



Australian and New Zealand
College of Anaesthetists
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Joint Faculty of Intensive Care Medicine



The Royal Australasian
College of Physicians

DIPLOMA OF FELLOWSHIP

GENERAL FELLOWSHIP EXAMINATION

Aug/Oct 2008

REPORT

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

The exam included two 2.5 hour written papers comprising of 15 ten-minute short answer questions each. Candidates were required to score at least 50% in the written paper before being eligible to sit the oral part of the exam. The oral exam comprised 8 interactive vivas, and two separate hot cases.

This is the second examination with the new regulations which came into force in 2008. The main changes to this exam were:

- a) Incorporation of the unmanned part of the OSCE into the written paper. The following were assessed. (Blood gases, Haematology, Coagulation, Clinical methods, Microbiology, Infectious diseases, Clinical Photographs, Equipment, Monitoring, Toxicology, Endocrinology, ECG and Pacemaker)
- b) A minimum mark of 50% in the written paper was required to be invited to the oral section
- c) The procedure and communication stations were incorporated into the vivas
- d) The radiology station was also incorporated into the vivas as a manned station.
- e) The cold cases were not included in the examination
- f) The threshold for a bad fail in the clinical was increased from 30% to 40%.

The tables below provide an overall statistical analysis as well as information regarding performance in the individual sections. A comparison with Apr 08 data is also provided.

OVERALL STATISTICS

Table 1-Overall performance

		Oct 08	Apr 08
a)	Total number of candidates presenting for the Examination (b+c+d)	66	51
b)	Total number of candidates appearing for the written exam	53	43
c)	Number of candidates carrying the written mark from a previous attempt	10	5
d)	Number of OTS candidates – eligible to appear for the vivas directly	3	3
	Breakdown of written exam performance		
e)	Number of candidates scoring > 50%	39	31
g)	Total number invited to the vivas based on written marks	39	31
h)	Total number invited to the vivas (c+d+e)	52	39
i)	Total number approved	42	25
j)	Pass rate (as a percentage of those presenting for the written + eligible from previous exam – $(i/a*100)$)	64%	49%
k)	Pass rate (as a percentage of those presenting to the vivas $(i/h*100)$)	81%	64%
l)	Pass rate amongst those who scored >50% in the written paper (33/39)	85%	74%

Table 2: Analysis of performance in individual sections

		Oct 08	Apr 08
a)	Pass rate in the written paper (39/53)	74%	72%
b)	Pass rate in the viva section (47/52)	90%	85%
c)	Pass rate in the clinical section (31/52)	60%	46%
	Number of candidates passing both hot cases (21/52)	40%	28%

Detailed statistics for the written paper

- 1) Highest aggregate mark in the written paper – 70%
- 2) In no question was there a 100% pass rate.
- 3) In 7 of the 30 questions, the pass rate was < 50%.

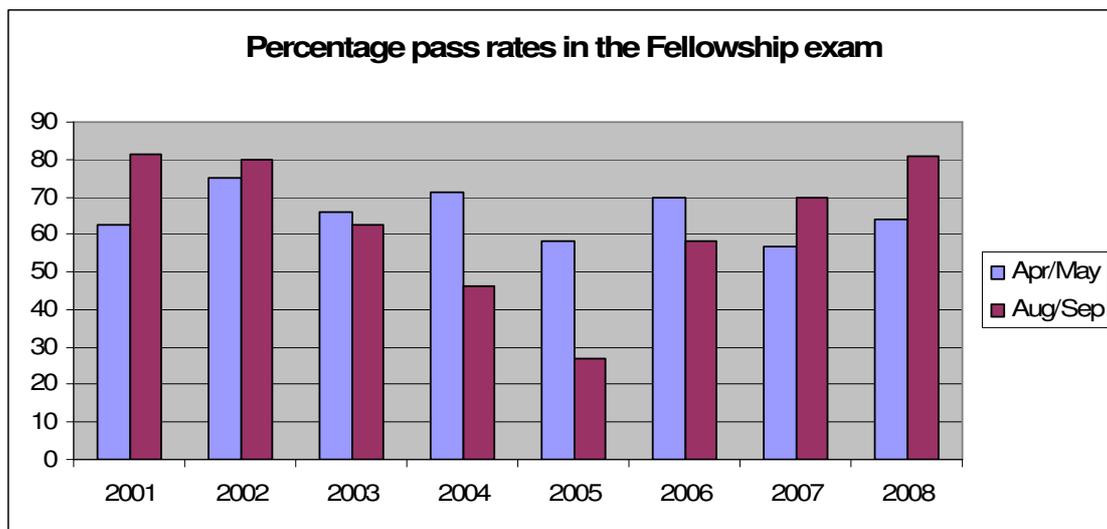
Detailed statistics for the clinical / oral component

Station	Pass rate	Highest individual mark for the station
CROSS TABLE VIVAS		
Viva 1- Inotrope /pressor usage	85%	99%
Viva 2 – Ventilation wean	58%	90%
Viva 3 – Nutrition	73%	81%
Viva 4 – Febrile critically ill patient	56%	90%
Viva 5- Neurotrauma	94%	90%
Viva 6- Communication	73%	90%
Viva 7 - Radiology	56%	80%
Viva 8 - Procedure	92%	100%
CLINICALS		
Hot Case 1	65%	87%
Hot Case 2	56%	93%

Breakdown of reasons for failure in the examination

Total number of candidates who failed the examination	24
Number of candidates who scored less than 50% in the written paper	14
Number of candidates who failed after presenting to the oral section	10
Reasons for failure in the oral section of the examination	
Proportion of candidates failing to score a total of 50% in the exam overall (7/10)	70%
Proportion of candidates who failed because of failure in > 1 section (4/10)	40%
Proportion of candidates who scored a “bad fail in the clinicals <40%” (3/10)	30%

A comparative pass rates over the last 7 years is provided below.



The courts of examiners made the following observations with regards to the performance of the candidates and suggest that candidates appearing for the exams in the future take note of these recommendations.

Written section

- Candidates appeared to score well in questions related to data interpretation, but scored poorly on other questions particularly in areas which are currently topical but are not discrete chapters or section in textbooks –
- It was disappointing to note the low pass rate in the question related to clinical methods.
- It is recommended that candidates prepare for this exam with a broad approach and use not only just a text book as the source, but review articles, and editorials etc from appropriate journals.

Clinical Section

Although the overall performance this exam was an improvement on the Apr 2008 sitting, the performance in the clinical section continues to raise major concerns.

- The pass rate in the hot cases was < 50% .
- *Trainees are reminded that from Apr 2008, the clinical section in the exam carries a higher mark (30%) and the threshold mark for a severe fail in the clinical section has increased from 30% to 40%.*
- A pass in the clinical section had a predictive value of 100% for a pass in the entire examination. The importance of performing well in the clinical section of the exam cannot be overstated. *Besides its relative weight in the examination marking scheme, hot cases are integral to our practice and regular practice practising presentation under exam conditions at least once a week and more frequently as the exam approaches) is recommended.*
- Many candidates had failed to adequately prepare for the clinical examination. Under the pressure of the exam, the deficient clinical skills of poorly prepared candidates' become obvious to the examiners. Candidates should take care to listen to the examiners' instruction and focus their examination, at least initially, towards the questions asked. The best candidates were very specific in what they examined and their discussion presentation revolved around the question asked. Some of the reasons for failure in the clinical included:
 - a) missing clinical signs
 - b) inability to present in a cogent manner
 - c) Lack of ability to put the fundamental aspects of the case together
 - d) Inability to put forward a big picture scenario
 - e) Many candidates repeated non-essential findings in their discussion, and their examination and presentation were often not targeted to the question.
 - f) Candidates need to be aware of the dangers of confabulation. Manufacturing signs that do not exist is of significant concern.. Candidates should be aware that there may not be many signs to elicit, particularly in hot cases – in fact, the absence of signs may be the most significant finding.
 - g) Whilst it is important to start with a general observation of the patient, pumps , etc, candidates often took too long to get to the patient.

Future candidates need to focus on practising their clinical approach until it becomes efficient and effective and their clinical examination technique is so well entrenched that it can survive the stress of the Fellowship exam!

Candidates are also reminded of the need to have completed a supervised assessment on 4 hot cases and have it documented prior to application for each examination. The spirit of this regulation is to engender a culture of regular clinical presentations, assessments and feedback and it is recommended that candidates continue to present beyond the minimum required number of 4 cases to assist with their preparation.

4) Vivas: Viva stations traditionally are high scoring sections. It was disappointing that in 2 of the 8 stations, the pass rate was < 60%.

Reasons for failure in the vivas include

Knowledge deficit

Failure to recognise clinically significant issues

From 2009, candidates are advised that the X-ray station in the vivas may include both hard copies and digital images

WRITTEN PAPER

GLOSSARY OF TERMS

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

1. A 35 year old female is 39 weeks pregnant. Her pregnancy has been complicated by hypertension and proteinuria. Her blood pressure is 160/120 mm Hg. You are called to the labour ward when she suffers a generalised (“grand mal”) convulsion. Outline your overall plan of management.

Initial management

- ABC
- Left side
- Terminate the seizure
 - a. Diazepam 5-10mg or Mg 4g IV up to 8 g
- Monitors / investigations

Management of Hypertension

- Hydrallazine
- Labetalol
- (Other agents are acceptable – late in pregnancy – increasing trend to use “mainstream” agents)

Treatment of convulsions

- MgSO₄ bolus followed by maintenance MgSO₄
- (Shown to be more effective than phenytoin or diazepam in preventing recurrent seizures)
- Addition of Benzodiazepine / Barbiturate if recurrent seizures despite MgSO₄

Planning for delivery

Brief period of resuscitation once seizures controlled

Post partum management

Continue anti-convulsants until patient improves (diuresis, fall in BP)

Pass rate 64%

2. With reference to base of skull fractures following trauma:

- a) List 5 clinical signs commonly associated with base of skull fractures.**
- b) List 3 life threatening complications specifically associated with base of skull fractures**
- c) Briefly outline the role of prophylactic antibiotics in the management of base of skull fractures**

a) List 5 clinical signs commonly associated with base of skull fractures.

- 1) CSF rhinorrhoea
- 2) CSF otorrhoea
- 3) Battle's sign
- 4) Raccoon eyes
- 5) Haemotympanum
- 6) Cranial nerve palsies.

b) List 3 *life threatening* complications of base of skull fractures

Panhypopituitarism

Basal meningitis

Carotid artery trauma or pseudoaneurysms

Cavernous sinus thrombosis

c) Briefly outline the role of prophylactic antibiotics in the management of base of skull fractures.

BOS # predispose patients to meningitis because of possible direct contact of bacteria in paranasal sinuses, nasopharynx or middle ear with CNS. Also CSF leak is associated with a greater risk of contacting meningitis. Few RCTs exist and the primary end point was a reduction in meningitis.

- 1) No role for prophylactic antibiotic therapy whether there is CSF leak or not.
- 2) Do not reduce the risk of meningitis.

Pass rate 62%

3.1 A 43 year old man, with no history of previous illnesses is admitted with septic shock requiring administration of high dose vasopressor. His blood results on 40% oxygen, pressure support ventilation are as follows:

Parameter	Value	Normal range
pH	7.64	7.35-7.45
PaCO ₂	28 mmHg (3.7 kPa)	35-45 mmHg (4.7-6.0 kPa)
PaO ₂	189 mmHg (25.2 kPa)	75-98 mmHg (10.0-13.0 kPa)
Actual bicarbonate	29 mmol/l	22-26 mmol/l
Sodium	147 mmol/l	134-145 mmol/l
Potassium	3.5 mmol/l	3.5-5.1 mmol/l

- a. Describe the acid-base abnormality
- b. List 3 likely causes of each acid-base abnormality in this patient.

a. Describe the acid-base abnormality

Respiratory and metabolic alkalosis

b. List 3 likely causes of each acid-base abnormality in this patient.

Respiratory alkalosis: Hyperventilation – spontaneous or IPPV induced, septic encephalopathy, pneumonia

Metabolic alkalosis: Diuretics, volume contraction, upper GI losses, steroids.

3.2 A 41 year old man is admitted to your Emergency Department, unconscious, with the first set of blood results. The second set of blood gases are taken 1 hour later.

Parameter	Initial values	1 hour later	Normal range
pH	7.05	7.35	7.35-7.45
PaCO ₂	34 mmHg (4.6 kPa)	39 mmHg (5.2 kPa)	35-45 mmHg (4.7-6.0 kPa)
PaO ₂	203 mmHg (33.6 kPa)	94 mmHg (12.5 kPa)	75-98 mmHg (10.0-13.0 kPa)
Actual bicarbonate	9 mmol/l	21	22-26 mmol/l
Sodium	137 mmol/l		134-145 mmol/l
Potassium	4.2 mmol/l		3.5-5.1 mmol/l
Glucose	11.2 mmol/l		
Ionised Calcium	1.21 mmol/l		2.15-2.55 mmol/l
Chloride	105 mmol/L		95-105 mmol/L

a. Describe the initial acid-base disturbance

b. List 3 clinical scenarios which may produce such a pattern of arterial blood gas derangement?

3.2a. The initial acid-base disturbance is a mixed metabolic and respiratory acidosis with a raised anion gap.

3.2b. Seizures

Resuscitated cardiac arrest

Near drowning

Near hanging

3.3 A 48 year old diabetic with a history of alcohol abuse is admitted with abdominal pain and the following results:

Parameter	Value	Normal range
pH	6.87	7.35-7.45
PaCO ₂	8 mmHg (1.1 kPa)	35-45 mmHg (4.7-6.0 kPa)
PaO ₂	149 mmHg (20 kPa)	75-98 mmHg (10.0-13.0 kPa)
Actual bicarbonate	1.4 mmol/l	22-26 mmol/l
Lactate	16 mmol/l	<2 mmol/l
Sodium	142 mmol/l	134-145 mmol/l
Potassium	4.7 mmol/l	3.5-5.1 mmol/l
Urea	14 mmol/l	3.4-8.9 mmol/l
Creatinine	170 micromol/L	(60-110 micromol/L)
AST	60	(<40 U/L)
ALT	70	(<40U/L)
LDH	1400	50-150 U/L
Total bilirubin	20	4-25 micromol/L)
Glucose	6.5 mmol/l	
Serum osmolality	314	275-295 mOsm/kg

a. Give the three most likely diagnoses

b. List two additional investigations that you would perform based on the above information

3.3

a) Diagnoses: 3 ischaemic bowel, 2 metformin induced lactic acidosis, thiamine deficiency, pancreatitis.

b) Two of the following investigations: Diagnostic laparoscopy or laparotomy, CT abdomen, red cell transketolase, lipase

Pass rate 62%

4. List the ways in which the paediatric airway differs from the adult airway. Outline how these influence your management.

Anatomic paediatric airways offer significant potential challenges to the critical care practitioner. Factors to consider include:

- Absolute size of airway (including trachea), small mandible, large tongue (use of chart, formula [$\text{age}/4 + 4 \text{ mm}$ if $> 1 \text{ yr}$] or Braselow measurement tape to allow sizing of ETT, and depth estimates essential [$\text{age}/2 + 12 \text{ cm}$ from lower lip]; often need smaller blade [narrower, shorter]; concern about tracheostomy)
- Large head (neck already flexed, not need pillow or as much head extension for intubation and airway management)
- Epiglottis long and stiff and may obscure view (may need to include epiglottis under laryngoscope blade, or consider using straight blade)
- Larynx high, anterior and the narrowest point is usually the laryngeal outlet/cricoid cartilage (often use uncuffed tubes, increased concern about laryngeal stenosis)

Other specific management concerns related to the small size of the artificial airways include: importance of fixation (ease of dislodgement), increased likelihood of blockage, circuit/mechanics to minimise work of breathing.

Pass rate 77%

5. Critically evaluate the role of routine daily interruption of sedation for all mechanically ventilated patients.

- A daily interruption of sedation may have a role in preventing over-sedation and reducing the duration of mechanical ventilation in selected mechanically ventilated ICU patients. (*a reasonable opening summary statement*)

Evidence:

There are two clinical trials of interruption of sedation that show

- significant reduction in duration of ventilation (0.5)
- duration of ICU stay (0.5)
- fewer CNS investigations. (0.5)
- Follow up studies suggested that there was a decrease in a range of complications including:
 - VAP, Upper GIT haemorrhage, bacteraemia, venous thromboembolic disease and sinusitis) in patients who received a daily interruption of sedation. (1)
 - There is also a single observational study of longer term outcomes that suggests that a daily scheduled interruption of sedation is not associated with worse psychological outcomes. (0.5)

Candidates were awarded extra marks if they mentioned the names of the two big RCTs or if they offered a critical appraisal of the most recent evidence.

- Kress 2000 NEJM
and
- Girard, Lancet 2008 or Awake and Breathing Controlled (ABC) study
- Critical appraisal of the Girard RCT: appropriate randomisation with allocation concealment, intention to treat analysis, unblinded

Potential problems:

Routine daily interruption of sedation is not appropriate for **all** patients, for example;

- Those with poorly controlled intracranial pressure
- Those requiring controlled ventilation
- Those in whom self extubation is particularly dangerous (e.g., those intubated for airway obstruction)
- Those patients receiving therapy that is likely to be particularly distressing (burns, permissive hypercapnia)

Summary statement

- Due to the risks involved, particularly the risk of self-extubation (10% is a lot!) the use of the protocol would need to be adapted to local circumstances. Studies to date have been performed in the USA. It could be disastrous if a patient self-extubated when there were not sufficiently skilled personnel available to appropriately manage the patient's airway. Thus "routine" daily interruption may not be necessary if the ICU is closed and the level of sedation required is assessed daily by skilled and knowledgeable staff.

Pass rate 21%

6.1 A 57 year old female has the following haematology and coagulation profile post admission to the intensive care unit after a laparotomy for intraabdominal sepsis with significant blood loss.

WCC	(3.5 – 11.00 x10 ⁹ /L)	*2.77
Hb	(115 –165 g/L)	*65
Platelets	(150-400 x10 ⁹ /L)	*14
PT	(12.0 – 15 Sec)	*28.9
INR	(0.8 – 1.1)	*2.7
APTT	(25.0 – 37.0 Sec)	*122.5
Fibrinogen	(2.20-4.30g/L)	*1.1

a) What is the most likely cause of the coagulation abnormalities?

Haemodilution with inadequate replacement of blood and clotting factors DIC

b) How would you correct the coagulopathy and briefly provide a reason for your choice of therapy or therapies?

Ensure patient is normothermic

Exclude ongoing surgical haemorrhage

Platelets to increase platelet count

FFP to replace factors II, V, VII, IX, X, and XI.

Cryoprecipitate to replace factor VIII, and fibrinogen if FFP does not reverse INR.

Activated Factor 7

6.2 A 44 year old male presents with dyspnoea and is diagnosed as having multiple pulmonary emboli on Computerised tomography pulmonary angiogram (CTPA). He is commenced on 1000 units of heparin per hour after a 5000 unit bolus. During the night his heparin has steadily increased to 1500 units per hour. These blood results are from the next morning.

Test	Value	Normal range
PT	12 sec	12-16
APTT	*38.3sec	25.0-37.0
Fibrinogen	3.8 g/ L	2.20-4.30
D-DIM LIA	*>20.0 mcg/ml	<0.5

a) Give 2 reasons for the relatively low APTT despite heparin therapy

- 1 – Inadequate heparinisation
 2. ATIII deficiency
 3. Increased heparin clearance
 4. Increased heparin binding proteins
- (1.5 marks)

b) List 4 causes for an increased predisposition to venous thromboembolic disease

Protein C def

Protein S def

AT III def

Malignancy

Factor V Leiden

Lupus anticoagulant

6.3) A 58 year old male is admitted with haematemesis. His coagulation profile is shown below. List 2 likely causes of his coagulation abnormalities?

Test	Value	Normal range
PT	*25.9 sec	(12-14)
APTT	*39 sec	(34-38)
INR	*2.4	(0.8-1.2)

- 1) Liver dysfunction due to alcoholic or viral liver disease.
- 2) Vit K deficiency
- 3) Patient on warfarin therapy.

Pass rate 96%

7.1 List the classic cardiac auscultatory signs of atrial septal defect, ventricular septal defect and patent ductus arteriosus. What typical findings on a right heart catheterization will also support your diagnosis? (You may tabulate your answer)

ASD	VSD	PDA
Fixed split of second heart sound	Harsh pansystolic murmur confined to the left sternal edge	A continuous murmur heard over the pulmonary area
Mid diastolic flow murmur over tricuspid area if significant shunt	Mid diastolic flow murmur over mitral area if significant shunt	Mid diastolic flow murmur over mitral area if significant shunt
Step up in oxygen saturation at atrial level	Step up in oxygen saturation at ventricular level	Step up in oxygen saturation at pulmonary artery level

7.2 The following assessment was made on the visual field testing of a patient who presented with impaired vision.



L	R
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(The darkened halves of the fields indicate the area of impaired vision).

a) What does the visual field testing indicate?

Rt. homonymous hemianopia

b) List 3 likely anatomical sites of lesion which may result in this visual defect.

Left optic tract
 Left optic radiation
 Left occipital lobe

7.3) A patient presented with massive abdominal distension. On examination, a fluid thrill was present. List three clinical diagnoses, which may produce these findings..

Candidates listing 3 correct differentials for a fluid thrill (see a-c below) or providing 3 conditions which may result in massive ascites (see d-f below) were awarded full marks.

- a) Massive ascites
- b) Massive ovarian cyst
- c) Pregnancy with hydramnios
- d) Severe liver disease
- e) Budd-Chiari syndrome
- f) Severe right heart failure or pericardial constriction
- g) Abdominal malignancy.

Pass rate 47%

8. Outline the advantages and limitations of the various sites for measuring body temperature in critically ill patients. (You may tabulate your answer).

	Advantages	Limitations
PAC	Considered gold standard, continuous measurement	Invasive, needs a PA catheter
Bladder	Continuous measurement, minimally invasive, stable measurements regardless of urine flow rates	Costly, needs a monitor for display.
Rectal probe	Intermittent or continuous measurements	Few tenths of a degree higher than core temperature, intrusive, may be difficult with patient positioning in ICU, risk of spread of pathogens, rectal trauma
Oesophageal	Provide continuous readings	Probe position difficult to confirm as they are not always radio-opaque, risk of oesophageal trauma or perforation, uncomfortable in spontaneous or alert

		breathing patients
Tympanic	Reflects hypothalamic and core temperature.	Poor agreement with other methods, presence of wax or ear pathology may distort measurements.
Nasopharyngeal	Similar to oesophageal	Sinusitis, can't be used in BOS #. Accuracy depends on position
Oral	safe, convenient, and familiarity	Needs cooperative patients, presence of ET and oro gastric tubes may limit this in ICU patients, mouth breathing, drinking hot or cold fluids may distort measurements.
Forehead	Dot technique, non-invasive	Poor agreement with PAC in ICU patients, intermittent
Axillary	Non-invasive	Less than core body temperature, intermittent data

Pass rate 60%

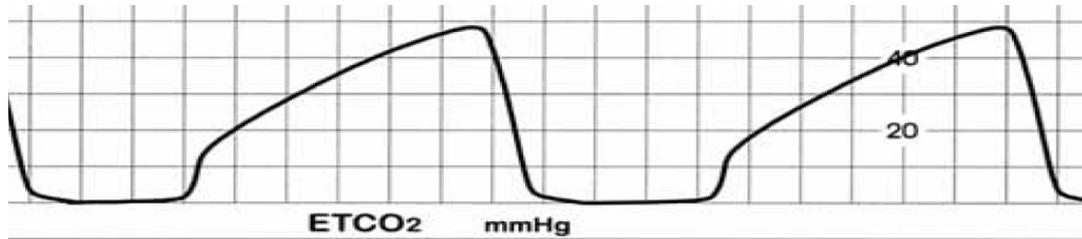
9.1 Outline how pH, PCO₂ and PO₂ are measured in a blood gas analyser and briefly state the underlying principle behind each of those measurements.

pH – glass electrode, The specimen is put in a capillary tube surrounded by buffer solution. The tube is made of pH sensitive glass across which a potential difference is generated, Measures potential difference across the electrodes

PCO₂ modified glass electrode, comprises a glass pH electrode which is in contact with a thin film of NaHCO₃ solution. This is separated from the specimen by a membrane that is permeable to CO₂ – CO₂ diffuses from specimen into the HCO₃ solution where it dissociates with a change in pH which is measured by the electrode. Measures potential difference across the electrodes

PO₂ – Clark electrode or polarographic electrode, polarographic or measures current generated (an amperometric system) or the current flow across the Clark electrode is determined by the PO₂ of the solution

9.2



The above is a capnograph trace obtained from a patient in an intensive care unit.

a) What technology is used for the detection of CO₂ in expired breath in the ICU?

Infra-red absorption spectrophotometry

b) List 3 uses for capnography in intensive care

Airway disconnection alarm
Confirmation of ET tube placement in airway
During CPR to assess adequacy of cardiac compression
Recognition of spontaneous breath during apnoea test
Neurosurgical patient to provide protection against unexpected hypercapnia

c) List 3 conditions which may increase the gradient between end-tidal and arterial PCO₂?

Low cardiac output or cardiogenic shock
Pulmonary embolism
Cardiac arrest
Positive pressure ventilation and use of PEEP
High V/Q ratios.

Candidates who mention increased alveolar dead space should also get some credit.

Pass rate 43%

10. Outline and justify your approach to “clearing” the cervical spine in an adult multi-trauma patient with a severe closed head injury.

This is a controversial area with no consensus. Aim is to test understanding of literature on cervical spine injury, sensitivity and limitations of imaging, risk Vs benefits, understanding of institutional protocols and systems issues. A well reasoned and an appropriate approach would score high marks.

A suggested approach is

1. Detailed history and clinical exam with review of mechanism of injury, speed, other injuries
2. 3 view (AP, lateral and peg view) or 5 view(3 + right and left obliques) cervical spine with focussed CT to missed areas or CT scan of neck from base of skull to upper thoracic vertebrae with reconstructions.
3. If CT scan normal after interpretation by specialist radiologist and ortho spine/neurosurgeon/ICU specialist then neck is “clear”.
4. MRI if clinically suspected spinal neurological injury or abnormal CT scan or very high risk cord injury (high speed, ejection from vehicle, high ISS)
5. Transfer to specialised trauma centre.

Justification

1. 5-10 % of patients with a severe head injury have an associated unstable cervical fracture.
2. Clinical clearance not possible here.
3. Maintaining cervical/spinal immobility via a cervical collar until clinical clearance increases the risk of pressure areas, pneumonia and raised intracranial pressure.
4. 3 and 5 view cervical X rays are frequently of inadequate quality and detect 75-90% of unstable injuries even when of adequate quality and correctly interpreted.
5. Multislice CT scan from the base of skull to upper thoracic spine with sagittal and coronal reconstructions will detect most injuries. It may miss an unstable ligamentous injury without bone fracture (risk 1/1000). It is convenient to image the neck at the same time as the CT brain scan or other CT scans
6. MRI will detect spinal cord and soft tissue pathology such as ligamentous injury, spinal cord injury and epidural haematoma.

Additional Marks:

- Role of flexion extension views
- Requirements for clinical clearance
- Timing of clearing cervical spine Vs attending to other life threatening injuries
- Institutional Protocols

Pass rate 22%

11.1 A 27 year old male with a prolonged ICU stay following a subarachnoid haemorrhage has a CSF specimen taken from his external ventricular drain.

The CSF gram stain result is:

Red Blood Cells	1946 x 10 ⁶ /L	(0-5 x 10 ⁶ /L)
Polymorphs	198 x 10 ⁶ /L	(0-5 x 10 ⁶ /L)
Mononuclear cells	74 x 10 ⁶ /L	

Gram stain: scant gram positive cocci.

a). What is your assessment of the CSF result and provide a reason ?

Ventriculitis : due to raised WCC:RCC ratio and a positive gram stain

b). List two likely organisms commonly reported on the Gram stain in this setting.

Staphylococcus epidermidis

Staphylococcus aureus

c). List 2 therapies you may consider based on this report .

Removal of EVD / replacement

Vancomycin

11.2 A previously well, 19 year old female presents with fever, headache, photophobia and neck stiffness.

a). List three (3) clinical features that would indicate the need for a brain CT scan prior to lumbar puncture in this patient?

New onset seizures

Immunocompromised state

Abnormal level of consciousness

Focal neurological signs (signs suspicious of a space occupying lesion)

History of CNS disease (mass lesion, stroke, focal infection)

Papilloedema

b) A lumbar puncture is performed. The initial results reveal:

Red blood cells	356 x 10 ⁶ /L	(0-5 x 10 ⁶ /L)
Polymorphs	3180 x 10 ⁶ /L	(0-5 x 10 ⁶ /L)
Mononuclear cells	206 x 10 ⁶ /L	
Protein	2.96 g/L	(0.15 – 0.40 g/L)
Glucose	0.4 mmol/L	(2.5 – 5.6 mmol/L)

What are the three (3) most likely causative organisms?

Neisseria meningitidis
Streptococcus pneumoniae
Haemophilus influenzae

c) After 24 hours of appropriate therapy she develops new onset of generalised tonic-clonic seizures. List three (3) likely intracranial causes.

Raised intracranial pressure
Cerebritis
Cerebral abscess
Septic venous thrombosis

11.3 A 66yo diabetic female with a history of a recent febrile illness now presents with increasing weakness and altered sensation in both legs. A lumbar puncture is performed and the initial CSF result is shown.

Red blood cells	594 x 10 ⁶ /L	(0-5 x 10 ⁶ /L)
Polymorphs	550 x 10 ⁶ /L	(0-5 x 10 ⁶ /L)
Mononuclear cells	154 x 10 ⁶ /L	
Protein	0.99g/L	(0.15 – 0.40g/L)
Glucose	10.4 mmol/L	(2.5-5.6 mmol/L)
No organisms seen		

a). What is the most important diagnostic investigation indicated in this clinical scenario?

MRI of the spine

b). What is the most likely diagnosis?

Epidural abscess

Pass rate 81%

12. A 45-year-old male is admitted from the ward to your high dependency unit for observation of his neurological state. On examination, his temperature is 38.7°C. He is confused and agitated with a GCS of 12. He has a stable respiratory and cardiovascular status. A blood culture showed Gram-positive cocci in both bottles.

His relevant background history is a splenectomy following a motor vehicle accident 20 years ago, hypertension and mild asthma.

a) What is the likely diagnosis and what other investigations would you order?

pneumococcal bacteraemia likely meningitis

Investigations -

urine pneumococcal antigen

CT head

Routine bloods FBC/EUC/LFTS/CMP/COAGS/BSL

Lumbar Puncture – argument can be made for performing LP after CT or not performing an LP at all. Both responses are acceptable.

PCR for pneumococcus

b) Outline your specific treatment for this condition

1) Empirical antibiotics

ideally within 30 minutes

3rd generation cephalosporin Ceftriaxone 2 gm BD or cefotaxime 2gm tds

Plus Vancomycin 1 gm BD / 500 tds

Then target Pen 1.8 gm 4 hour if MIC < .125 gm/l Cease Vancomycin if sensitive

2) Dexamethasone before or with antibiotics. Risk with altering vancomycin penetration for 4 days. 0.15gm /KG max 10 gm for 4 days.

c) list 5 predisposing factors for this condition

Extreme of age <2 or >65

Chronic lung disease

Asplenia both functional and anatomic

Immunosuppression

Transplant patients

CSF leaks

Cochlear implants

d) what prophylactic measures could have been taken to prevent this condition in this patient ?

Vaccination 14 days before or 14 days post splenectomy (early vaccination not immunogenic)

Re vaccinate 5 year intervals

Patient's penicillin/ amp daily for 2 years after splenectomy

Antibiotics empirically if he develops temperature. (eg Augmentin)

In this patient consider life long antibiotics orally

Pass rate 64%

13. Compare and contrast the pharmacology of dobutamine and levosimendan

	LEVOSIMENDAN	DOBUTAMINE
Class	Calcium sensitiser	Synthetic catecholamine
Pharmacokinetics	Slower onset of action (requires loading dose) t _{1/2} of parent compound 1 h Metabolised by conjugation and acetylation Active metabolite with t _{1/2} 80-96 h (Effects persist once infusion ceased for up to 7-10 days)	Onset of action in 1 – 2 min t _{1/2} < 3min Metabolised by methylation and conjugation Excreted in urine and bile Inactive metabolites
Mechanism of action	Increases myocyte sensitivity to calcium by binding to troponin C Opens ATP-dependant K ⁺ channels in vascular smooth muscle	Selective beta-1 and beta-2 receptor agonist
Therapeutic effects	Increased cardiac contractility Coronary, systemic and pulmonary vasodilation Reduced preload and afterload without impairing diastolic relaxation	Increased cardiac contractility Mild peripheral vasodilation
	LEVOSIMENDAN	DOBUTAMINE
Adverse effects	Hypotension Headache	Drug-induced myocardial ischaemia Rate/ rhythm disturbances Hypotension Hypertension in XS dose Tachyphylaxis
Contraindications	Hypersensitivity to levosimendan LV outflow tract obstruction Severe renal or hepatic failure Severe hypotension and tachycardia History of torsade de pointes	Hypersensitivity to dobutamine LV outflow tract obstruction

Pass rate 34%

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

Causes:

- Iatrogenic - Medications – chemotherapy, antihistaminics, neuroleptics. Trauma - TOE, intubation , tracheostomy
- Infectious - candidial mucositis. Metabolic – thyrotoxicosis, Cushing’s
- Myopathic – myasthenia gravis, connective tissue disorders, myotonic dystrophy
- Neurological – severe head injury, stroke, Guillain-Barre syndrome. Structural - Zenker's diverticulum, Oropharyngeal and oesophageal tumours.

Assessment:

- History – hoarseness, weak cough – vocal cord palsy, slurred speech, nasal regurgitation – neuromuscular. Odynophagia – infections , malignancy
- Clinical assessment – oral cavity –poor dentition, dry mouth. Neurological – cranial nerves – V. VII, IX, X, XI, XII.
- Bedside assessment by speech therapist – coordination of swallowing, aspiration of dye (methylene blue).
- Nasopharyngeal laryngoscopy – visual inspection oropharynx, vocal cords for anatomical abnormality.
- Video fluoroscopy – accurately analyses aspiration, pooling of secretions and movements of muscles during swallowing.
- Barium swallow – identifies anatomical abnormalities – diverticuli, tumours, Upper GI endoscopy.

Pass rate 70%

15.1 The following information was obtained during the insertion of a right heart catheter

RA	14	mm Hg
RV	105/14	mmHg
PA	33/18	mmHg
PAOP	14	mmHg
CI	2.4	L/min/m²

- a) What dominant abnormality is indicated by the right heart catheter data?
Pressure gradient between the RV and PA
- b) List two (2) likely causes of the abnormality

pulmonary valve stenosis
supravalvular or RVOT stenosis

15.2 List 5 causes of a mixed venous oxygen saturation (SvO₂) recording of 86%

Septic shock
Left to right shunt
High FIO₂
Hyperbaric oxygenation
Measurement error (poor calibration)
Reduced oxygen consumption – Hypothermia, NM blockade, hypothyroidism, general anaesthesia

15.3 Examine the ECG provided below

A print out of an ECG provided

a) Describe the abnormalities on the ECG

Tachycardia
Intraventricular conduction defect probably RBBB
Widespread ST elevation

b) List 2 potential causes

Acute myocardial infarction (extensive)
Maybe myopericarditis

Pass rate 51%

16. Outline the risks specifically associated with Magnetic Resonance Imaging of critically ill patients (you do not have to outline risks associated with transport to and from the scanner).

General risks of MRI

Magnetic field induced movement of ferromagnetic objects

* Ferrous Projectiles accelerating into scanner causing trauma

* Movement of ferrous implants and prostheses

* Movement of metallic foreign bodies, such as foreign bodies in the eye

Others

* Malfunction/failure of pacemaker/ IAD

Specific risks with the critically ill patient

* Cold environment and prolonged exposure time away from ICU due to length of time it takes to do an MRI

* Patient inaccessibility

* Monitoring and ventilation equipment is limited and needs to be MRI compatible, often sub-optimal

* Unable to take resuscitation equipment into “magnet zone”

* Infusions may be difficult to run – MRI compatible pumps that can be used in “magnet zone” are not widely available. Long tubing can be used.

* Gadolinium exacerbation of nephrogenic systemic fibrosis

Potential risk of hyperthermia in patients with disordered thermal regulation (ie all critically ill patients)

Potential for burns (ECG dots)

Pass rate 62%

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

Clinical presentation is variable and all signs and investigations lack sensitivity and specificity. 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 (may be diagnostic) +/- CT abdomen and blood cultures. HIDA scans are reported to be useful in cases when diagnoses can't be established with certainty.

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.

Pass rate 91%

18.1 An 81 year old woman is admitted to the ICU with a 24 hour history of altered mental state and confusion. She has a history of type II diabetes managed with metformin. The following blood results were taken on admission.

Arterial blood	Value	Reference values
pH	7.30	7.36-7.44
PCO ₂	31 mmHg (4.0 kPa)	40 mmHg (5.3-5.7 kPa)
PO ₂	90 mmHg (12.0 kPa)	80-100 mmHg (10.5-13.0 kPa)
HCO ₃ ⁻	20	22-33 mmol/L
Na ⁺	140	135 -145 mmol/L
K ⁺	3.9	3.2-4.5 mmol/L
Cl ⁻	105	100-110 mmol/L
Urea	21.8	3.0-8.0 mmol/L
Creatinine	220	50-100 micromol/L
Glucose	40	3.0-7.8 mmol/L
Lactate	4.8	< 2 mmol/L

a. Which clinical condition is most consistent with the above data? - Justify your answer from the results provided.

Answer: Non ketotic hyper osmolar state

- Marked hyperglycaemia (higher than usually observed DKA) plasma glucose may be >55mmol/L.
- Hyperosmolarity (by definition osmolarity should be >320)
- Relatively normal pH/HCO₃ suggesting non ketotic state. A small anion gap acidosis may be present secondary to lactate.

b. List 3 complications of this condition.

- Cerebral oedema:
- Vascular thrombosis:
- Electrolyte derangements in particular hypokalemia, dysnatraemia. Hyperchloremia from saline administration.
- Intercurrent events such as sepsis, aspiration, myocardial infarction, iatrogenic (eg vascular access related complication)
- Hypotension and shock due to intravascular volume depletion or inadequate resuscitation.

18.2 A 63 year old patient with a background of type II diabetes had vascular surgery 24 hours previously. His post operative course has been uncomplicated except for consistently elevated serum potassium measurements. He is not receiving supplemental potassium and vital recordings have been stable. His most recent arterial blood gases and plasma biochemistry are presented below:

Arterial blood	Value	Reference range
pH	7.24	7.36-7.44
PCO ₂	24 mmHg (3.2 kPa)	40 mmHg (5.3-5.7 kPa)
PO ₂	90 mmHg (12.0 kPa)	80-100 mmHg (10.5-13.0 kPa)
HCO ₃ ⁻	10	22-33 mmol/L
Na ⁺	135	135 -145 mmol/L
K ⁺	5.7	3.2-4.5 mmol/L
Urea	15	3.0-8.0 mmol/L
Creatinine	180	50-100 umol/L
Cl ⁻	120	100-110 mmol/L
Albumin	35	35-50 G/L

a) Describe the acid base abnormality

This is a normal anion gap metabolic acidosis.

b) List three causes of the acid-base abnormality.

The major causes are:

- Loss of bicarbonate (eg diarrhoea, pancreatic biliary drainage and urinary diversions (ureterosigmoidostomy)
- Renal tubular acidosis (RTA).
- Other: saline loading, TPN and cholestyramine use.

c) What is the most likely cause of the abnormality in this patient?

Type 4 RTA.

18.3 You are called to the Emergency Department to review a nulliparous 28 year old woman. She is currently 35 weeks pregnant, and has presented with 72 hours of nausea and vomiting accompanied by epigastric and right upper quadrant pain. On examination she was jaundiced, confused and had a blood pressure of 120/70. Laboratory results from a venous blood taken on arrival are shown below:

Venous Blood	Value	Reference range
Na ⁺	138	135 -145 mmol/L
K ⁺	3.8	3.2-4.5 mmol/L
Urea	15	3.0-8.0 mmol/L

Creatinine	245	50-100 micromol/L
Albumin	30	33-40g/L
Glucose	2.5	3.0-7.8mmol/L
Bilirubin (total)	142	<20micromol/L
ALP	293	32-156 U/L
AST	99	<31U/L
ALT	88	<34U/L
GGT	67	<38U/L
LDH	180	110-250U/L
Uric acid	0.72	0.15-0.5 mmol/L
APTT	45	36-38 sec
INR	2.8	<1.2
Platelets	123	150-450x10 ⁹ /L

List 3 likely differential diagnoses for the above history and laboratory data

A number of differentials are possible however in the third trimester in a nulliparous woman the three main considerations are:

- Acute fatty liver of pregnancy (AFLP):
- HELLP (Haemolysis, elevated liver enzymes and low platelets) Syndrome:
- Pre eclampsia with hepatic involvement.

Other considerations are: (these are not the cause of *severe* hepatic failure in pregnancy and so will attract fewer marks if mentioned without the first three)

- Intrahepatic Cholestasis of Pregnancy:
- Viral hepatitis: The commonest cause of jaundice in pregnancy. May occur at any time. The ALT and AST would be expected to be greatly elevated (>500-1000U/L). DIC is rare.

Pass rate 87%

19. Compare Continuous Venovenous Haemofiltration (CVVHF) , Sustained Low Efficiency Dialysis (SLED) and Intermittent hemodialysis (IHD with respect to

a) mechanism of solute clearance

b) advantages and

c) disadvantages

-	- CVVH	SLED	IHD
- Mechanism of solute clearance	- Solvent removal occurs as a consequence of a pressure gradient across a semi permeable membrane. Solute removal occurs only by convection (solvent drag).	- Solute removal occurs predominantly by diffusion down a concentration gradient created by dialysate fluid on the other side of the semi permeable membrane.	- Solute clearance by diffusion
- Advantages	Achieves better clearance of middle molecules (< 15 Kd) than CVVHD/IHD, fluid management easier and flexible, lesser hemodynamic instability as compared to IHD.	- Can be done at night so patient can be mobilized during the day. Period of anticoagulation reduced. Possible cost savings by using online water and ability for one machine to deliver 2 treatment episodes per day.	- shortest treatment time, anticoagulation often not required, cost savings by using online water
- Limitations	- Patient immobilized , need for continuous anticoagulation , higher nursing requirement	- inferior clearance of middle molecules, reduced fluid management flexibility. Higher risk of disequilibrium syndrome	- least clearance of middle molecules, least flexible fluid management, highest risk of disequilibrium syndrome. Possible greater

			haemodynamic instability.
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Pass rate 68%

20.1. Examine the clinical photograph. (Colour photograph provided)

- a) List the abnormalities visible in this patient's hands.
 b) What is the most likely diagnosis?
 c) List 4 other clinical features associated with this condition?

- a)
- Evidence of Raynaud's or ischaemia with pallor of digits,
 - Sclerodactaly
 - Calcinosis,
 - Multiple amputations of distal digits
 - Distal ulceration with gangrene
 - Fixed flexion deformity of ring finger right hand.
- b) Systemic sclerosis or Scleroderma
- c)
- Telangiectasia,
 - Fine creps bibasally due to lower lobe fibrosis,
 - Beaking of the nose
 - Limitation of mouth opening
 - Thickening of the skin and pigmentation changes
 - Features consistent with Pulmonary H/T,
 - Sjogrens syndrome
 - Oesophageal involvement
 - Renal failure

20.2 This previously well 4 year old child originally presented with fever and a cough. He was given Paracetamol, Ibuprofen and a cough mixture obtained from the chemist. Despite this he deteriorated and developed a progressive rash and skin lesions

Colour photograph provided

- a) What is the character of the rash and skin lesions?

b) Based on the history and the clinical photograph, list 3 differential diagnoses?

c) How would you investigate this condition?

a) The rash is

- Erythematous,
- Patchy
- Widespread
- Bullous formation or blistering

b) Top 3 differentials

- Stevens – Johnson syndrome (erythema multiforme major)
- Drug eruption
- Bullous pemphigoid

Less likely, but worthy of some marks

- Staphylococcal scalded skin syndrome
- Toxic shock syndrome
- Purpura fulminans

c)

- history in particular recent drug exposure, other symptoms of infective aetiology, Exposure to infected children
- FBC, UEC, LFTs, CRP, COAGs
- Serology – Mycoplasma and varicella
- Skin biopsy
- Blood cultures
- MC&S of bullae

Pass rate 70%

21. What do you understand by the term “Damage Control Surgery” (DCS) in relation to abdominal trauma? What important complications may occur following the initial admission to ICU after DCS?

Key feature. Damage Control Surgery involves a 4 phase approach to major emergency abdominal injuries:

- recognition of at risk patient
- Limited, focused surgery for control of haemorrhage and address contamination with temporary abdominal closure,

- restoration of near normal physiology – cardiovascular resuscitation, rewarming (usually active) if hypothermic, correction of coagulopathy (blood products and aFVII) and acidosis. – with optimization of ventilation and
- re laparotomy at 24 – 36 hours with removal of packs, definitive surgery and formal abdominal closure, where possible.

Important complications

New onset or uncontrolled surgical bleeding
 Abdominal compartment syndrome (ACS),
 inability to wake and wean (open abdomen / planned return to theatre)
 missed injuries in the multiply injured patient (need for full examination on admission)

Pass rate 68%

22.1 A 45 year old man received an allogeneic bone marrow transplant for Acute Lymphatic Leukaemia. 26 days after the transplant the patient developed severe gastroenteritis and a maculopapular skin rash and respiratory insufficiency. The following investigations were performed:

Hb	94 G/L	(110-150)	Na (mmol/L)	132	135-145
WCC	$2.3 \times 10^9/L$	(4.0-10.0)	K (mmol/L)	3.4	3.5-.5.0
Platelets	$54 \times 10^9/L$	(150-300)	Urea (mmol/L)	8.2	4.0-6.0
			Creatinine (mmol/L)	0.1	0.04-0.12
			Bilirubin (micromol/L)	67	<25
			Alkaline phosphatase	265	<125
			ALT	51	<40
			AST	40	<40

Coagulation profile - normal

Stool: Microscopy: WCC ++ Cultures: No growth
 C.difficile toxin- Not detected

a) List 3 possible diagnoses.

Sepsis
 CMV
 GVH

Over the next 3 weeks, the patient developed generalized oedema predominantly in the trunk and lower extremities. An ultrasound Doppler study of the abdomen revealed dilated portal vein and inferior vena cava. The right atrial pressures were normal.

Portal pressure	18 mm Hg (8 – 10)
Infrahepatic IVC	20 mm Hg (9-11)
Hepatic vein	8 mm Hg (9-10)
Suprahepatic IVC	8 mm Hg (7-8)
Right atrium	6 mm Hg

b) What is the likely explanation for these findings?

Veno-occlusive disease of the liver

c) Name 2 treatment measures for the diagnosis in b)

TIPS procedure
Diuretics
Fluid restriction

22.2 A previously healthy 34 year old woman is transferred to your hospital intubated and ventilated with a history of a prolonged generalized tonic-clonic convulsion. On arrival, she is deeply unconscious with a GCS of 3, fixed dilated pupils, absent tendon reflexes and bilateral up-going plantar reflexes. An admission CT scan shows bilateral intracerebral haemorrhages. A full blood count report is as follows:

- 1) Hb 78 g/l (130-150),**
- 2) WCC $14.5 \times 10^6/\text{mm}^3$ (4.0-11.0),**
- 3) Platelets $43 \times 10^6/\text{mm}^3$ (150-300)**

Blood picture: Thrombocytopenia, fragmented cells and reticulocytosis

Based on the history, CT scan and the hematology report, provide three possible differential diagnoses

Eclampsia
Thrombotic thrombocytopenic purpura
HUS
Meningococcal meningitis with DIC ...(although big bleed is unlikely)
Vasculitis.

Pass rate 49%

23. In the context of a randomised control trial comparing a trial drug with placebo:

a) briefly explain the following terms:

Type 1 error

Type 2 error

Study power

Effect size

b) List the factors that influence sample size.

Type 1 error

The null hypothesis is incorrectly rejected. Type 1 errors may result in the implementation of therapy that is in fact ineffective or a false positive test result.

Type 2 error

The null hypothesis is incorrectly accepted. Type 2 errors may result in rejection of effective treatment strategies or a false negative test result.

Study power

Power is equal to $1-\beta$. Thus if $\beta = 0.2$, the power is 0.8 and the study has 80% probability of detecting a difference if one exists

Effect size

Effect size (Δ) is the clinically significant difference the investigator wants to detect between the study groups. This is arbitrary but needs to be reasonable and accepted by peers. It is harder to detect a small difference than a large difference. The effect size helps us to know whether the difference observed is a difference that matters.

Factors influencing sample size

- Selected values for significance level, α , power β and effect size Δ (smaller values mean larger sample size)
- Variance /SD in the underlying population (larger variance means larger sample size)

Pass rate 55%

24. What general guidelines will you use when administering a fluid challenge for hemodynamic instability to a critically ill patient? In your answers, list the parameters, which may be used to predict fluid responsiveness in critical illness.

This area remains controversial with, in reality, no single correct answer. Examiners expected and were prepared to accept a range of approaches (if reasonable)

- a) The type of fluid – crystalloid/colloid . No ideal fluid in all clinical settings.

In general no differences in mortality in critically ill patients, between crystalloids and colloids (SAFE study). However in subgroups, albumin may be useful (sepsis) whilst in neurotrauma, crystalloids may be preferable.

b) Rate of fluid administration (250-500 ml of colloid /500-1000 ml of crystalloid or 20 ml/kg of crystalloid over 30 min.)

Again, no hard data exist to support either regime, but these are rules of thumb and recommended in the Surviving Sepsis Campaign Guidelines.

c) A clear defined goal such as a MAP/Urine output or resolution of tachycardia – commonly used goals in clinical practice.

d) Defining safety limits – such as an upper limit or an increment of CVP/ PAWP Although no criteria for the above end points exist, an increment in CVP 2-5 mm Hg and PCWP 3-7 mm Hg in 30 min or earlier should be used as an indication to cease fluid challenge. In the absence of invasive monitoring, measurement of JVP and signs of pulmonary oedema should be looked for.

Parameters predicting fluid responsiveness

1) Clinical endpoints such as collapsed veins and state of peripheral circulation not sensitive.

2) CVP / PCWP changes poor predictors

Other end points have been proposed:

- a) Systolic pressure variation with respiration
- b) Pulse pressure variation with respiration
- c) Stroke volume variation with respiration
- d) Aortic blood velocity variation with respiration
- e) Intra-thoracic blood volume
- f) Respiratory variation in SVC / IVC diameter
- g) Haemodynamic responses to passive leg raising.

None of the above has been shown to be a reliable predictor, although the haemodynamic response to passive leg raising is thought to be more sensitive than the rest. The reliability of some of these end points are also influenced by the presence of positive pressure ventilation

Pass rate 34%

25.1. An 82 year old woman presents with fever, seizures and a history of anorexia, diarrhoea and vomiting.

Following a normal CT scan of head, a lumbar puncture is performed.

The immediate results are as follows:

CSF slightly turbid in appearance.
 300 polymorphs /mm³, 240 monocytes/mm³
 Glucose 2.5mmol/l
 Protein 0.6 g/l (0.2-0.4 g/l).

a) What is the likely diagnosis?

Meningitis./ meningoencephalitis

b) The microbiologist rings to inform you that the gram stain demonstrates numerous small non-branching Gram-positive bacilli. What is the likely diagnosis?

Listeria monocytogenes infection

c) What are the appropriate antibiotics for this organism?

Ampicillin or Penicillin G.

d) You discover the patient is allergic to your choice of antibiotic. Suggest an alternative antibiotic.

IV Bactrim (cotrimoxazole, trimethoprim/sulphamethoxazole)./
 Meropenem/ Linezolid-Rifamp combination

25.2. A patient who had been on meropenem and fluconazole for 6 days for intra-abdominal sepsis developed new fevers and grew a Gram negative organism in the blood. The initial sensitivities are given below. Further sensitivity testing will take another 24 hours.

	Gentamicin	Tobramycin	Ampicillin	Imipenem	Ciprofloxacin	Ticarcillin
Gram negative rods	R	R	R	R	R	R

List 3 likely causative organisms of the new sepsis. What is an appropriate antibiotic for each of the listed organisms, whilst waiting for the final sensitivity report?

Stenotrophomonas maltophilia - Bactrim
 Multi-resistant Acinetobacter – Amikacin/colistin
 Multi-resistant pseudomonas / Burkholderia - Amikacin

Enterobacter/proteus - Amikacin

25.3) A 36 year old cattle farmer was admitted to hospital with a flu like illness. 3 days after admission he developed arthralgia and progressive shortness of breath. There was a soft systolic murmur over the precordium. Chest X-Ray showed bilateral infiltrates.

ECG showed non-specific ST-T changes. Troponin raised.

Echo revealed decreased LV function.

Hb 90 G/L.

Reticulocytes 4% (0.5-2).

List 5 differential diagnoses for his presentation

- a) Viral pneumonia
- b) Legionella
- c) Pneumococcal
- d) Q fever
- e) Mycoplasma
- f) Infective endocarditis
- g) Leptospirosis
- h) Brucellosis
- i) Vasculitis (unlikely)

Pass rate 53%

26.1 A 64 year old man is admitted to ICU with a 5 day history of increasing shortness of breath, non-productive cough and acute respiratory failure. Clinical examination reveals reduced breath sounds and inspiratory and expiratory wheeze bilaterally. Chest X-Ray reveals hyperinflated lung fields. The following data are from pulmonary function testing performed 3 months ago.

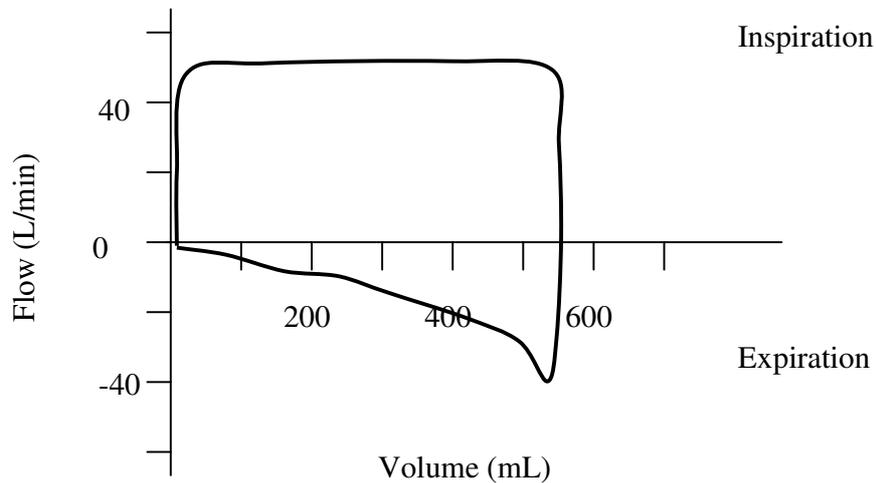
Variable	Predicted	Pre-bronchodilator	Post-bronchodilator
FEV1 (L/min)	3.15	0.77	0.85
FVC (L/min)	4.05	3.00	3.38
FEV1/FVC %	70	20	25%

The patient is intubated and volume-controlled ventilation instituted. The settings are SIMV, rate of 8, TV 500 ml, FIO₂ 1.0, PEEP 0. Three sets of ventilatory parameters are provided below. Based on the information above, select from A, B or C, which pattern will be most likely to fit with his respiratory dysfunction and explain why.

	A	B	C
Peak pressure (cm water)	65	65	35
Plateau pressure (cm water)	20	63	33

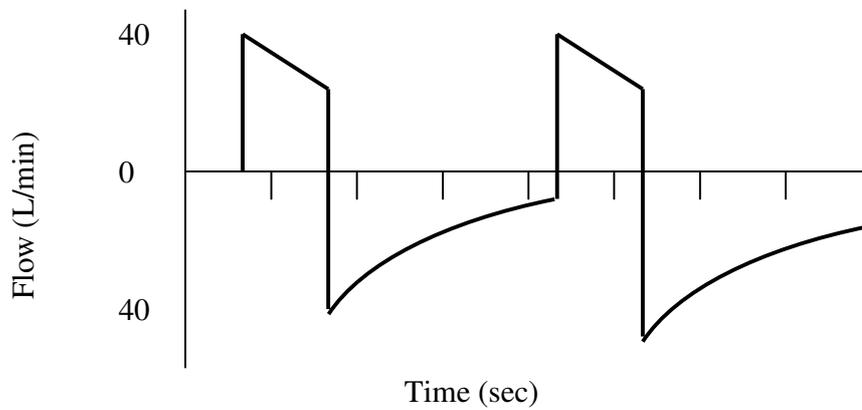
Answer: A (A high peak-plateau gradient with high peaks are consistent with obstructive lung disease)

b) The patient is intubated and volume-controlled ventilation instituted. This is the patient's flow-volume loop. What abnormality is illustrated by the flow pattern?



Expiratory flow scooped out/Increased expiratory resistance

c) This is the patient's flow-time respiratory waveform. What abnormality is illustrated by this trace?



Incomplete emptying/potential for gas trapping

d) List 3 changes to the ventilator settings you could do to correct the abnormality noted in c)?

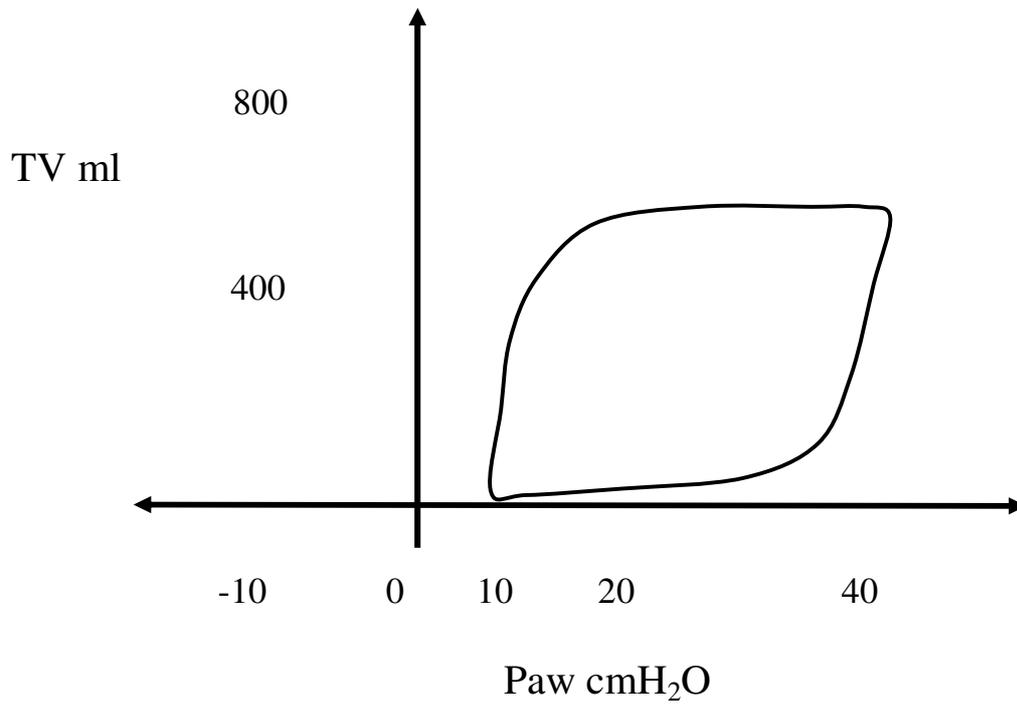
Decrease respiratory rate

Increase peak inspiratory flow

Decrease the I:E ratio (increase expiratory time//decrease inspiratory time)

26.2.

A 56 year old female with septic shock and multiple organ failure is admitted to intensive care. She is endotracheally intubated and ventilated. This is the patient's pressure-volume loop. What abnormalities does the loop indicate?



Reduced compliance / Increased resistance

26.3. Listed below are the co-oximetry data for two patients A & B. What would the pulse oximetry measured saturation be for patient A and patient B? Give reasons for your answer.

	Patient A	Patient B
Oxyhaemoglobin (%)	70	50
Reduced haemoglobin (%)	10	10
Carboxyhaemoglobin (%)	20	40

Patient A – 90%

Patient B - 90%

Pulse oximetry only uses 2 wavelengths and COHb is measured as OxyHb.

Pass rate 75%

27. What are the risk factors for the development of post-extubation stridor? Briefly outline the treatment of post extubation-stridor.

Risk factors:

- 1) Duration of IPPV > 5 days
- 2) Traumatic or difficult intubation
- 3) Prior history of self extubation
- 4) Trauma, surgery or infection of upper airways
- 5) History of agitation
- 6) Female sex
- 7) High BMI
- 8) Over inflated cuff
- 9) Older age group
- 10) Elevated APACHE
- 11) Low GCS
- 12) Large ETT size

Treatment:

- 1) Adrenaline nebs: constrict arterioles, reduce oedema, useful in acute stridor.
- 2) Steroids: May be more useful in prevention rather than treatment, commenced 12 hr prior to extubation (recent Lancet paper). Also useful in children
- 3) CPAP – relief of symptoms, reduction in work of breathing (needs to be done with caution)
- 4) Heliox – improved patient comfort, shown to reduce need for intubation
- 5) If all above fail, endotracheal intubation and ventilation

Pass rate 66%

28.1 A 53 year old patient was admitted with a GCS of 3. The GCS has remained unchanged for 24 hours. The cause of the coma is unclear. He has had no sedation or paralysis for more than 24 hours. His temperature is 36.5⁰C

Na+	149 mmol/L (135-145)
K+	4.6 mmol/L (3.5-5.0)
Glucose	6.2 mmol/L (4-6)
Liver function tests	normal
Renal functions	normal

You find the following on neurological examination

Train of four neuromuscular testing – 4 twitches elicited

Pupils (R & L)	Fixed and dilated
Corneals, conjunctivals	Absent
Oculocephalic	Absent
Vestibuloocular	Absent
Facial reflexes	Absent
Cough and Gag	Absent
Spontaneous respiration	Absent

Arterial blood gases during apnoea test:

pH	7.23
PCO₂	65 mm Hg (8.75kPa)
PO₂	146 mm Hg (19.4 kPa)

What is your assessment of the neurological status and why?

Patient clearly has no evidence of brain stem reflexes, however, can't be declared brain dead as there is no known cause of coma.

28.2 A 56 year old man was admitted to your ICU for monitoring of his deteriorating conscious state following an acute thrombotic stroke involving the carotid territory. Over the next 6 hours, the patient's conscious state has improved significantly. However, you are notified of an abnormal coagulation result from a sample taken at 6 hours after admission to intensive care. There are no signs of bleeding.

	Baseline	6 hours	
PT	13	27	(12-16 sec)
APTT	34	120	(32-36 sec)
INR	1.1	2.1	
TT	12	34	(12-14 sec)
Platelets	146	148	(150-300 X 10⁹/L)
Fibrinogen	3.6	0.9	(2.5-4 G/L)

a) Suggest a reason for the abnormal blood result.

Patient has received thrombolysis. Release of brain thromoblastin causing a DIC is unlikely as patient is clinically getting better and platelets are normal.

28.3. List 4 causes of an elevated serum ammonia concentration in critically ill patients

Hepatic failure

Inherited disorders of urea cycle

Drugs: Valproate, glycine, carbamezapine

Porta-systemic shunts

Increased protein load: GI bleed, TPN,

Infection with urease splitting organisms – proteus

Gastric bypass, urinary diversion procedures

Cancers – myeloma

Chemotherapy.

Pass rate 81%

29.1. Besides history and clinical examination, what investigations may help distinguish between cardiac and non-cardiac causes of pulmonary oedema in the critically ill patient?

- 1) Measurement of PCWP and CI
- 2) Serum BNP
- 3) Echocardiography
- 4) PICCO

29.2 A 70 year old man is admitted with shortness of breath and respiratory failure to the intensive care unit. A systolic murmur is audible on examination. A chest X-ray reveals upper lobe diversion of pulmonary veins. A transthoracic echo reveals the following. (abnormal values marked with an asterix)

OBSERVATIONS:

<u>TRICUSPID VALVE:</u>	Normal
<u>PULMONIC VALVE:</u>	Normal
<u>RIGHT VENTRICLE:</u>	Normal size and function
<u>RIGHT ATRIUM/IVC:</u>	Normal
<u>MITRAL VALVE:</u>	Normal

***LEFT VENTRICULAR EVALUATION**

Normal LV size. Moderate to severe impairment of systolic function. EF 25%. No regional wall motion abnormalities. Moderate LV hypertrophy.

30. A 55 year old man has been admitted to your unit with 60% burns involving his face, chest, upper and lower limbs and torso. He has had some debridement and grafting of his burn sites. Ten days after admission, after return from theatre following a debridement, he is noted to be hypotensive with a blood pressure of 85/50 mm Hg. Briefly outline the causes and the management of his hypotension.

Possible causes	Investigation
<ol style="list-style-type: none"> 1) Ongoing fluid shifts and evaporative fluid losses from raw surfaces 2) Ongoing SIRS 3) Bacteremia from operative stimulation. Sepsis – burn site, line sepsis, nosocomial sepsis, deep seated muscle sepsis, high risk of fungal sepsis, endocarditis 4) Bleeding - from surgical and burn sites, 5) Anaphylactic reactions to drugs 6) Pneumothorax <p>Less likely</p> <ol style="list-style-type: none"> 7) Incidental PE (in hospital for 10 days) 8) Myocardial dysfunction 9) GI bleed from stress ulcers 10) Adrenal insufficiency described with burns. 	<ol style="list-style-type: none"> 1) Clinical assessment of fluid balance 2) Assessment of filling pressures 3) Septic screen - to include burn biopsies 4) Hb 5) ECG, troponin, Echo 6) Screen for anaphylaxis – mast cell tryptase 7) CTPA

Treatment

- 1) Depends on cause
- 2) Fluid bolus +/- inotropes – usually norad
- 3) Line change if indicated
- 4) Broad spectrum Gram positive and gram negative cover if sepsis is deemed likely. +/- fungal cover
- 5) PRBC as required
- 6) Targeted therapy for PE /anaphylaxis

Pass rate 77%

VIVAS

VIVA 1

A 58 year old man is admitted to the Intensive Care Unit, intubated and ventilated. Haemodynamic monitors have been inserted and the following haemodynamic measurements have been recorded:

Mean arterial pressure	53 mmHg
Central venous pressure	15 mmHg
Cardiac output	6.8 L/min
[Cardiac index	3.8 L/min/m ²]

1. Describe this circulatory disturbance.

The rest of the questions focused on the rational approach to uses of inotropes and vasopressor including a discussion of some of the recent evidence.

VIVA 2

Mr Gere, a previously well 47 yo male, has been admitted to the ICU for 5 days with severe sepsis secondary to a perforated sigmoid colon. He had a sigmoid colectomy and washout of his peritoneum, and appropriate antibiotic therapy. His initial course was complicated by severe septic shock and multi-organ failure that is now resolving. He is currently ventilated via an oral endotracheal tube, on SIMV with a rate of 16, TV of 700 ml, PEEP of 5 cm H₂O and FIO₂ of 0.45. He is receiving a small dose of fentanyl and propofol, but is awake and co-operative although he has generalised weakness. His arterial blood gas result is shown below:

pH	7.32	
PaO ₂	85 mmHg	(11.3 Kpa)
PaCO ₂	45 mmHg	(6 Kpa)
HCO ₃ ⁻	18 mmol/L	(24 - 32mmol/L)
BE	-4.9 mmol/L	(-2.0 to 2.0 mmol/L)

1. How will you assess whether Mr Gere is ready to be extubated?

The rest of the questions focused on the approach to weaning a ventilated critically ill patient including a discussion on the various modes of weaning , timing of tracheostomy etc.

VIVA 3

A 60 year old man has been transferred to your ICU from another hospital ICU, where he had been admitted 10 days ago with severe pancreatitis and requiring mechanical ventilation. His oral intake was said to be poor during the week leading up to that hospital admission.

1. How would you assess his nutritional state?

The rest of the questions focussed on the route of administration of feeds, calculation of caloric requirements, and the role of immunonutrition.

VIVA 4

A 63 year old woman was admitted to the Intensive Care Unit 4 days ago. She has suffered a cardiac arrest in the community, was resuscitated by Ambulance Officers and was treated with urgent cardiac angiography and stenting of a significant left main coronary artery lesion.

Her clinical condition:

- On moderate sedation, she has started to obey commands this morning
- Intubated and ventilated since admission. Currently $FiO_2 = 0.6$, $PaO_2 = 120$
- Right internal jugular central line, left radial arterial line, right cephalic vein peripheral IV line – all inserted on admission
- She is being treated with clopidogrel, ranitidine and intravenous heparin.
- She has been in atrial fibrillation since admission

This morning she developed a temperature of 38.8C.

What are the likely causes of fever in this lady?

The rest of the question focused on the approach to the febrile critically ill patient.

VIVA 5

A 26 year old male is a passenger in a high speed motor vehicle crash. At the scene his Glasgow coma score is 3 and he is intubated by paramedics and transferred to your hospital. In the emergency room, clinical assessment and radiological investigations are consistent with an **isolated severe traumatic brain injury**. He is transferred to the ICU.

1) Define severe traumatic brain injury

The rest of the questions focussed on the evidence based approach to ICP and CPP management.

VIVA 6

You are the intensivist caring for a patient Mr James Wilson, a 70 year old man admitted to your ICU last night with aspiration pneumonitis associated with a bowel obstruction. He had been in hospital for 4 days prior to admission to the ICU. He is sedated, intubated, ventilated on 80% oxygen and requiring inotropic / vasopressor support.

At the morning hand-over round you are told of an attempt by the new night ICU Registrar to insert an internal jugular central venous catheter just an hour ago that has resulted in technical difficulties with the guidewire being accidentally pushed into the venous circulation. It is seen on X-ray to be in the right atrium, ventricle and pulmonary artery.

The patient's son/daughter has arrived and wishes to speak to someone about their father's condition. You are asked to enter this room and update the patient's relative about the condition of their father.

VIVA 7

Radiology station.

Six sets of X-Rays (4 chest X-Rays, 1 CT abdomen and 1 MRI brain) were shown to the candidates and required to identify major radiological findings.

VIVA 8

Procedure Station

You have decided to initiate CVVHDF in a septic patient with acute renal failure and the following biochemistry:

	Normal Range	On Admission
Na (mmol/L)	135 – 145	133
K (mmol/L)	3.5 – 4.5	6
Urea (mmol/L)	3 – 8	50
Creatinine (umol/L)	50 – 100	550
Phosphate (mmol/L)	0.7 – 1.4	2.5
Lactate (mmol/L)	0.2 - 2	8

Please choose the filter that you will use in a CVVHDF circuit for this patient?

Name some advantages of the filter you have chosen?

The rest of the questions focused on circuit set up, discussion of pre-dilution, choice of dialysate, trouble shooting various alarms and interpretation of raised urea creatinine ratio.

CLINICAL SECTION

Case 1: A 77 yr old man admitted headache, blurred vision and left sided weakness. Patient had had a previous prosthetic mitral valve replacement.

Candidates were asked to make a neurological assessment and proceed with general examination as required.

Case 2: A 73 year old man with MODS following a recent staphylococcal bacteremia. Other findings included evidence of a septic circulation on a PA catheter, PPM, fluid overload, and evidence of multi-organ dysfunction.

Case 3: A 71 year old man post major abdominal vascular surgery, still ventilated and evidence of impaired gas exchange, renal dysfunction, increased lung water and multi-organ dysfunction.

Case 4: A 50 year old man with a background h/o of Hodgkin's disease for which he received radiation therapy, was admitted following a cardiac arrest. Recently, prior to present admission, he was in ICY for a month following a cardiac surgical procedure. The problem presented was difficulty in weaning.

Findings included – poor respiratory compliance, pericardiostomy scar, anuric renal failure, tracheostomy, and pleural effusions evident on CT chest.

Case 5: A 77 year old man with a history of DM and myasthenia gravis was found collapsed at home. He was presented a patient who is now slow to wean.

Findings included evidence of global muscle weakness, pulmonary hypertension on a PAC, moderate TR, inotrope requirement, and dialysis dependent renal failure.

Case 6: A 74 year old lady was presented as a failure to wean after admission to ICU following a collapse.

Findings included: a prosthetic AVR, Rt. Pleural effusion, and global muscle weakness.

Case 7: A 33 year old man with a history of schizophrenia was found unresponsive at home in a pool of vomit and faeces. He has been slow to wake up.

Findings: A ventilated patient, low GCS, pressure areas, biochemical features of rhabdomyolysis and an old infarct on a CT scan.

Case 8: A 42 yr old male post intracerebral hemorrhage due to untreated hypertension. Directed to examine as per normal daily ward round.

Findings: EVD, blood stained CSF, hemiparesis, LLL collapse on CXR, morbid obesity and febrile

Case 9: A 32 yr old lady with vertebral artery dissection and SAH. Candidates were asked to perform a neurological examination.

Case 10: A 64 year old male with GB syndrome in ICU for 2 months, ventilator dependant. Candidates were asked to examine and determine diagnosis and problems related to long term ICU stay.

Case 11. 71 yr old admitted 10 days ago admitted with acute respiratory failure. Assess suitability for weaning.

Case 12: A 64 yr old man with cardiogenic shock following a cardiac arrest. Findings included a dilated L.pupil, raised A-a gradient, CRRT and a broad complex rhythm.

Case 13: A 42 yr old female following an MVA and chest trauma. Patient presented with hypotension and respiratory difficulty. Candidates asked to assess cardio respiratory system.

Case 14: A 32 yr old lady admitted with isolated head injury and candidates asked to assess neurology.

Case 15: 62 year old male, 5 days in ICU post resuscitated cardiac arrest and candidates asked to assess neurology, discuss prognostication and management plan over the next few days.

Case 16: A 58 yr old man – 4 days in ICU, following a perforated sigmoid diverticulum for which he had undergone a Hartmann's procedure. He was on chronic steroid therapy. Issues: AF, gastroparesis, absent BS, globally weak, ongoing temperatures and cushingoid features.

Case 17: 52 year old male, admitted with pneumonia, bilateral infiltrates, worsening respiratory function, empyema, decortication and slow respiratory wean.

Case 18: 64 year old lady with ruptured oesophagus after vomiting. Currently sedated and ventilated. No candidate noted a left thoracotomy wound

Case 19: 65 year old male, 1 day in ICU post resuscitated cardiac arrest and candidates asked to assess neurology, discuss prognostication and management plan over the next few days. Active hypothermia, IABP, no corneals, gag or cough reflexes.

B. Venkatesh
Chairman of Examinations

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