to provide a systematic approach to their technique of performing a percutaneous tracheostomy. The scenario provided was as follows:

   "This is a procedure station where you will demonstrate your skill and knowledge of the practical aspects of the procedure percutaneous tracheostomy."

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

8. **Rest station**

9. ***Communication station***. The scenario provided was as follows:

   "You are the ICU consultant today after a 2-week break. Your Intensivist colleague yesterday arranged this family meeting with the daughter of your patient Mrs Pearson.

   Mrs Pearson is a 78 year old lady who has been in ICU for 2 weeks. She has had three bowel resections for recurrent GI bleeding (angio-dysplasia). Her ileostomy continues to bleed and she requires 2-3 units of blood each day, every day. She has a tracheostomy, is ventilated, and occasionally obeys commands. Her blood lactate is 7 mmol/L suggesting ischaemic gut.

   The Surgeon has decided that another operation is pointless, that angiography has failed, that transfusions should cease and therapy be withdrawn. You have assessed the patient and you and your colleagues agree, but no one has yet spoken with her daughter, Dianne Pearson. The Blood Bank director advised today that no more blood would be provided."

   Candidates were expected to discuss these issues with the daughter in a compassionate manner.

   Eighteen out of twenty-two candidates passed this section.

10. ***Rest station***

11. ***Equipment***. Examples included anaerobic and aerobic blood culture bottles, a tracheostomy tube with supraglottic suction port, 3 different personal protective respiratory devices, a jejunal (oro- or naso-) enteric feeding tube, and an angle tip tracheal suction catheter.

    Eighteen out of twenty-two candidates passed this section.

12. ***CT scans***.. Material presented included a head CT with a middle cerebral artery territory cerebral infarction, a chest CT of a man with an aortic coarctation, a chest CT with a chest tube and abnormal collections of fluid and air, and a chest CT of a pulmonary embolus.

    Fifteen out of twenty-two candidates passed this section.

13. ***Clinical case*** .Material presented regarding post-operative management of a patient with multiple injuries included management of coagulopathy and lung injury , CXR and CT chest with chest trauma, complications of disease and management, and multiple invasive devices.

    Twenty out of twenty-two candidates passed this section.

14. ***Microbiology:*** Material presented included questions about gentamicin, Legionella pneumonia, VRE, synergistic drug combinations and Activated Protein C.

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

Cross Table Viva Section

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

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

- **Gastrointestinal**

Scenario*: Mr CJ is a 45 year old man involved in a motor vehicle accident.*
He sustained: Bilateral pulmonary contusions
Multiple rib fractures
Ruptured spleen
Liver lacerations
Fractured pelvis
He was taken directly from Emergency to theatre for surgery. He now returns to your Intensive Care Unit post operatively.

Introductory question*: Describe your approach to stress ulcer prophylaxis in this patient.*

Fifteen out of twenty-two candidates passed this section.

- **Cardiovascular**

Scenario*: A 65 year old diabetic man returns from theatre after coronary artery bypass grafting with an intra-aortic balloon pump in situ.*
His pre-op history included diabetes mellitus and hyperlipidemia.

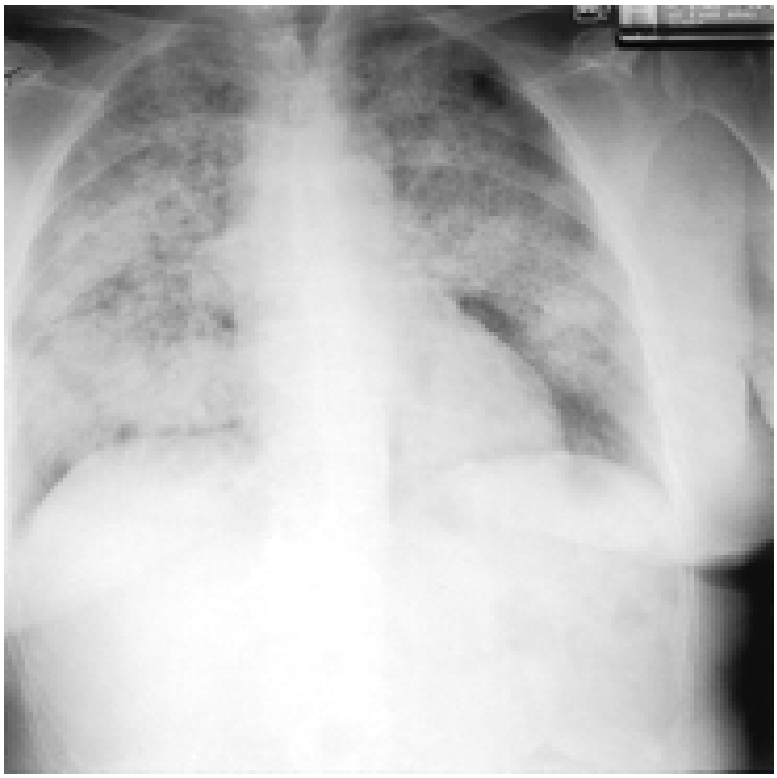
Introductory question *Describe your priorities in managing this patient.*

All twenty-two candidates passed this section.

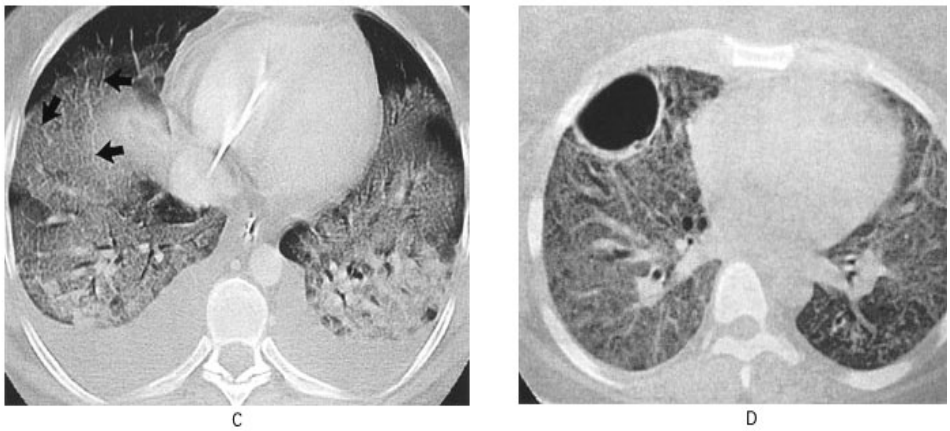
- **Respiratory/Ventilatory**

Scenario*: The plain Chest X-Ray and CT thorax below are those of a 25 year old man admitted to the Intensive Care Unit after a motorcycle accident in which he suffered bilateral fractured femurs and a ruptured spleen. He required a 15 unit blood transfusion before and during a laparotomy for splenectomy and open reduction and internal fixation of his fractured femurs (6-hour procedure).*

CXR day 2 post injury



CT scan day 5 post injury



Introductory Question*: What are the most likely causes of the CXR appearances?*

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

- **Ethics**

Scenario*: A 22 year old girl had chemotherapy and bone marrow transplantation for leukaemia.. While waiting for marrow recovery she develops hypoxic respiratory failure requiring admission to your Intensive Care Unit and non-invasive ventilation by mask with an FiO2 of 1.0. The PaO2 improves initially but she remains dyspnoeic. Over the next 24 hours she becomes progressively more hypoxic and exhausted, and is intubated. She requires an FiO2 of 1.0 and PEEP of 15cm H2O to achieve a PaO2 of 54mm Hg. Her Chest X-Ray shows dense bilateral pulmonary infiltrates. She requires increasing doses of noradrenaline by infusion (to 50mg/min) and progresses to acute renal failure.*
Your registrar asks you whether you think it is appropriate to continue active management.

Introductory question*: What are the ethical principles of medical care that must be considered when decisions regarding the withdrawal of active medical treatment are being made?*

Twenty out of twenty-two candidates passed this section.

- **Obstetrics**

Scenario*: A 34 year old Para 1 Gravida 1 primary school teacher presents at 28 weeks gestation with a blood pressure of 170/120.*
She has generalised tissue oedema and 3+ proteinuria.
Her liver function tests are abnormal with bilirubin 30umol/l (N<17), AST 300 IU/l (N<30).
The haemoglobin is 78 g/L, the blood film shows fragmented red cells. Her platelet count is 75 x 109/L.

Introductory question*: What do you think this patient is suffering from?*

Nineteen out of twenty-two candidates passed this section.

- **Neurological**

Scenario*: A 26 year old man crashed his motor bike one hour ago. He has been brought in by ambulance to your emergency department. He is unable to move his legs, and has limited movement in his arms.*

Introductory question *Tell me how you will determine his neurological level?*

Seventeen out of twenty-two candidates passed this section.

The Clinical Section

The Clinical Section was conducted at the Royal North Shore Hospital, Sydney.

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

Cases encountered as cold cases included patients with:

- severe arthritis, quadriplegia, renal transplant, systolic murmur, proximal muscle weakness, artificial valves, permanent pacemaker etc.

Eleven out of twenty-two candidates passed this section.

Cases encountered as hot cases included patients with:

- subarachnoid haemorrhage, jaundice, fever after neurosurgery, fever after abdominal surgery, cardiorespiratory arrest after laparotomy, chest injuries,

Fourteen out of twenty-two candidates passed this section.

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

WRITTEN SECTIONS

Nineteen out of twenty-two candidates passed this overall section.

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

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

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

Long Answer Questions

Eighteen out of twenty-two candidates passed this section.

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

QUESTION 1

A 60-year-old woman has a right hemi-hepatectomy for invasive cholangio-carcinoma. She has been admitted to your unit for postoperative care

Sixteen out of twenty-two candidates passed this question.

a) Describe in detail what problems she may develop in the first 48 hours and how you would treat them?

The perioperative complications could be classified into (1) that of any major upper abdominal surgery and (2) specifically that of a hemi-hepatectomy for cholangiocarcinoma; or divided into various systems, ie.

(1) Respiratory:	Inadequate or excessive analgesia, pulmonary oedema from fluid overload, R. haemothorax, R. pneumothorax, R diaphragmatic dysfunction, V/Q mismatch from hepatic failure, aspiration and possibly early pulmonary infection or thromboembolism. Very rarely, intraoperative air embolism ®ARDS.
(2) Cardiovascular:	Hypotension from bleeding, epidural block, perioperative myocardial ischaemia / infarction, Arrhythmias associated with electrolyte abnormalities.
(3) Gastro-intestinal failure:	Prolonged ileus, pseudo-obstruction, ascites, G I haemorrhage.
(4) Renal:	Hepatorenal syndrome, acute tubular necrosis, oliguria.
(5) Hepatic:	Cholangitis, hepatic failure, encephalopathy, coagulopathy,
(6) CNS:	Encephalopathy.
(7) Metabolic:	hyperlactataemia, ↑Na+, ↓K+, hypoglycaemia.
(8) Premorbid condition:	Possible ulcerative colitis/primary sclerosing cholangitis: Therefore, medication issues ie steroids, immune state, nutritional status etc.

Treatment is basically meticulous perioperative care with special regard to fluid and electrolyte balance, analgesia, coagulation control, and specific and supportive therapy for any individual complications that develop ie encephalopathy, hepatorenal syndrome etc.

b) On day 3, she has a rigor and blood cultures grow enterococcus faecalis. How will you manage this?

The rigor should demand culture of all possible sources: sputum, blood, urine, T Tube and other drains. Consideration of broad spectrum antibiotic cover should occur at that time. Once the definitive culture is known, specific therapy (ie amoxicillin or vancomycin) should be given and also, a reason why this gut organism has been grown should be elicited.

c) On day 6 she has a massive melaena requiring urgent endoscopy in the Intensive Care Unit. She requires endotracheal intubation. How will you perform this?

There probably will be hypovolaemia, a potentially full stomach, hepatic, renal dysfunction and encephalopathy. The safest method of intubation is mandatory.
Consider: Preparation of intubation (what equipment, help, drugs,), what monitoring, description of probable rapid sequence induction with cricoid pressure.

d) Subsequent laparotomy reveals an infective erosion of the hepatic artery, which is grafted. She is now developing multiple organ failure. Describe your management.

The 'usual' management of MSOF may be discussed here, but this is a woman with a limited outlook before these complications occurred (5% 5 year survival). Discussion of outlook with the patient (if possible), immediate family as well as the referring surgeon should be entered into, and of 'how far' therapy should go or whether it should be limited or even withdrawn should also be discussed by the candidates.

QUESTION 2

A 76-year-old woman with severe ischaemic heart disease being treated with aspirin, clopidogrel and metoprolol presents with severe abdominal and back pain, 6 hours after being discharged home from a routine cardiac angiogram via the femoral route.

Nineteen out of twenty-two candidates passed this question.

a) How would you investigate the cause?

The differential could be large and could include pancreatitis, retroperitoneal haematoma, aortic dissection, cholecystitis, infarcted gut, G-I perforation, diverticular disease, pericarditis, myocardial infarction/ischaemia, pneumothorax. Investigation includes, a proper history (character, type, severity, position of pain, associated features etc), full clinical examination (signs of all the above possibilities) and relevant investigations . Amylase, Hb (has it fallen?), wbc, U&Es, LFTs, ChestXR, ECG and troponin, U/S abdomen, echocardiogram, CT scan abdomen depending on the most likely cause. A good answer would also include what would be expected from the investigations ordered.

A large retroperitoneal haematoma is diagnosed. After resuscitation, the bleeding is stopped by angiographic embolisation of a branch of the left internal iliac artery.
She is still in the intensive care unit 2 days later when she becomes suddenly dyspnoeic, hypoxaemic and hypotensive with a BP of 80 systolic.

b) What is your initial management?

Most likely cause is a pulmonary embolism but cannot rule out other causes. Resuscitation, relevant investigations and therapy go hand in hand. So, ABC Supplemental oxygen, fluid, then if inadequate response, consider appropriate vasoactive ie dobutamine/noradrenaline? Get an ECG, CXR, ABG. (D-Dimer of no use here due to large resolving haematoma) consider V/Q or more likely spiral CT scan to prove it.

c) She stabilises and subsequent investigation reveals a moderate sized pulmonary embolism. Describe all the potential therapeutic strategies for her and describe in detail what your ongoing management would be in this case?

Strategies can be classified as medical or surgical. Medical therapy, the mainstay of treatment includes resuscitation with fluids and vasoactive support, anticoagulation, usually heparin with thrombolysis in cases usually of associated hypotension. Surgical therapy includes thrombectomy +/- RVAD, and the use of IVC filters to help prevent recurrence. The benefits and risks of each individual modality should be stated.

In the above scenario, she has stabilised, so systemic anticoagulation with heparin is indicated (the iliac artery branch tear has been embolised, so is unlikely to rebleed) but thrombolysis is possibly too risky and unnecessary after 2 recent angiograms, With the high likelihood of the embolism coming from the pelvic veins and other clot still present, the judicious employment of a filter may be wise.

Short Answer Questions

Sixteen out of twenty-two candidates passed this question.

1. Outline your principles for conveying bad news to family members.

Thirteen out of twenty-two candidates passed this question.

There are many published studies (including multiple reviews) addressing this area. Most information relates to non-critical care areas, and the majority are written from a medical perspective, and relate to conveying new to a conscious patient. Few studies address actual outcomes of the process. The welfare of the deliverer of the news should also be considered (eg. preparedness, training). The general principles espoused include: the importance of knowledge (content) of the medical details; delivery in a comfortable location offering privacy and relative quiet; setting aside sufficient time; identifying support network for the family members and having them present; delivery by or with a staff member who knows the family; sitting close to family members without physical barriers in between; non-verbal messages consistent with the verbal message; consider warning of bad news before news actually broken; awareness of what family know/have been told; present information in a way that conveys respect and empathy, use of touch may be appropriate in some circumstances; deliver at a pace appropriate to the family, allowing time for discussion; use clear & simple language to avoid confusion, though specific medical terminology may be referred to; convey some hope, even if in terms of minimising discomfort; provide for follow up meetings; document information regarding meeting in medical record. (Ptacek JT. Breaking bad news. JAMA 1996 26(6):496-502; Fallowfield L. Communicating sad, bad, and difficult news in medicine. Lancet 2004 363:312-9)

2. Critically evaluate the role of nitric oxide in the management of the critically ill patient.

Nineteen out of twenty-two candidates passed this question.

Nitric oxide has many potential benefits in the critically ill. In particular, selective delivery via the inhalational route allows local vasodilatation (potentially improving ventilation:perfusion matching, and reducing pulmonary arterial hypertension), as well as providing some immunomodulating effects (inhibiting neutrophil adhesion and platelet aggregation). Despite a number of prospective randomised trials (in acute lung injury and ARDS) demonstrating some short-term oxygenation benefits (up to 72 hours), in adult patients there have been no improvements in longer-term outcomes (such as weaning from ventilation or mortality). Similarly, physiological improvements in

pulmonary hypertension in various clinical scenarios have been demonstrated (e.g. primary pulmonary hypertension, heart transplantation) but no longer-term benefits have been demonstrated. Use of NO requires complex equipment, including monitoring for NO and nitrogen dioxide concentrations. Administration of NO has not been without its own potential adverse effects: Methaemoglobinaemia, prolonged bleeding time, and reports of increased renal failure and nosocomial infections. (Adhikari N. JAMA 2004; 291:1629-31; Sokol J et al. Inhaled nitric oxide for acute hypoxemic respiratory failure in children and adults: A meta-analysis. Anesth Analg 2003; 97:989-98 & Sokol J et al. Inhaled nitric oxide for acute hypoxemic respiratory failure in children and adults (Cochrane Review). In: The Cochrane Library, Issue 1, 2004.)

3. Critically evaluate the role of fluconazole in the management of the critically ill patient.

Fourteen out of twenty-two candidates passed this question.

Fluconazole is an azole anti-fungal agent that has good bioavailability (can be administered enterally). It has a proven role in treatment of candidal (skin/mucosal/systemic) and cryptococcal infections as an alternative to amphotericin. It has much less activity against other fungal pathogens (e.g. aspergillus species). Usual duration of therapy is until evidence of active fungal infection has subsided. Specific anti-fungal sensitivities may be required. Usually fluconazole is very well tolerated, but observed adverse effects include an increase in trans-aminase enzymes, other gastrointestinal & haematological problems, adrenal suppression, and rare cases of QT prolongation and torsades de pointes. As fluconazole is predominantly renally excreted as the unchanged drug, dose adjustment is required with renal impairment. Fluconazole is an inhibitor of the cytochrome P450 system, particularly the CYP2C, and as such may increase concentrations of various drugs (e.g. warfarin, theophylline, cyclosporin, oral hypoglycaemic agents, phenytoin, and midazolam).
Recent interest has surrounded empiric therapy in patients with septic shock. One small prospective randomised study suggested improved 30 day and hospital mortality when 200 mg fluconazole was administered daily to patients with septic shock (due to either intra-abdominal source or nosocomial pneumonia) until resolution of shock. The majority of the benefits were attributable to the group with intra-abdominal sepsis. (Jacobs S et al. Crit Care Med 2003 31(7):1938-46)
Fluconazole also has a role in prophylactic therapy (e.g. HIV patients) and in prolonged maintenance therapy (e.g. HIV patients with cryptococcal meningitis or recurrent oropharyngeal candidiasis).

4. List the causes and outline your management of a patient with severe rhabdomyolysis.

All twenty-two candidates passed this question.

Rhabdomyolysis indicates muscle necrosis and release of intracellular constituents into the circulation. Causes of severe rhabdomyolysis (in this case implying Intensive Care management) include trauma (especially with compression injuries), extreme exertion (e.g. marathon or uncontrolled seizures), immobilisation for prolonged periods, Malignant Hyperpyrexia and Neurolept Malignant syndrome. Rare causes include metabolic myopathies and metabolic/endocrine abnormalities. Management includes confirmation of diagnosis (relevant history; marked elevation of CK, hyperkalaemia, hyperphosphataemia, hypocalcaemia, hyperuricaemia, and acute renal failure with metabolic acidosis [and/or lactic acidosis]), specific treatment for any underlying cause (e.g. fasciotomies for compartment syndromes, dantrolene and remove exposure to precipitant for MH, anti-seizure drugs and/or paralysis [as last resort] for status epilepticus), adequate fluid resuscitation (e.g. with isotonic saline), maintenance of an alkaline diuresis (e.g. use of mannitol), careful monitoring and treatment of metabolic disturbances, management of associated disorders (especially with multiple trauma or drug overdose) and consideration of renal replacement therapy.

5. Compare and contrast the roles of angiography and surgical management in the management of the critically ill patient with ongoing haemorrhage due to pelvic fractures.

Fifteen out of twenty-two candidates passed this question.

Practice management guidelines exist for the management of haemorrhage in pelvic fracture. The general principles are included below.
Angiography is not always required but may be life saving. It requires specialist radiology expertise (not necessarily widely available), requires transport to and needs to be performed in an area that may not be adequately set up for the complex monitoring and resuscitation that may be required in an unstable patient. Definitive selective embolisation may be able to be achieved to control arterial bleeding where other strategies (e.g. pelvic stabilisation or laparotomy) have failed.
Some form of surgical management is probably required in all cases, as at least some form of immobilisation (usually external fixation) will be required for unstable pelvic fractures. Laparotomy is indicated for the associated traditional signs of intra-abdominal bleeding or intestinal perforation. Apart from definitive stabilisation, other definitive surgical management is not usually helpful apart from general packing (without exploration) for venous haemorrhage, and rarely ligation of internal iliac arteries for uncontrollable arterial haemorrhage. Some aspects of surgical management may be able to be performed outside the operating room; otherwise transport is required (but to an area set up for ongoing monitoring and stabilisation).

6. Outline the techniques you would use to assess the methodological quality of a placebo controlled prospective randomised clinical trial.

Seventeen out of twenty-two candidates passed this question.

Various checklists are available for assessing methodological quality. One such list is that proposed by David Sackett. It includes 3 main questions: was assignment randomised and was the randomisation list concealed (minimise potential for bias)?; was follow up of patients sufficiently long and complete (ensure endpoints accurately assessed)?; were patients analysed in the groups to which they were randomised (maintain benefits of randomisation)? It also includes 3 finer points to address: were patients and clinicians (and outcome assessors) kept blind to treatment (minimise bias)?; were groups treated equally apart from the experimental treatment (ensure intervention effect is only thing being assessed)?; were the groups similar at the start of the trial (were there any potentially confounding effects that randomisation did not eliminate)? In addition to these, the study should have enrolled enough patients to be sufficiently powered to detect the perceived clinically important benefit in the primary outcome variable! Standardised criteria have also been published (CONSORT) that were recommended to facilitate consistency and clarity in studies submitted for publication, allowing the reader to more readily assess the internal and external validity of a study.
(Sackett DL et al (eds.). Evidence-based medicine. Churchill Livingstone, London. 2000
Begg C et al. Improving the quality of reporting of randomized controlled trials. The CONSORT statement. JAMA. 1996 Aug 28;276(8):637-9).

7. Outline the potential advantages and disadvantages of a tracheostomy in the weaning of patients from mechanical ventilation.

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

Limited actual clinical trial data is available to support the performance of a tracheostomy over maintaining prolonged endotracheal intubation. Purported advantages include: less laryngeal pathology (not supported by the literature); improved patient comfort including reduced respiratory work of breathing and less sedation requirements for tube tolerance; improved communication (speech not possible with ETT), enhanced nursing care (including mouth care & mobility), ease of

replacement of tracheal tube, ease of removal/reinstitution of ventilatory support, facilitate transfer to ward (with airway protection and ready airway access for suctioning). Potential disadvantages include: requirement for surgical procedure and therefore associated peri-operative and post-operative procedural risks including haemorrhage, pneumothorax, tracheal perforation, and even death; increased aspiration risk, increased incidence of nosocomial pneumonia; increased risk of subglottic stenosis and granuloma formation; infection of stoma; occlusion of tracheostomy tube (posterior tracheal wall, granulomata, secretions [if not regular change of tube or inner cannula and/or problems with humidification]); problems associated with decannulation (either elective or emergent: including complicate emergency airway management).

8. A 45-year-old woman presents with seizures, after having had a fluctuating level of consciousness and fever. Her admission tests revealed:

Test	Value	Normal range
Haemoglobin	**100**	**115-160 g/L**
White blood cells	**6.9**	**4.0-11.0 x10^9/L**
Platelets	**64**	**140-400x10^12/L**
International Normalised Ratio	**1.1**	**0.8 – 1.3**
APTT	**38**	**24-35 seconds**
Fibrinogen	**3.6**	**2.0-5.0 g/L**
Na	**142**	**135-145 mmol/L**
K	**4.8**	**3.5-5.5 mmol/L**
Glucose	**6.8**	**3.6-7.7 mmol/L**
Urea	**18.9**	**2.5-8.3 mmol/L**
Creatinine	**0.21**	**0.05-0.11 mmol/L**
Lactate De-Hydrogenase	**540**	**120-250 IU/L**

What is the most likely diagnosis, and what other investigations would you order to help confirm the diagnosis? What do you expect the results of these investigations to show?

Fourteen out of twenty-two candidates passed this question.

This woman has anaemia with an elevated LDH (suggestive of haemolysis), thrombocytopenia without evidence of DIC or other significant coagulation problems, renal insufficiency, fluctuating neurological abnormalities and fever. These are the "pentad" of features of the syndrome of Thrombotic Thrombocytopenic Purpura (also known as TTP-Haemolytic Uraemic Syndrome). Further tests are required to confirm the diagnosis (some by excluding significant negatives which require dramatically different treatment). Sepsis is less likely because of the normal white cell count and the presence of thrombocytopenia without evidence of DIC. Peripheral blood film should confirm a microangiopathic (i.e. red cell fragmentation) anaemia, confirm thrombocytopenia, and exclude a toxic appearance of the white cells (as they are normal in number). Haemolysis screen should demonstrate an elevated bilirubin and a reduced haptoglobin concentration, but a negative Coombs test. Urinalysis should be near normal and should exclude an active sediment. Microscopy and culture of appropriate samples (eg. urine and blood, and/or lumbar puncture to exclude meningitis) should exclude active infection. A CT scan of the head should also be performed to exclude intracranial pathology as the cause for the seizures.

9. Compare and contrast the pharmacology of noradrenaline, vasopressin and phenylephrine.

Eighteen out of twenty-two candidates passed this question.

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/neurotranmitter 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 adrenoreceptor agonist, similar in structure to adrenaline. Not administered enterally, biotransformation not well described 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). Can be administered topically for alpha-adrenergic effect.

10. Outline the diagnostic features, complications and treatment of critically ill patients with pancreatitis.

Eighteen out of twenty-two candidates passed this question.

This is a complex field with a large amount of literature to collate. Pancreatitis is usually presents with persistent upper abdominal pain, associated with nausea and vomiting, which can be associated with signs of local tenderness through to peritonism, and/or signs of a systemic inflammatory response (e.g. fever, tachycardia) or signs of associated disorders (e.g. jaundice with biliary obstruction) or rarely signs of complications (e.g. ecchymotic discoloration in flank [Grey-Turner's sign] or peri-umbilical [Cullen's sign] regions). These signs may be difficult to elicit or masked in critically ill patients. Investigations that assist in the diagnosis include: serum amylase (usually > 3 times normal) (serum lipase does not improve diagnostic accuracy); liver function tests (looking for evidence of obstructive pattern with gall stone induced pancreatitis); plain abdominal radiograph (excludes other aetiologies, and may show localised ileus ["sentinel loop"]; abdominal ultrasound (enlarged hypo-echoic pancreas, and looking for gall stones); and abdominal CT scan with contrast (confirm diagnois and looking for areas of necrosis or pseudocysts). Ranson's criteria (or more recently Glasgow criteria or Imrie score) are used to assess severity and predict outcome, and they include white cell count (>16,000/mm3), glucose (>11 mmol/L), AST > 250 IU/L, Ca < 2mmol/L, hypoxaemia (<8kPa), and a decrease in haematocrit (>10%) and an increase in urea (>1.8 mmol/L).
Complications include: those associated with a systemic inflammatory response (e.g. myocardial depression/shock, ARDS, renal failure, death); respiratory (including pleural effucsion and atelectasis); metabolic (including hypocalcaemia, glucose disturbances); and intrabdominal problems (including ileus, necrosis, pseudo-cysts, abscess formation, etc).

Treatment should include: aggressive fluid resuscitation to stabilise the haemodynamic state, treatment of underlying cause (e.g. ERCP if gall stones present, withdrawal of offending drug), treatment of pain (morphine controversial), surgical treatment of complications (e.g. aspiration/drainage of infected collections) and general support of the critically ill patient. More contentious issues that should be considered include: early prophylactic broad spectrum antibiotics (evidence that decrease complications), prophylactic anti-fungal therapy, jejunal feeding (safe, feasible, cheaper than TPN, possibly of benefit), the use of somatostatin, octreotide or protease inhibitors (none have sufficient evidence base to use routinely), and the timing and nature of surgical interventions.

11. Outline the role of urinary electrolytes in the assessment of the critically ill patient.

Only seven out of twenty-two candidates passed this question.

Urinary electrolytes (sodium, potassium and chloride) can assist in the diagnosis of a number of electrolyte disturbances in ICU patients (especially where the intake of electrolytes is known and relatively controlled). This question does not refer to urinary pH or osmolality measurements. Some of the more commonly used example are included here. In assessing oliguria: a spot urinary sodium when low (<10 mmol/L) can indicate depleted extracellular volume and a pre-renal cause, whereas >20 is more indicative of tubular damage. Hyponatraemia associated with extrarenal losses should be associated with a low spot urinary sodium (<10), whereas a higher level (>20) is more indicative of other causes (e.g. renal salt losing states, SIADH, and diuretic therapy). Fractional excretion of sodium can be calculated (100*UNa*PCr/PNa*UCr) but its ability to determine causes of oliguria (e.g. <1% implies pre-renal)is limited by sodium intake and diuretic therapy. Urinary chloride estimation is of most use when assessing normal anion gap metabolic acidosis. Renal tubular acidosis is associated with impaired urinary acidification (decreased ammonium excretion) and this is associated with a low urinary chloride (e.g. <10 mmol/L), a positive urinary anion gap (Na + K – Cl), and an inappropriately high urinary pH (e.g. >6). If the acidosis is due to extra-renal losses of bicarbonate, in the absence of renal failure the kidneys will excrete ammonium (and chloride) resulting in a negative urinary anion gap (as urinary Cl > Na + K). Urinary potassium concentration can also help with the cause of hypokalaemia. Renal loss is generally indicated by >20 mmol/L as iopposed to an extra-renal loss (<20 mmol/L).

12. Outline the causes, and principles of management of raised intra-cranial pressure in the patient with a severe closed head injury.

Nineteen out of twenty-two candidates passed this question.

Raised intracranial pressure (usually considered > 20 to 25 mmHg) in the setting of severe closed head injury is a relatively frequent phenomenon. The causes usually dictate the specific therapy. specific causes to be considered included artefact, transient elevations associated with coughing/valsalva manoeuvres, , increased brain parenchymal volume (ie. cerebral oedema), increased cerebral blood volume (especially haematomata), increased CSF volume (especially decreased drainage). The likelihood of each is related to the individual circumstances, and relative timing with respect to the injury itself.
Principles of management depend upon what techniques/interventions have already been instituted, but include: provision of adequate oxygenation, ventilation (usually mechanical, aiming for normocapnia if normal bicarbonate [situation less clear if abnormal bicarbonate]) and circulation (adequate CPP [usually considered > 70 mmHg] with euvolaemia and/or use of vasopressors); elevation of head and neck, and ensuring that there is no obstruction to venous drainage; if not already done, establishment of invasive monitoring (to confirm diagnosis and allow titration of therapy); exclusion of artefactual error (zeroing, levelling and calibration as able); minimisation of coughing/valsalva and reduction of metabolic demand with sedation and/or paralysis; drainage of

CSF via ventricular drain (if available); detection and drainage of intracerebral haematomata; correction of hyponatraemia (administration of hypertonic saline may provide some short term control); techniques to decrease metabolic demand include anti-seizure treatment/prophylaxis, and temperature control at least to normothermic levels (induced hypothermia is controversial, but seems to decrease ICP in refractory cases); osmotherapy using mannitol may be useful in refractory cases or when buying time before definitive surgery (keeping osmolality < 320 mOsm/kg); other techniques for refractory cases include barbiturate coma, decompressive craniectomy, and possibly hyperventilation (for short term use only).

13. Outline your approach to the use of non-invasive ventilation in the critically ill patient.

Seventeen out of twenty-two candidates passed this question.

The discussion of the approach to the use of non-invasive ventilation should include various aspects including: indications (types of patients), contra-indications/precautions, and some discussion of the way it would be used. The use of CPAP alone (e.g. via face mask, or nasal mask) may be considered to be a form of non-invasive ventilatory support, but further discussion here is not required. There is good data to support its use in patients with exacerbations of chronic airways disease (improving symptoms, physiological endpoints, deceasing intubation rate, and even potentially decreasing hospital mortality). Less data supports its use in patients with acute asthma, pulmonary oedema, pneumonia, other causes of hypoxic acute respiratory failure, and as a technique to avoid endotracheal intubation (where considered inappropriate), or to facilitate weaning from invasive ventilation. Usual contraindications to the use of non-invasive ventilation include facial injury/trauma, cardiovascular instability, an inappropriate conscious state (e.g. an unconscious or uncooperative patient), an unprotected airway and excessive secretions. Non-invasive ventilation is usually delivered via a face mask (or nasal mask or helmet), using an inspiratory pressure above a level of CPAP. This inspiratory pressure may be time or flow cycled on and off. Usually the pressures (CPAP and inspiratory pressure) are started at a baseline which is well tolerated (e.g. 5 and 8), and are slowly titrated upward to achieve oxygenation, relief of dyspnoea (work of breathing) or tidal volume targets. Early improvements in oxygenation, respiratory rate and carbon dioxide/pH have been claimed to b predictors of success. An approach to weaning from the non-invasive supports should also be included.
At least one candidate misinterpreted this question to read “how you set up non-invasive ventilation”.
(Hore CT. Non-invasive positive pressure ventilation in patients with acute respiratory failure. Emerg Med (Fremantle). 2002 Sep;14(3):281-95. Lightowler JV, Wedzicha JA, Elliott MW, Ram FS. Non-invasive positive pressure ventilation to treat respiratory failure resulting from exacerbations of chronic obstructive pulmonary disease: Cochrane systematic review and meta-analysis. BMJ. 2003 Jan 25;326(7382):185 and Ram FSF, Picot J, Lightowler J, Wedzicha JA. Non-invasive positive pressure ventilation for treatment of respiratory failure due to exacerbations of chronic obstructive pulmonary disease (Cochrane Review). In: The Cochrane Library, Issue 1, 2004).

14. Outline the way in which you would evaluate and treat oliguria which has developed in a 36-year-old patient who has been admitted to your Intensive Care Unit with severe community acquired pneumonia.

Seventeen out of twenty-two candidates passed this question.

Oliguria in the critically ill may well be an appropriate physiological response to relative volume depletion and circulating stress hormones (including ADH). In that scenario, there would be no evidence of renal failure per se (eg. increase in serum creatinine, decreased creatinine clearance), appropriate urinary concentration would occur (elevated urinary specific gravity and osmolality and

low urinary sodium <20 mmol/L), and an increase in urine output would be expected with fluid loading and/or diuretic administration. If instead signs/investigations suggest renal failure is developing, this would be traditionally divided into pre-renal, renal and post-renal causes. History (e.g. deliberate fluid restriction, associated medical conditions, past history of abdominal surgery, muscle damage, administration of nephrotoxic drugs [e.g. NSAIDs] etc.) and examination (confirmation of diagnosis [e.g. palpation, catheterisation, bladder scan], dehydrated, abdominal distension with increased intra-abdominal pressure, blocked/misplaced urinary catheter, etc.) will obviously help in the diagnosis. Urinalysis is also helpful (e.g. granular or epithelial cell casts with acute tubular necrosis, active sediment with glomerulonephritis, heavy proteinuria with nephritic syndrome. Further monitoring may be required if the haemodynamic status is considered inadequate, and specific investigations to assess renal blood flow or exclude obstruction may be clinically indicated.
Specific treatment will depend on the cause (e.g. optimise pre-renal state with hydration and/or haemodynamic supports, adequate treatment of infection, relieve obstruction, remove nephrotoxins), but in general there are no specific therapies that have been demonstrated to improve long-term outcome. Treatment options that could be considered include diuretics to enhance urine output, alkalinisation of urine for rhabdomyolysis, and CRRT rather than intermittent haemodialysis if indications for dialysis have been met.

15. Critically evaluate the role of the prone position in critically ill patients.

Fifteen out of twenty-two candidates passed this question.

The prone position has a number of obvious potential advantages to critically ill patients. These include enhancing the ability to rest and dress soft tissue injuries (including burns, skin grafts, plastic surgical flaps etc). The majority of ICU interest however relates to the potential ventilatory benefits associated with prone positioning: increased homogeneity of ventilation, improved ventilation:perfusion matching, increased Functional residual capacity, reduced atelectasis, and facilitation of drainage of secretions. Improved gas exchange is seen in approximately 2/3 of patients, and these improvements are persistent in some. A prospective randomised study confirmed these improvements in oxygenation in patients with Acute Lung Injury/ARDS, but was unable to demonstrate any short or long term mortality benefits. Many details are still under much discussion (e.g. which groups should be "proned", when in their course, duration of time left prone, and for how many days to persist with prone positioning). Unfortunately, positioning patients prone is not without problems: expertise, manpower and time required for turning; potential for dislodgement of lines/tubes; problems with airway access; increased number of new pressure sores; increased new pressure sores in prone-related areas; increased intracranial pressure and decreased tolerance of enteral feeding. (Gattinoni L et al. N Engl J Med 2001; 345:568-73; Broccard AF. Chest 2003; 123:1334-6; Beuret P et al. Intensive Care Med 2002; 28 :564-69).

The following "Glossary of terms" was provided for the candidates

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

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

Circulation: Board of Joint Faculty; Supervisors of Intensive Care Training; Panel of Examiners; Course Supervisors; Registered Trainees