



Australian and New Zealand
College of Anaesthetists
ABN 82 055 042 852

Joint Faculty of Intensive Care Medicine



The Royal Australasian
College of Physicians

Exam Report Apr-May 2009

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 third examination with the new regulations which came into force in 2008. The tables below provide an overall statistical analysis as well as information regarding performance in the individual sections. A comparison with April 08 and October 08 data is also provided.

Examiner comments - Written paper

- 1) Lack of specificity and precision in the answers
- 2) Inability of candidates to score well on mainstream topics – such as indications for ICP monitoring only a 44% pass rate.
- 3) Poor pass rate on clinical methods questions – suggests that candidates are not taking clinical examination seriously and they will need to read books like Talley and O'Connor thoroughly.
- 4) Candidates seem to score well largely on Data interpretation /OSCE type questions. The inability to score well on other questions reflects a general lack of preparation and knowledge even of common topics in intensive care.

Hot Cases

The performance in this section was very disappointing. After what appeared to be an improvement in the October 08 sitting, there was a marked drop in performance. A detailed feedback is provided regarding the reasons for poor performance in each case under the Hot Case Section. The major reason for failure of candidates in this exam was poor performance in Hot Cases. There was a very high proportion of <40% in the clinicals. It cannot be emphasised enough that a good performance in hot cases is vital to pass the exam and that repeated hot case examination and presentation to consultant colleagues under exam conditions during training and preparation is essential. Candidates are again advised not to postpone practising hot cases till after the written results are announced.

Vivas

Whilst the performance in the vivas was comparable to the October 08 exam, the viva stations represent an opportunity to score marks and make up for any deficits in the clinical exam. Again, considerable deficiencies in knowledge were noted in mainstream topics. A detailed feedback from examiners is provided under each station.

Overall statistics

Table 1 – Overall performance

		Apr 09	Oct 08	Apr 08
a)	Total number of candidates presenting for the Examination (b+c+d)	49	66	51
b)	Total number of candidates appearing for the written exam	38	53	43
c)	Number of candidates carrying the written mark from a previous attempt	9	10	5
d)	Number of OTS candidates – eligible to appear for the vivas directly	2	3	3

Breakdown of written exam performance

		Apr 09	Oct 08	Apr 08
e)	Number of candidates scoring > 50%	25	39	31
f)	Total number invited to the vivas based on written marks	25	39	31
g)	Total number invited to the vivas (c+d+e)	36	52	39
h)	Total number approved	18	42	25
i)	Pass rate (as a percentage of those presenting for the written + eligible from previous exam – (i/a*100)	37%	64%	49%
j)	Pass rate (as a percentage of those presenting to the vivas (i/h*100)	50%	81%	64%
k)	Pass rate amongst those who scored >50% in the written paper (17/25)	68%	85%	74%

Table 2 – Analysis of performance in individual sections (comparative data provided for previous exams)

		May 09	Oct 08	Apr 08
a)	Pass rate in the written paper (25/39)	64%	74%	72%
b)	Pass rate in the viva section (28/36)	78%	90%	85%
c)	Pass rate in the clinical section (15/36)	42%	60%	46%
	Number of candidates passing both hot cases (8/36)	22%	40%	28%

Detailed statistics for the written paper

- 1) Highest aggregate mark in the written paper – 72%
- 2) In no question was there a 100% pass rate.
- 3) In 12 of the 30 questions, the pass rate was < 50%.

Detailed statistics for the clinical / oral component (Comparative pass rates for the previous exam are also provided)

May 09			Oct 08	
Station	Pass rate	Highest individual mark for the station	Station	Pass rate
CROSS TABLE VIVAS			CROSS TABLE VIVAS	
Viva 1 – Burns	83%	100%	Viva 1 – Inotrope / pressor usage	85%
Viva 2 – Transfusion medicine	58%	75%	Viva 2 – Ventilation wean	58%
Viva 3 – Ventilator graphics	44%	83%	Viva 3 – Nutrition	73%
Viva 4 – Fluid responsiveness	69%	87%	Viva 4 – Febrile critically ill patient	56%
Viva 5- Sedation /analgesia	78%	94%	Viva 5 – Neurotrauma	94%
Viva 6- Communication	56%	93%	Viva 6 – Communication	73%
Viva 7 - Radiology	56%	90%	Viva 7 – Radiology	56%
Viva 8 - Procedure	83%	85%	Viva 8 – Procedure	92%
CLINICALS			CLINICALS	
Hot Case 1	42%	83%	Hot Case 1	65%
Hot Case 2	42%	92%	Hot Case 2	56%

Breakdown of reasons for failure in the examination (comparative data provided for previous exams)

	May 09	Oct 08
Total number of candidates who failed the examination	31	24
Number of candidates who scored less than 50% in the written paper	13	14
Number of candidates who failed after presenting to the oral section	18	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 (16/18)	89%	70%
Proportion of candidates who failed because of failure in > 1 section (7/18)	39%	40%
Proportion of candidates who scored a “bad fail in the clinicals -<40%)” (12/18)	67%	30%

Written paper – Short Answer Questions 1 – 30

1. A 23 year old man is admitted to your intensive care following a near drowning at the local beach. On admission to ICU he has a GCS of 4 and is intubated and ventilated.

a) Briefly list the potential complications from his clinical presentation.

b) What are the risk factors for severe neurological injury?

a) Complications

- Arrhythmia (severe hypothermia)
- Pneumonia
- Aspiration pneumonitis (water, sand, vomit)
- Acute lung injury/ARDS
- Hypoxic encephalopathy
- Multiple organ dysfunction
- Trauma brain injury or other traumatic injuries (particularly at surf beaches or jetties)
- Electrolyte abnormality

b) Risk factors for severe neurological injury

- At scene
 - Immersion > 10 minutes
 - Delay in CPR commencement
- In the Emergency Department
 - Asystole on arrival in ED
 - CPR > 25 minutes
 - Fixed dilated pupils and GCS < 5
 - Fixed dilated pupils and pH < 7.0
- In the ICU
 - No spontaneous movements and abnormal brainstem function at 24 hours
 - Abnormal CT scan within 36 hours of submersion

Pass rate: 39%

2. Define tumour lysis syndrome. List the risk factors associated with its development.

Outline measures to prevent it and provide a rationale for the use of each of those measures.

Definition:

Tumor lysis syndrome (TLS) is an oncologic emergency that is caused by massive tumor cell lysis with the release of large amounts of potassium, phosphate, and nucleic acids into the systemic circulation

Risk factors

Tumour-related factors

- High tumour cell proliferation rate
- Chemo sensitivity of the malignancy
- Large tumour burden

Patient factors

- Pre-treatment hyperuricemia or hyperphosphatemia
- A pre-existing reduction in renal function
- Volume depletion

Prevention measures

a) Fluids and hydration to achieve a urine output of at least 1 – 1.5 ml/kg (80 to 100 mL/m²) per hour.

Justification: minimize the likelihood of uric acid precipitation in the tubules.

b) Avoid fluids containing potassium and calcium

Justification: Minimize risk of hyperkalemia and calcium deposits

c) Alkalinization of urine

Justification: convert uric acid to the more soluble urate salt, thereby diminishing the likelihood of uric acid precipitation in the tubules. However, there are no data demonstrating the efficacy of this approach.

d) Allopurinol: decreasing uric acid formation by blocking xanthine oxidase.,

e) Rasburicase: Decreases uric acid levels by converting uric acid to allantoin. Justification: Thus, for patients with preexisting hyperuricemia rasburicase is the preferred hypouricemic agent

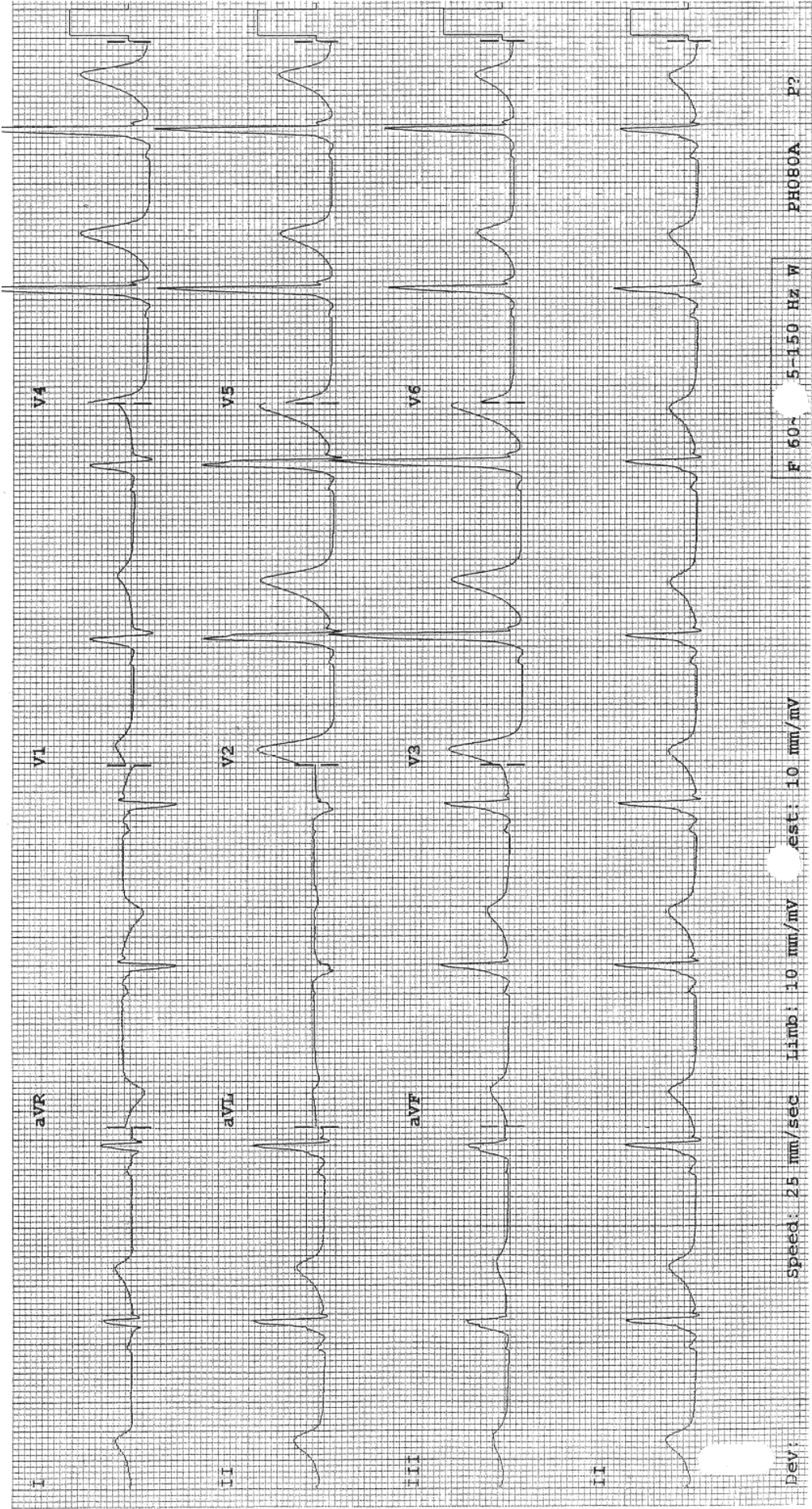
f) Role of dialysis if there is pre-existing renal dysfunction

g) Posttreatment monitoring

- uric acid, phosphate, potassium, creatinine, calcium and LDH
- Fluid input and urine output should be assessed four to six hours after the initial administration of chemotherapy.
- Evidence of TLS or a rising level of uric acid should prompt immediate therapeutic intervention.

Pass rate: 47%

3.1 Examine the ECG provided



ECG of a WPW syndrome (there was also a wave suggestive of a J wave)

- a. **List 3 abnormalities on this ECG**
- b. **Name 2 drugs which are contraindicated in this disorder**
- c. **Name 2 complications of this disorder**
 - a. List 3 abnormalities on this ECG
 - Short PR
 - Delta wave
 - Wide QRS
 - J wave (candidates mentioning this also received credit)
 - Tall R wave in V1
 - b. Name 2 drugs which are contraindicated in this disorder
 - Verapamil
 - Digoxin
 - c. Name 2 complications of this disorder
 - VF arrest
 - Syncope
 - AF/tachyarrhythmias

3.2 You are provided with a report of an echocardiogram of a patient in the ICU.

INDICATIONS/REASON FOR ECHOCARDIOGRAM:

Hypotension soon after admission to ICU following prosthetic aortic valve replacement for aortic stenosis . BP 70/30 mm Hg (mean 43 mm Hg). Study performed on adrenalin 10 mcg/min.

- a) **What is the cause of this patient's hypotension? Justify your answer.**
- b) **List 4 principles of management of this patient's hypotension based on the report.**

(Abnormal values are shown in bold)

LEFT VENTRICULAR EVALUATION

Small LV cavity size. Normal systolic function (EF 60%). No regional wall motion abnormalities. $E' = 4$ cm/s. **Moderate to severe concentric LV hypertrophy. Flow acceleration noted in LVOT on colour Doppler.**

LEFT ATRIUM

Mildly enlarged. LA area 26 cm^2

RIGHT VENTRICLE

Normal size and systolic function

RIGHT ATRIUM/IVC

Normal.

AORTIC ROOT

Normal

MITRAL VALVE

Structurally normal mitral valve; **Systolic anterior motion of the valve leaflets. Moderate mitral regurgitation.** E-wave 0.8 m/s; A-wave 0.5 m/s; Deceleration time 196 ms

AORTIC VALVE

Prosthetic aortic valve is well seated. Trivial paravalvular regurgitation.

LVOT: Max vel 5.0 m/s; Mean vel 3.5 m/s;

Max pressure gradient 100 mm Hg; Mean pressure gradient 49 mm Hg

AV: Max vel 5.1 m/s; Mean vel 3.7 m/s;

Max pressure gradient 104 mm Hg; Mean pressure gradient 55 mm Hg

TRICUSPID VALVE

Normal tricuspid valve. E-wave 0.3 m/s; Mild regurgitation; TR vel 2.0 m/s

PULMONIC VALVE

Normal pulmonic valve

1. What is the cause of this patient's hypotension? Justify your answer
 - Left ventricular outflow tract obstruction.
 - Gradient across LVOT and not across valve
 - SAM
2. List 4 principles of management of this patient's hypotension based on the report.
 - Stop adrenalin
 - Volume load
 - Beta blockers to slow the heart rate and reduce contractility
 - Vasoconstrictor without inotropic effect (eg phenylephrine)

Pass rate: 86%

4. A 47 year old man has severe ARDS following a perioperative aspiration. He is endotracheally intubated and ventilated in SIMV mode with PEEP 5 cm H₂O and an FiO₂ 0.4 resulting in a PaO₂ of 45 mm Hg (6 kPa). On the chest X-Ray, the endotracheal tube is properly positioned in the trachea. The only abnormality on the chest X-ray was bilateral diffuse alveolar infiltrates.

List the steps you could take to improve his oxygenation. Include a brief comment on the rationale for each step.

Basic Measures

- Increase FiO₂): Improve PAO₂
- Increase PEEP
- surface area for gas exchange
- Improvement of atelectasis
- Redistribution of lung water

General Measures

- Physio / suctioning
- Sedation / Consider Paralysis: Decrease O₂ requirements and CO₂ production
- Treat factors that increase metabolic demand, sepsis etc: Decrease O₂ requirements and CO₂ production
- Optimise fluid balance: balance of interstitial overload and maximising cardiac output and DO₂
- Optimise Haemoglobin, optimal oxygen carriage / viscosity combination and minimise immune and volume effects of transfusion

Optimise Recruitment and FRC

- Lung recruitment manoeuvre: Opening collapsed alveoli, increasing FRC and area available for gas exchange
- Increase I:E Ratio towards 1:1: Increased FRC as above, recruitment, increase PAO₂
- Inverse ratio ventilation: Longer in inspiration with potential to gas trap and provide autoPEEP above set PEEP with subsequent increase FRC and area for gas exchange.

Positioning

- Prone position: better VQ matching, improved mechanical advantage, less lung compression from abdominal and mediastinal contents

Optimise Flow to Ventilated Alveoli

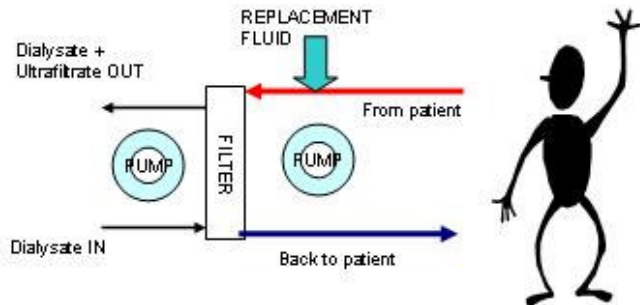
- Inhaled Nitric oxide: inhaled dilator delivered only to ventilated alveoli
- Prostacyclin: improved perfusion to ventilated alveoli

Last Resorts

- Tracheal Gas insufflation and other measures to decrease circuit dead space: reduced dead space means lower CO₂ with relative increase in partial pressure of O₂
- HFOV
- ECMO, external membrane oxygenation and CO₂ removal: lung rest and minimisation of VALI.

Pass rate: 46%

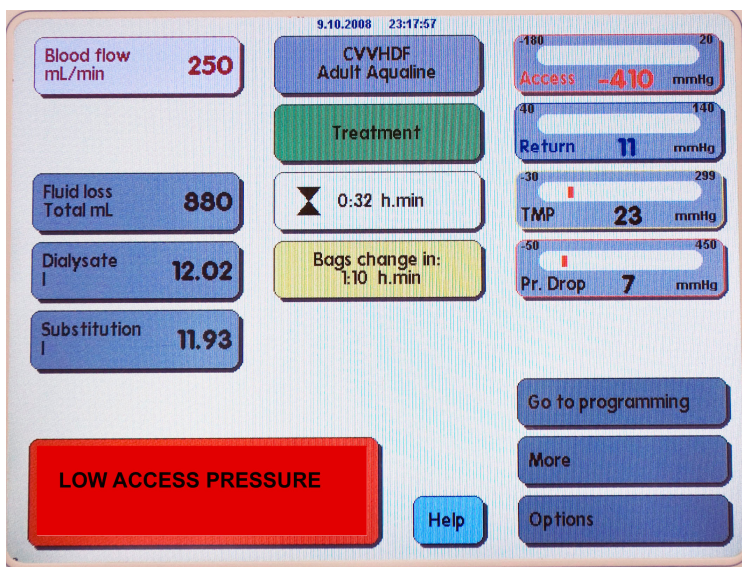
5.1 You have decided to initiate CVVHDF in a septic patient with acute renal failure. The CVVHDF circuit is set up as shown below. What are the advantages of the replacement fluid administered as shown in the diagram?



Adv:

- Flush for filter and prolong filter life by reducing clotting in filter
- May increase urea clearance by elution from red cells

5.2 Following initiation of CVVHD, the following alarm is noticed (see figure below). What are the likely causes and what measures will you undertake?



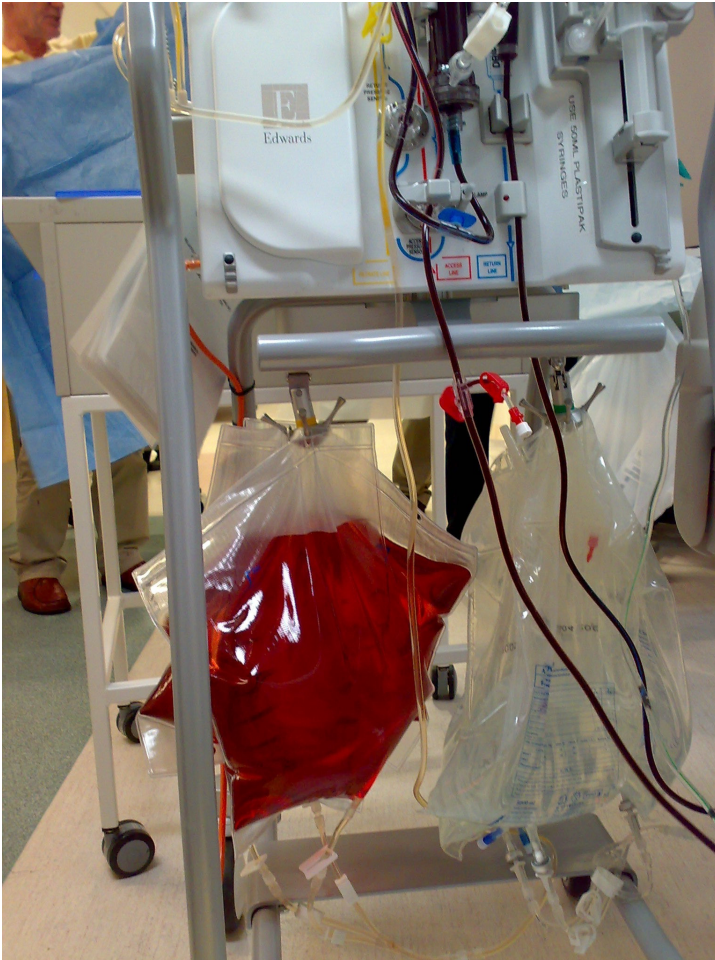
Causes

*Insufficient flow noted in the venous access limb (afferent).
Obstruction along the venous access limb from the lumen in the vein to the pump*

Measures

*Check line for obvious kinks/obstructions
Check position on x-ray if relevant (subclavian or IJ line)
Reposition line and ensure no clot.
Consider flushing line
Consider replacing line/ site esp if the low access flow state cannot be resolved.*

5.3. Give two causes for this appearance of the ultrafiltrate from a CVVHDF circuit.



Answer:

Intravascular hemolysis

Rupture of filter membrane

**5.4. After 24 hrs of CVVHDF there has been no worsening in the patients clinical state.
Repeat plasma biochemistry is as follows:**

	Normal Range	On Admission	After 24 hrs of CVVHDF
Na (mmol/L)	135 – 145	133	133
K (mmol/L)	3.5 – 4.5	6	4
Urea (mmol/L)	3 – 8	50	45
Creatinine (umol/L)	50 – 100	550	500
Phosphate (mmol/L)	0.7 – 1.4	2.5	2
Lactate (mmol/L)	0.2 - 2	8	5

What changes will you make to the CRRT to improve the biochemistry?

- Increasing the rate of the dialysate flow
- Increasing the rate of blood flow
- Change composition of dialysate fluid to increase the concentration gradient
- Increasing the surface area of the membrane
- Replacement fluid to go post dilution

Pass rate: 39%

6. You have been asked to review a six week old infant in the emergency department with a presumptive diagnosis of bronchiolitis.

(a) Outline your approach to the assessment and

(b) management of this baby.

(a) Assessment

Important points include:

- a) Past medical history. Premature delivery, neonatal ventilation, any previous respiratory disease, congenital heart disease or other syndromes (eg trisomy 21). All of these worsen the prognosis, and increase the likelihood of the need for respiratory support.
- b) Diagnosis: must exclude undiagnosed congenital cardiac condition; is this RSV bronchiolitis? PCR analysis of the naso-pharyngeal aspirate is the usual way of making this diagnosis. Other differentials include pertussis and influenza, both of which have the potential to be worse.
- c) Length of history of this illness. In the normal child, RSV bronchiolitis runs a course of 7 – 10 days. So a severe presentation in the first 3 days is more serious than the fifth or sixth day, although a biphasic disease suggests possible secondary infection (Staphylococcus or Streptococcus).
- d) Current observation. Pulse and respiratory rate, severity of respiratory distress, and history of apnoeas requiring resuscitation.
- e) If the child has very significant respiratory distress, has had more than one significant apnoea, has very high pulse or respiratory rate, is desaturating despite significant oxygen therapy (such as $>60\%$ FiO₂), or presence of exhaustion –then ICU/HDU admission is indicated and consideration of transfer to a paediatric facility.

(b) Management includes

- a) Oxygen therapy
- b) Minimal handling with grouped cares
- c) Consideration of IV fluids and fasting whilst under assessment
- d) If ventilatory support is required this can be with CPAP via N/P tube/ bubble CPAP/high flow nasal prong oxygen or face mask BIPAP
- e) Antibiotics are indicated if there are grounds for suspecting a superadded bacterial infection
- f) Aminophylline or Caffeine may be useful in reducing the number of apnoeas if the child has been premature
- g) A few children, usually in the high risk groups above, will need mechanical ventilation or if there is consideration of transportation/retrieval. Comment that intubation and ventilation will prolong the PICU course by 2- 3 days

Could also mention other advocated therapies

Eg nebulized adrenaline/salbutamol/heliox /Ribavarin– and comment that these therapies have not been proven to be effective in all cases but a few may respond.

Pass rate: 45%

7. 1. A 16 year old male has been treated all night for diabetic ketoacidosis. In the morning the blood gas printout is as follows:

Barometric pressure	760	mm Hg	
FiO ₂	0.21		
pH	7.32		
pO ₂	100 mm Hg	(13.3 kPa)	
pCO ₂	30 mm Hg	(4 kPa)	
HCO ₃ ⁻	15.0	mmol/L	
Standard base excess	-9.9	mmol/L	
Sodium	135	mmol/L	(135 – 145)
Chloride	114	mmol/L	(100 -110)
Potassium	3.5	mmol/L	(3.2 - 4.5)
Lactate	1.3	mmol/L	(0.2 - 2.5)
Glucose	14.3	mmol/L	(3.6 – 7.7)

a) Describe the acid-base status.

b) Has the keto-acidosis resolved? Give your reasoning.

Q7.1a) Normal anion gap metabolic acidosis with appropriate respiratory compensation.

Q7.1b) Yes The anion gap is normal, indicating resolution of ketoacidosis. The persistent acidosis reflects saline fluid replacement coupled with the chloride retention during the period of ketonuria.

7.2. You are asked to review a drowsy 80-year-old male with chronic obstructive pulmonary disease, 6 hours after internal fixation of a fractured hip. He is normotensive, and rousable with stimulation. The following are data from arterial blood.

Barometric pressure	760	mm Hg	
FiO ₂	0.4		
pH	7.47		
pO ₂	170 mm Hg	22.6 (kPa)	
pCO ₂	65 mm Hg	8.6 (kPa)	
HCO ₃ ⁻	46.6	mmol/L	
Standard base excess	20.9	mmol/L	

a) Describe the acid- base status.

b) List four measures which might improve his acid-base status (apart from mechanical ventilation).

Q7.2a) Metabolic alkalosis and respiratory acidosis.

Q7.2b) Cease narcotics; Naloxone (cautious); Reduce FiO₂ and titrate to SpO₂ 90-95%; Reverse metabolic alkalosis (acetazolamide, KCl if hypokalaemia).

7.3. A 21 year old female is brought to ICU extubated post Caesarian section for pre-eclampsia and foetal distress. The following are data from blood gas analysis.

Barometric pressure	760 mm Hg	
FiO ₂	0.5	
pH	7.31	
pO ₂	150 mm Hg	20 kPa
pCO ₂	42 mm Hg	5.6 kPa
HCO ₃ ⁻	20.5	mmol/L
Standard base excess	-4.9	mmol/L

- Describe and explain the acid-base status.
- If she had normal lung function, what should her PaO₂ be?
- Name three possible causes of her reduced oxygen transfer?

Q7.3a) Acute respiratory acidosis following previous compensated respiratory alkalosis of pregnancy. At 38 weeks pregnancy the normal PaCO₂ is <30 mm Hg with compensatory HCO₃⁻ reduction. The blood gases therefore indicate acute CO₂ retention, probably due to pain and narcotics.

Q7.3b) > 250 mm Hg.

Q7.3c) Potential explanations include loss of FRC post abdominal surgery, segmental collapse or consolidation, aspiration, pulmonary oedema.

Pass rate: 84%

8. In a patient hospitalised following a motor vehicle accident,

- What findings on patient assessment would suggest the presence of traumatic diaphragmatic rupture?
- Briefly outline the abnormal findings you would seek on rectal examination and their clinical significance if the patient was unconscious.

Diaphragm rupture;

- Frequently no direct symptoms or signs referable
- Shoulder pain
- Left >> right, usually associated with other injuries
- Intrathoracic bowel
- Obscured diaphragm shadow on CXR
- If delayed presentation – post prandial epigastric or thoracic pain
- Rarely gastric herniation or volvulus

Rectal examination:

- Absent anal tone - cord lesion (unless relaxants administered)
- Palpable sphincter rupture
- Displaced (high riding) prostate – ruptured urethra
- High tenderness in anterior quadrants – ruptured viscus
- Pelvic haematoma – pelvic fracture
- Palpable bony disruption – sacro-coccygeal / pelvic fracture
- Visible external lacerations / bleeding.

Pass rate: 78%

9. What are the indications for decompressive craniectomy? Briefly outline the complications of decompressive craniectomy. Comment briefly on the outcome from decompressive craniectomy.

Recognised indications

- Malignant MCA infarction

Indications for which there is anecdotal evidence:

Refractory intracranial hypertension following TBI

Cerebral swelling from vasospasm and SAH

Hypertensive bleeds

Encephalitis

Cerebral venous thrombosis

Complications:

Infection

Collections –subgaleal and subdural collections usually on the ipsilateral side.

Bleeding

Brain herniation through the craniotomy

Venous thrombosis secondary to herniation through the defect and occlusion of venous circulation.

Sinking flap syndrome

Paradoxical subtentorial herniation with LP or CSF drainage – due to atmospheric pressure – intracranial pressure gradient

Hydrocephalus

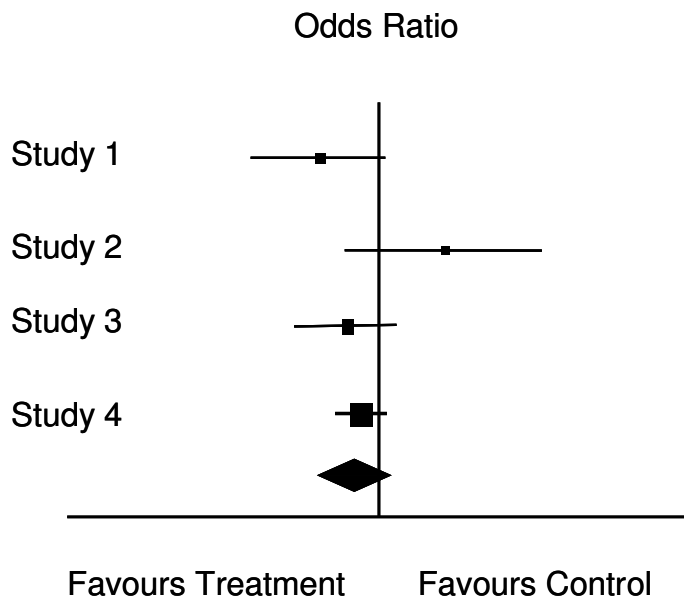
Bone flap resorption

Worsening of brain injury

Outcome: Long term data are lacking. Although hospital survival is improved in patients with refractory ICP in head injury and malignant infarction, quality of survival needs further evaluation. Age is important in patient selection and current recommendation for DCI in malignant MCA infarcts is <50 and considered on a case by case basis over 50. Paediatric data suggest better outcome in paediatric head injuries.

Pass rate: 60%

10. Inspect the data representation shown below.



10.1. What form of data representation is depicted here?

Forest Plot or Meta Analysis Graph

10.2. With respect to the study plots what is represented by:

The horizontal lines?

The position of the square?

The size of the square?

The position of the square and the horizontal line indicate the point estimate and the 95% confidence intervals of the odds ratio respectively. The size of the square indicates the weight of the study.

10.3. From the data depicted what could be inferred with regard to the effectiveness of the treatment under investigation?

The depicted data suggest the treatment is not more effective than control as the 95% confidence limits of the combined odds ratio cross the vertical line.

10.4. What further information relating to the performance of this analysis would you require in order to gauge the accuracy of the conclusions?

Definition of inclusion criteria for studies

Adequate search protocol

Assessment of methodological quality

Measurement of heterogeneity

Assessment of publication bias

Pass rate: 60%

11. List the desirable features of an Illness Severity Scoring System for Intensive Care patients.? Compare and contrast the Acute Physiology and Chronic Health Evaluation (APACHE) and Sequential Organ Failure Assessment (SOFA) scoring systems.

The ideal scoring system would have the following characteristics:

1. Scores calculated on the basis of easily/routinely recordable variables
2. Well calibrated
3. A high level of discrimination
4. Applicable to all patient populations in ICU
5. Can be used in different countries
6. The ability to predict mortality, functional status or quality of life after ICU discharge

Compare

	APACHE	SOFA
Basis	Three factors that influence outcome in critical illness- pre-existing disease, patient reserve and severity of acute illness	Degree of organ dysfunction related to acute illness (initially based of sepsis related organ dysfunction but later validated for organ dysfunction not related to sepsis
Score	Physiological variables, chronic health conditions and emergency /elective admissions and post-operative/non- operative admissions	Defined score (1-4) for each of six organ systems- respiratory, CVS, CNS, Renal, coagulation and liver

Scoring duration	Based on the most abnormal measurements in the first 24 hours of ICU stay	Daily scoring of individual and composite scores possible during course of ICU stay
Population Outcome comparison	Standardized mortality ratios (SMR) (observed/predicted) can be used for large patient populations.	No predicted mortality algorithm. In general higher SOFA score is associated with worse outcome. Treatment effects on SOFA
Individual patient outcomes	Not possible to predict individual patient outcome or response to therapy	Response of organ dysfunction to therapy can be followed over time

Pass rate: 13%

12. Critically evaluate strategies that have been used in the prevention of acute kidney injury (AKI) associated with the administration of iodinated radio contrast medium.

General

- Identify high risk patients-baseline renal impairment, other organ failure e.g. circulatory, age, diabetes, hypovolemia, myeloma. Multiple risks factors in the one patient are additive for AKI/dialysis dependence following contrast.
- Review need for imaging in every patient-consider alternative imaging methods USS, MRI (without gadolinium) and non contrast CT

Contrast Media

Type : - Use of iso-osmolar or lower osmolality contrasts associated with lower risk of nephrotoxicity – supported by double blind trials and meta-analysis

Volume :- contrast volume is an independent predictor of contrast induced AKI- avoid repetitive closely spaced studies.

Route: - The risk is greater if given intra arterially as opposed to IV.

Volume expansion Volume expansion has a well established role in the prevention of contrast induced AKI. 0.9 % saline probably preferable to 0.45% saline (Mueller; Arch Int Med: 2002). Most pronounced in diabetics and larger volumes

IV Bicarbonate Alkalisiation may protect against free radical injury.

Merten (JAMA, 2004) The REMEDIAL trial also demonstrated a benefit of bicarbonate when combined with N-Acetylcysteine (NAC)

Recent trials dispute the use of bicarbonate. Brar, (JAMA 2008) included 353 patients undergoing coronary angiograms. Patients received either isotonic saline or bicarbonate. There was no difference in the primary outcome which was a 25% decrease in GFR on days 1 to 4 following angiography.

Candidates were not expected to provide specific details of authors and journal names

D- Pharmacologic

Many agents have been examined. NAC most effective, although not clearly proven because of considerable heterogeneity exists in the studies examined and effect on clinical outcome (other than minor changes in serum creatine levels) remains unknown.

E- Dialysis and hemofiltration

Contrast medium is removed by dialysis. Both hemofiltration and dialysis have been studied. Marenzi (NEJM 2003) examined 114 patients with a mean creatinine of 265 umol/l who required coronary intervention. They were then randomised to either isotonic saline or hemofiltration begun 4-8 hours prior and resumed for 18-24 hours after. Those in the hemofiltration group had significantly lower rates of serum creatinine elevation, requirement for dialysis and one year mortality. The applicability of these findings to clinical practice is unclear. The high cost and need for prolonged ICU care will limit the utility of these techniques.

Candidates were not expected to provide specific details of authors and journal names

Pass rate: 42%

13. A 52 yr old patient presents to the Emergency Department with acute coronary syndrome and cardiogenic shock. He receives 300mg aspirin, 600mg clopidogrel and a tirofiban infusion is initiated. The angiogram shows left main stem occlusion– and he is referred urgently to cardiac surgery. The tirofiban infusion is ceased. On return from theatre, there is 400ml/ hr blood loss for the first 3 hours.

13.1 List 5 causes of early post-operative bleeding in this patient.

Causes

- 1 Surgical bleeding
- 2 Hypothermia
- 3 Inadequate reversal of heparinisation
- 4 Pre-existing platelet dysfunction - pharmacological or pathological
- 5 Dilutional coagulopathy
- 6 Thrombocytopenia - due to trauma of bypass circuit

13.2 Briefly outline the mode of action and half life of aspirin, tirofiban and clopidogrel.

- a) Tirofiban – 2b3A inhibitor. Binds to this receptor on platelet membrane
Half life approx 2 hrs – Accumulates in renal failure
- b) ASA – Prostaglandin and Thromboxane A2 receptor – Irreversible blockade -platelets affected till replaced.
- c) Clopidogrel – Blocks ADP receptor of platelet hence reduces fibrinogen binding to platelet.
Irreversible binding – platelets affected till replaced

Pass rate: 86%

14.1 A 24 year old male is admitted to the ICU following a spontaneous intracranial haemorrhage. He is noted to have labile blood pressure that is difficult to control, and a persistent tachycardia in spite of high dose sedatives. Further investigation reveals raised plasma and urinary catecholamines. List 4 potential causes of the above biochemical finding in this patient.

Causes

Phaeochromocytoma
Physical stress - critical illness, hypoxia, hypercapnia, hypoglycemia
Use of catecholamines, amphetamine use
Prior h/o tricyclic use

14.2. A 69 yo male with a history of previous pneumonectomy for lung carcinoma, is admitted with confusion. There were no focal neurological signs on clinical examination. Neck stiffness was not present. Contrast CT brain scan is normal

His initial plasma biochemistry is shown:

		Normal Range
Na ⁺	148 mmol/L	(134-145)
K ⁺	3.7mmol/L	(3.5-5.0)
Cl ⁻	109mmol/L	(97-107)
HCO ₃ ⁻	33mmol/L	(24-34)
Albumin	15 G/L	(35-40)
Urea	12.8 mmol/L	(3.1-8.1)
Creatinine	36 micromol/L	(60-100)
Ca ⁺⁺	2.59 mmol/l	(2.20-2.55)
Phosphate	0.86 mmol/L	(0.78-1.43)
Mg ⁺⁺	0.89 mmol/L	(0.67-1.05)

- a) **What is the most likely cause of the confusion in this patient, based on the above information? Justify your response.**

Hypercalcemia (When corrected for albumin, the true calcium is higher).

Extra marks for recognising the inaccuracy of this correction

List 4 therapies for the cause stated in a)

Calciuresis (saline +/-frusemide)

Bisphosphonates

Calcitonin

Corticosteroids

NSAIDS

Mithramycin

14.3 A 55 yo male with a history of significant alcohol intake presents with a 2-week history of lethargy. He takes no regular medications and has no other medical disorders. Clinically, he appears malnourished and euvolaemic. Investigations reveal:

Plasma		Normal Range
Na ⁺	115 mmol/L	134-143
K ⁺	3.7 mmol/L	3.5-5.0
Cl ⁻	80 mmol/L	97-107
HCO ₃ ⁻	22 mmol/L	24-34
Urea	3.0 mmol/L	3.1-8.1
Creatinine	46 micromol/L	50-90
Glucose	4.1 mmol/L	4.4-6.8
Osmolality	241 mmol/Kg	274-289
Urine		
Na ⁺	<5mmol/L	
Osmolality	53 mmol/Kg	

- a) **What is the most likely cause of the hyponatraemia?**

Water intoxication.

14.4 . A 76 yo female presents with seizures. She takes no regular medications. On examination she weighs 60kg, has no evidence of cardiac failure or liver disease, and appears euvolaemic. Her blood results in the emergency department reveal:

Plasma		Normal Range
Na ⁺	110 mmol/L	134-143
K ⁺	3.8 mmol/L	3.5-5.0
Cl ⁻	81 mmol/L	97-107
HCO ₃ ⁻	24 mmol/L	24-34
Urea	5.7 mmol/L	3.1-81
Creatinine	36 mmol/L	50-90
Osmolality	237 mmol/Kg	274-289

Urine		
Na ⁺	23	(10-20 mmol/L)
Osmolality	488	(40-1200 mmol)

a) What is the likely cause of the hyponatraemia?

SIADH

b) Approximately how many mmol of NaCl would need to be given to raise her serum sodium to 120mmol/L? . Show your calculations.

An answer between 300 – 360 mmol was acceptable)

$$\begin{aligned}
 (\text{Sodium deficit} &= \text{TBW} \times (\text{desired Na} - \text{Actual Na}) \\
 &= 0.5/0.6 \times 60 \times (120-110) \\
 &= 30/36 \times 10 \\
 &= 300/360)
 \end{aligned}$$

Pass rate: 68%

15. A 60 year old patient 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 that is now resolving and acute renal failure for which he is still receiving continuous renal replacement therapy. He is currently still ventilated via an oral endotracheal tube, on SIMV with a rate of 16, TV of 700, PEEP of 5 and F_iO₂ 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 gases are shown below:

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

What criteria will you use to determine whether the patient is ready to be extubated?

Usually based upon combination of factors rather than a single number.

- *Has the process that required intubation resolved?*
 - Sepsis and shock
 - Abdominal pain
 - Intra-abdominal complications that require further intervention
- *Airway?*
 - Cuff leak
 - Difficult airway at time of intubation
- *Respiratory?*
 - Rapid shallow breathing index (80-110??, on a spontaneous breathing mode)
 - Secretions (volume/character)
 - Vital capacity (>8-12ml/kg) measured with 0 PS.
 - Minute ventilation (<10l/min)
 - Adequate gas exchange
 - Negative inspiratory force (< -20cm H₂O)
- *Neurological?*
 - Awake and co-operative
 - General muscle strength
- *Cardiovascular?*
 - Low/stable dose of vasopressors and inotropes
 - Stable cardiac rhythm
- *Other factors*
- - Need for more procedures

Pass rate: 63%

16. What are the indications for intracranial pressure monitoring in traumatic brain injury?

What are the limitations of intracranial pressure monitoring?

All patients with severe head injury and moderate head injury whose progress can not be followed by serial neurological evaluation should be considered for ICP monitoring.

The Brain Trauma Foundation guidelines suggest ICP-monitoring should be considered in the following settings:

- Severe head injury (GCS 3-8) + abnormal CT scan
- Severe head injury (GCS 3-8) + normal CT scan if 2 of the following are present):
 - Age > 40
 - BP < 90 mmHg
 - Abnormal motor posturing

Individual intracranial pressure monitors have different limitations:

- Intraparenchymal monitors/subdural bolts: can not be calibrated, subject to “drift”, do not allow CSF drainage for control of ICP
- Require expertise and resource availability for placement
- Infection

No RCTs have demonstrated that ICP-guided therapy improves patient-centred outcomes.

Some observational studies have noted an association between ICP guided management and prolonged length of stay (Cramer, 2005) and worse outcome (Shafi, 2008).

Pass rate: **44%**

17. 1 You review a 40 year old male with chest pain and shortness of breath. He had been admitted with a deep vein thrombosis in his right leg. His coagulation profile is shown below.

INR	1	(0.9 TO 1.2)
APTT	61 seconds	(24 to 39 sec)
PT	11.5 seconds	(10.5 to 13.5 sec)

A. List 5 causes of the abnormality in the coagulation profile

- Heparin
- Lupus inhibitor
- Haemophilia A & B
- Factor xii deficiency
- Factor xi deficiency
- Von Willebrands disease
- Artefactual (incorrect amount of blood in the tube.)

B. List 5 tests that could differentiate the cause of this abnormality

- Repeat test
- Heparinase assay or antibodies
- Mixing test
- Thrombin time and reptilase time
- Factor assay
- Anti-cardiolipin antibody

17.2 A 60 year old gentleman on subcutaneous enoxaparin 80 mg bd for deep vein thrombosis has the following blood results. The blood sample was taken prior to the dose of enoxaparin

Normal range		
INR	1.3	0.9 TO 1.2
APTT	38 SEC	24 to 39
D dimer	<0.2 mg/l	<0.2 mg/l
		0.6 to 1.0 iu/ml
Anti Xa	1.8 IU/ml	(therapeutic range)

List 2 likely causes of a raised Anti-Xa level in this patient?

If the patient has underlying

- a) renal failure
- b) body weight is low / incorrect dose of enoxaparin

17.3 The following blood results are obtained in a patient post cardiac surgery.

a) What is the most likely cause of the abnormal coagulation profile ?

PT	13.9 seconds	10.5 to 13.5
INR	1.4	0.9 to 1.2
APTT	85 sec	24 to 39
ACT	240 seconds	<150 seconds

Consistent with heparin

b) List 3 complications of the agent commonly used to correct the above coagulation abnormality.

Anaphylaxis
Pulm HT
Hypotension
Bleeding
Bradycardia

Pass rate: 84%

18. Outline the challenges specifically associated with the management of a pregnant patient with status asthmaticus.

- 1) Pregnancy can worsen asthma – pulmonary congestion, reflux disease, low FRC
- 2) Because of reduced respiratory reserve, decompensation can be rapid
- 3) Need to be aware of the changes in blood gas reference values
- 4) Medications –
 - a) Steroids – potential malformations in the fetus if used in the first trimester – cleft lip
 - b) Beta 2 agonists- risk of tocolytic pulmonary oedema - delay in onset of labour
- 5) Sedation of the ventilated pregnant patient
Benzodiazepines – floppy infant syndrome
Opiates- fetal respiratory depression
If need for prolonged paralysis – risk of arthrogryphosis in the fetus
- 6) IPPV –
High risk intubation
Avoid nasal intubation
High pressures may reflect raised intraabdominal pressures
- 7) Maternal hypercapnia – reduces uteroplacental blood flow
Also shifts oxyHb dissociation curve in the fetus to the right, thus impairing fetal oxygenation – fetal monitoring essential
Long term maternal hypoxia associated with IUGR
- 8) NIV – may be difficult with increased risk of aspiration
- 9) Positioning of patient issues – Risk of aortocaval compression

Pass rate: 16%

19.1 .With reference to intoxications, list the relevant physical features of hemodialysis and hemoperfusion filters which make them suitable for use and give one example of a toxin cleared by each of these.

The relevant physical features include

Haemodialysis

Small molecule < 500 Da
Water Soluble
Non-protein bound
Low volume of distribution

Haemoperfusion

Larger non-protein-bound molecules 1000 to 1500 KDa

Examples

Haemodialysis

Lithium, metformin

Haemoperfusion

Phenobarbitone, theophylline

19.2 . List 3 drugs or poisons that, when taken as an overdose, result in both a raised osmolar gap and anion gap. List the major anion associated with each drug responsible for the rise in anion gap.

Drug	Anion
Ethanol	- Lactate
Methanol	- Formate or formic acid
Ethylene glycol	- Glycolate / oxalate

19.3. With references to intoxications, what do you understand by the term “oxygen saturation gap”?

When there is a difference in the oxygen saturation between a pulse oximeter reading and a co-oximeter reading, seen with CO poisoning and other drugs which result in a methemoglobinemia.

Pass rate: 68%

20. Define ideal body weight and what is its significance to dosing of drugs. Briefly, outline the effects morbid obesity (body mass index > 40kg/m²) may have on the pharmacokinetics of medications in critically ill adults.

- ° Ideal body weight is usually estimated from formulae or approximately: IBW (kg) males = height cm - 100, IBW (kg) females height cm - 110
- ° Dosing weight is best worked out from ideal body weight. Lean body weight or dosing weight = ideal body weight + (ABW-IBW) x 0.4

Pharmacokinetics

Distribution

- markedly affected by ratio of adipose tissue to lean body mass
- Increased volume of distribution for lipid soluble drugs
- Accumulation of lipophilic drugs in fat stores
- May increase dose needed to gain effect
- Vd of hydrophilic drugs less affected but blood, extracellular fluid, body organ, and connective tissue volume are also increased.
- Total body water may be increased by resuscitation volume etc
- Cmax reduced and T1/2 increased

- Lipid soluble drugs usually dosed on ABW, water soluble drugs dosed on ideal or lean body weight

Metabolism

- Variable effects. More likely to be affected by critical illness with drug interactions, reduced hepatic blood flow, altered protein binding

Excretion

- Obese patients with normal renal function have an increased glomerular filtration rate and thus an increased clearance of drugs excreted by the kidney. Co existing disease processes eg diabetes may change this
- Calculated and measured creatinine clearance correlate poorly in obesity and in critically ill

Thus morbidly obese predisposed to inadequate dosing and increased toxicity. Need to measure serum levels of drugs with low therapeutic index.

Pass rate: 21%

21. 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/m²]

21.1. Describe this circulatory disturbance.

Hyperdynamic circulation with moderate hypotension (Increased cardiac output and hypotension suggests low SVR). More information needed before labelling this as 'shock'.

If they mention vasodilated state that is also acceptable.

If they mention the word shock, that is incorrect .

21.2. Give five possible clinical scenarios consistent with the above circulatory disturbance.

- Septic shock
- Non-septic inflammatory states
- Pancreatitis
- Burns
- Post cardio-pulmonary bypass
- Vasculitis
- Thyrotoxicosis
- Induced hypotension – nitroprusside, GTN
- A-V fistula – trauma, Pagets etc
- B1 deficiency
- Severe liver disease
- Severe anaemia
- Spinal shock
- Other
- Anaphylaxis – data inconclusive
- Poisonings – CO, CN

21.3. A review of the notes reveals that this man has a positive blood culture with Staph. aureus. Outline three mechanisms that lead to vasodilation in sepsis?

- Reduced Ca^{2+} entry into vascular SM myocyte due to membrane hyperpolarisation following K^{+} efflux via activated ATP-sensitive K^{+} channels.
- Activation of inducible NO synthase, increasing NO production (cyclic GMP)
- Relative deficiency of endogenous vasopressin
- Relative adrenocortical insufficiency

21.4. Briefly outline what initial agent you will use to treat the circulatory disturbance and how would you initially titrate the dose of the agent

Lots of ways of doing this and any sensible answer is acceptable. Some units titrate mcg/kg/min, others will for example put 6 mg in 100 ml such that 1 ml/hr = 1 mcg/min

Candidate must comment on the need to confirm adequate volume before winding up the noradrenaline (or at least simultaneous Norad and volume replacement). Lots of ways to assess volume.

One reasonable titration scheme is:

- Starting dose 0.1 mcg/kg/min
- Usual dose range 0.05 to 0.5 mcg/kg.min
- Titrated to MAP > 65 mm Hg
- Higher MAP if pre-existing hypertension

Pass rate: 81%

22. A 50 year old man, who had a heart lung transplant 8 years earlier, presents to your ICU with pneumonia. Discuss the clinical issues specific to the heart lung transplant that will need consideration in your management of this patient.

- a) Opportunistic infections - This can result in a wide range of opportunistic organisms causing infection including Pneumocystis, Aspergillus and CMV. It will therefore require early aggressive investigation and broad spectrum bacterial, fungal and possibly viral cover.
- b) Immunosuppression : Ongoing immunosuppression will need to be carefully managed in consultation with the transplant unit
- c) Cardiac issues- The transplanted heart is denervated. It is only responsive to directly acting drugs/hormones present in the circulation. Normal compensatory cardiac autonomic reflexes are not present and therefore the heart is more sensitive to directly acting drugs and less able to rapidly respond to changes in intravascular volume. This will clearly affect the ability to clinically assess a response to therapy and determine adequacy of therapy.
 - Altered ECG /rhythm strip patterns
 - Premature diffuse obliterative coronary atherosclerosis which results in impaired ventricular function
- d) Respiratory issues - Impaired cough and clearance of secretions.
 - Impaired lung function due to Obliterative Bronchiolitis (a manifestation of chronic rejection)
 - Bronchial or tracheal stenosis relating to the original anastomotic site.
- e) Renal – altered renal function secondary to immunosuppressive drugs.
- f) Altered adrenal function secondary to steroid use, need for steroid cover.

Pass rate: 26%

23. A 54 year old woman was referred to the emergency department by her GP with a 3 day history of vomiting accompanied by upper abdominal pain. On examination she was obese, appeared restless and confused, GCS 13, febrile 38.6 C, heart rate of 100 /min, BP 90/40 mm Hg. She has Spo₂ of 88% on oxygen via a non-rebreather bag. There was diffuse abdominal tenderness on palpation in particular in the upper abdomen. Bowel sounds were sluggish. Blood tests taken in a private laboratory the preceding day had revealed a lipase of 400 U/l (normal < 70).

23.1) What are the differential diagnoses of this patient's presentation?

- 1) Pancreatitis
- 2) Perf DU
- 3) Intestinal obstruction
- 4) Acute cholecystitis with sepsis
- 5) Aspiration and sepsis
- 6) Gut ischaemia

23.2) What are the causes of hypotension in acute pancreatitis?

- a) sequestration (3rd spacing) of protein rich fluids in and around the pancreas and abdominal cavity, retroperitoneum
- b) compounded by pre existing fluid depletion.
- c) direct myocardial depression
- d) SIRS / sepsis
- e) Intra-abd hypertension
- f) Bleeding

23.3) List 3 causes of a raised A-a gradient in acute pancreatitis?

Pulmonary dysfunction - Aspiration, pleural effusions, ARDS, atelectasis.

23.4) What do you understand is the role for prophylactic antimicrobial therapy in sterile pancreatic necrosis?

- a) Antibiotic use in SAP without overt infection controversial and trial data are conflicting.
- b) Antibiotics have been given either IV or IV plus orally/rectally via SDD.
- c) Early trials - underpowered, mostly non blinded and included patients with differing disease severity suggested a reduction in both infections and improved outcome with early use of prophylactic antibiotics (Cefuroxime and imipenem) in necrotising SAP when compared with placebo. Subsequent meta analyses including a Cochrane review also suggested that antibiotics reduced infections and mortality and need for surgery in necrotic pancreatitis.
- d) 2 recent RCTs (Isenmann 2004 and Dellinger 2007) have however demonstrated no effect on outcome or infection rate when prophylactic antibiotics were used in necrotic pancreatitis. The SCCM (2004) consensus conference on severe pancreatitis recommends against the use of routine prophylactic antibiotics.

Pass rate: **71%**

24.1. List 2 causes of clubbing (apart from cardiovascular and respiratory causes)

- Inflammatory bowel disease
- Thyrotoxicosis
- Idiopathic
- Familial
- Cirrhosis
- Celiac
- Pregnancy

24.2 List 4 clinical signs on cardiovascular examination which will support the diagnosis of pulmonary hypertension

- Prominent 'a' wave
- Parasternal lift
- Palpable P2
- Loud P2
- Features of tricuspid regurgitation

24.3 .List 3 causes of a massive splenomegaly.

- CML
- Myelofibrosis
- Chronic malaria
- Kala Azar

24.4. A patient was noted to have a persistent tonic conjugate deviation of the eyes to the right. List 2 likely causes.

- Irritative lesion of the left frontal lobe
- Paralytic lesion of the right frontal lobe
- Rt. Pontine lesion

24.5. List 4 causes of neck stiffness

- Meningitis/encephalitis
- Subarachnoid hemorrhage
- Post fossa syndrome
- Tetanus
- Cervical spondylitis
- Neck abscess
- Wry neck / Torticollis

24.6. List 3 causes of a mid-diastolic murmur over the apex

- Mitral stenosis
- Severe aortic regurgitation – Austin Flint murmur
- Severe mitral regurgitation
- Significant left to right shunt – VSD, PDA
- Atrial myxoma
- Carey-Coombs murmur

Pass rate: 66%

25.1. A 74 year old woman presents with a perforated colonic cancer with widespread peritoneal contamination. She has a laparotomy, peritoneal washout, colonic resection and a defunctioning ileostomy. On Day 6, she is noted to have an abdominal wall cellulitis, abdominal wall oedema and a positive blood culture growing Gram positive bacilli.

a) What is the likely diagnosis ?

Necrotising fasciitis

b) What is the likely organism isolated in the blood culture?

Clostridial species

25.2. 56 year old man presents with pyelonephritis. Ultrasound reveals an obstructed right kidney. Percutaneous nephrostomy is performed.

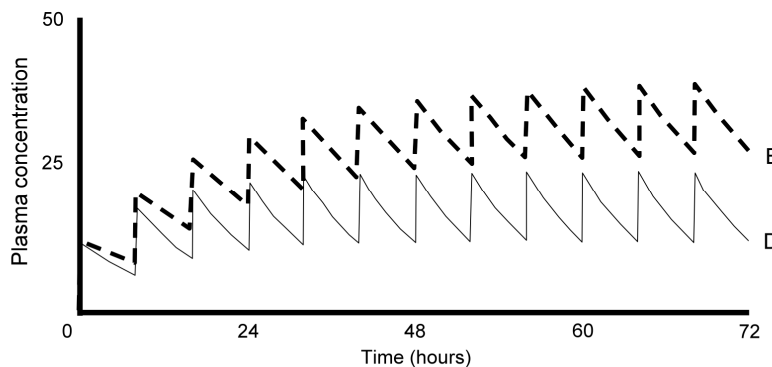
Blood cultures: 2/2 bottles growing *Enterobacter cloacae*, sensitive to ceftriaxone

Pus from renal pelvis: Gram negative bacillus on microscopy. Cultures growing *Enterobacter cloacae*, sensitive to ceftriaxone, aminoglycoside, meropenem

What antibiotic will you choose and why?

Choose an aminoglycoside or meropenem because it is an ESCAPM organism. (develop resistance to third gen cephalosporins)

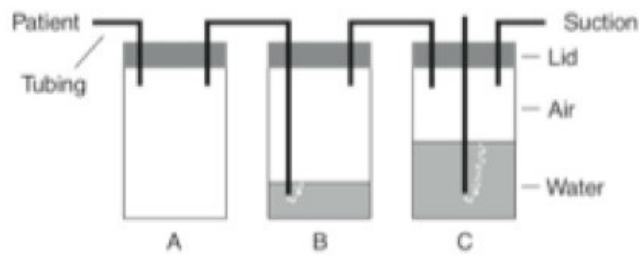
25.3. Curves D and E represent concentrations after regular bolus administration of the same dose of an antibiotic to the same patient at different points of time. What pharmacokinetic changes are noticed? List two clinical conditions that could explain the difference between E and D?



- a) PK changes – Increased plasma concentrations with E for the same dose indicating reduced clearance and increased half life.
- b) Hepatic dysfunction , renal dysfunction

Pass rate: 82%

26.1 Draw a 3 chamber chest drainage system and include a brief description of the function of each chamber



A drawing & description which identifies the following was required:-

- A) A collection chamber which is connected to the intercostal drain and collects pleural fluid. This chamber can be independently emptied and in addition allow for an accurate record of pleural drainage amount.
- B) A water seal chamber which ensures that the water seal is maintained at a predetermined level whilst still allowing for drainage of pleural fluid.
- C) A suction control chamber which ensures that an accurate , easily verifiable and consistent level of suction is being delivered to the pleural cavity as long as wall suction is greater than the required suction pressure.

26.2. What device is shown below? When is it used and what are its design features which make it suitable for use?



Name: A McCoy Blade laryngoscope (- improved visualization of the cords in the setting of a difficult intubation . It has a controllable flexible tip which allows for the elevation of distal structures, espec the epiglottis .

26.3 What device is shown below? When is it used and what are its design features which make it suitable for use?



Name: Glidescope (but mention of a video assisted laryngoscope would be sufficient), used in the setting of a difficult intubation for improved visualization of the cords.

Design features: a specifically angled laryngoscope with an integrated camera allowing direct visualization(via external monitor) of the cords.

***Pass rate:* 89%**

27. Compare and contrast the pharmacology of carbicarb, Sodium bicarbonate and THAM.

Carbicarb is an equimolar combination of sodium carbonate and sodium bicarbonate, generates a smaller rise in CO₂ than sodabicarb. More consistently increases intracellular pH, inconsistent effects on hemodynamics, not commonly used clinically.

Sodabicarb: 8.4% or 4.2% solution. Hyperosmolar, generates high CO₂, can cause paradoxical acidosis in the presence of a low output, cause hypokalemia, alkalosis and left shift of the curve. Phlebitis when given peripherally. On the other hand, frequently used to treat a metabolic acidosis if pH < 7.1, improves vasopressor responsiveness, may have a role in decreasing contrast nephropathy.

THAM: commercially available weak alkali. Buffers H⁺ ions. Buffering not associated with a CO₂ rise. Side effects include hyperkalemia, hypoglycemia, extravasation related necrosis, and hepatic dysfunction.

***Pass rate:* 13%**

28. Prior to the determination of brain death by clinical examination,

- a) list the preconditions that must be met before formal testing can begin**
- b) What are the indications for ancillary tests for brain death (ie tests that demonstrate the absence of intracranial blood flow)?**
- c) What are the 2 imaging techniques currently recommended by ANZICS for determining the absence of intracranial blood flow:**

Preconditions

- a) A known cause of coma (check terminology in new ANZICS guidelines)
- b) Minimum of 4 hour period observation
- c) neuro-imaging consistent with acute brain pathology which could result in brain death;
- d) temperature > 35C;
- e) normotension (as a guide, systolic blood pressure > 90 mmHg, mean arterial pressure (MAP) > 60 mmHg in an adult);
- f) exclusion of effects of sedative drugs: the time taken for plasma concentrations of sedative drugs to fall below levels with clinically significant effects depends on the dose and pharmacokinetics of drugs used, and on hepatic and renal function. If there is any doubt about the persisting effects of opioids or benzodiazepines, an appropriate drug antagonist should be administered;
- g) absence of severe electrolyte, metabolic or endocrine disturbances. These include marked derangements in plasma concentrations of glucose, sodium, phosphate or magnesium, liver and renal dysfunction and severe endocrine dysfunction;
- h) intact neuromuscular function. If neuromuscular-blocking drugs have been administered, a peripheral nerve stimulator or other recognised method (e.g. electromyography) should always be used to confirm that neuromuscular conduction is normal;

What are the indications for ancillary tests for brain death?

- ° Inability to adequately examine the brain-stem reflexes. It must be possible to examine at least one ear and one eye;
- ° Inability to perform apnoea testing. This may be precluded by severe hypoxic respiratory failure or a high cervical spinal cord injury.

What are the 2 imaging techniques currently recommended by ANZICS for determining the absence of intracranial blood flow:

Four vessel intra-arterial catheter angiography, with digital subtraction;
Tc-99 HMPAO SPECT radionuclide imaging

CT angio with certain caveats may be acceptable.
Do not recommend MR angio

Pass rate: 84%

29.1. A 29 year old man presents to the Emergency Department with a 2 day history of shortness of breath and hallucinations and one week history of a rash. Examination reveals that he is febrile (40.9°C), tachypnoeic (44 breaths per minute) and hypoxic on room air (SpO2 92%), tachycardic (120 beats per minute) and hypotensive (90/45mmHg). He is resuscitated and transferred to intensive care:

A clinical photograph of a chicken pox rash.



a).What is the likely pathogen for the rash?

Varicella Zoster Virus

b) What specific treatment can be used?

Acyclovir, famciclovir or valaciclovir

c) What are the risk factors for developing a pneumonia from this pathogen?

Smoker, contact with index case, >100 spots, duration of fever, chronic lung disease, 3rd trimester pregnancy, immunosuppression

d) What superimposed infection is likely?

Staphylococcal Aureus

29.2. A 63 year old woman is admitted from the ward to intensive care for respiratory support following an emergency laparotomy for an acute abdomen eight days previously. The findings upon examination include:

A clinical photograph of a pressure sore



a) What complication has developed?

Pressure area ulcer

b) What are the risk factors for this complication?

Duration of surgery, faecal incontinence and/or diarrhoea, low albumin concentrations, disturbed sensory perception, obesity, moisture of the skin, impaired circulation, use of inotropic drugs, diabetes mellitus, too unstable to turn, decreased mobility, and high APACHE II score.

Waterlow's score, or other valid scores

c) What is the management of this complication?

Remove all pressure from area, appropriate wound management, plastic surgical review, and adequate nutrition. Wound nurse team.

d) What are the major preventative strategies for this complication in intensive care patients?

Maintaining clean and dry skin, visualise skin integrity twice a day, regular pressure relief, pressure relief mattresses

Pass rate: ***68%***

30. Outline the important problems encountered by the patient following hospital discharge after a prolonged period of stay in the Intensive Care Unit. List two (2) tools available to assess the functional status of such a patient.

Many problems are encountered after hospital discharge. The **important problems** include Patients have usually had a tracheostomy (and/or prolonged endotracheal intubation) - complications associated with these include laryngeal pathology [eg. polyps, ulcers], aspiration, difficulty with swallowing etc.

- Limitation of mobility for some time – muscle tone, joint stiffness, Chronic Inflammatory Polyneuropathy
- Skin – hair loss, itching
- Sexual dysfunction
- Psychological problems – loss of memory, stress, nightmares, Post Traumatic Stress Disorder, depression, chronic fatigue syndrome
- Infectious: colonisation with resistant organisms (eg. MRSA)
- Miscellaneous (loss of taste, loss of appetite, ocular trauma, scarring near region of tape fixing for ETT)
- Decreased visual acuity in patients who are profoundly hypotensive.
- Unnecessary medication – Frequently medication commenced in ICU is commenced post discharge.

Tools to assess quality include: Quality Adjusted Life Years (objective measure), HAD – Hospital Anxiety & Depression, SF 36, PQOL (perceived quality of life), EuroQOL – European tool
- Simpler measures include Glasgow Outcome Scale. Some hospitals utilise follow up clinics
-

Pass rate: 55%

Viva Questions

VIVA 1

You are asked to review a 64 year old man who has been brought to the emergency department having been rescued from a house fire. There is no coherent history available from the patient and you observe that he is drowsy and confused, and, has a persistent cough.

His heart rate is 120 bpm, blood pressure 88/52 mmhg, respiratory rate 28 and oxygen saturations are 94 % on high flow oxygen via a non re-breather mask.

Q1: What are the initial priorities in management?

The other questions focussed on resuscitation, airway management, recognition of airway burns and management of burn shock

Areas of weakness identified by examiners:

Although this viva in general was answered well by most candidates, lack of precision in the answers was the main concern.

- Candidates demonstrated good core knowledge regarding specific problems encountered in the resuscitation of patients with burn injury.
- Specifically, the interpretation of Lund-Browder charts, and, controversies in fluid resuscitation in this patient population, including limitations in the use of (for example) the Parkland formula were well discussed.

VIVA 2

A 65 year old male with a past history of ischaemic heart disease is admitted to the ICU after a motorcycle crash having sustained long bone fractures of the lower limbs. He has no head, chest or abdominal injuries. Prior to surgery, his GCS was 15 and SpO₂ was 98% on 4l oxygen via Hudson mask with a normal chest X-Ray. He required prolonged operative fixation of his fractures and that was complicated by significant blood loss. Intra-operatively, he also developed increasing oxygen requirement. On arrival in ICU, his most recent ABG on an FiO₂ of 0.7 shows a PaO₂ 55 mmHg.

Q1: What are the possible differential diagnoses for his respiratory failure?

The rest of the viva focussed on progressing to TRALI related respiratory failure, pathogenesis of TRALI and other complications of blood transfusion- storage lesions and infections.

Areas of weakness identified by examiners:

- Very few candidates could clearly articulate the diagnostic criteria and the mechanisms of TRALI
- Candidates also had difficulty in outlining the storage lesions.

VIVA 3

A 72 year old female is admitted following a laparotomy for a perforated gastric ulcer. She was thought to have aspirated at the induction of anaesthesia, but was otherwise stable throughout the case. On arrival in the ICU she is haemodynamically stable, is ventilated on an SIMV mode,

- 10 breaths per minute,
- Tidal volume = 700ml,
- PEEP = 5cm H₂O,
- Inspiratory time 25%
- Inspiratory Pause 10%,
- FiO₂ = 0.4.

The junior registrar working with you is unsure what this mode of ventilation is, and asks you to explain how this mode of ventilation works.

1. Can you draw a flow vs time, a pressure vs time and a volume vs time curve to explain this mode of ventilation to the junior registrar?

The rest of the viva focussed on pressure control and pressure support ventilation

Areas of weakness identified by examiners:

- Candidates struggled to draw basic ventilatory graphics, frequently confused volume with flow.
- In PCV mode, did not realise that PIP =plateau pressure
- When given a printed graphics of PSV, they were not able to state the settings from the graphics.
- This aspect of intensive care is fundamental to what we do on a daily basis and most modern ventilators have graphics on their screen and it was disappointing that a large number of candidates did not perform well in this section.

VIVA 4

A 54 yr old female is in ICU with sepsis after repair of a leaking ileo-colic anastomosis. When you take over management on day 3, she is febrile and vasodilated. T 38.5^o C, pulse 110 / min, MAP 58 mm Hg. CVP 12 mm Hg. Urine output 15 mL/hr. Plasma creatinine is normal, but rising.

Your colleague has been giving fluid replacement guided by arterial waveform analysis, administering a fluid load when Stroke Volume Variation > 13%. She now has generalized oedema, with an acute weight gain of 12 kg.

Currently cardiac index = 4.1 L/min/m², Stroke Volume Variation = 19%

Q1. What is Stroke Volume Variation designed to monitor?

The rest of the viva focussed on fluid responsiveness, complications of fluid therapy and a discussion on the suitability of crystalloids and colloids in various clinical situations.

Areas of weakness identified by examiners:

- Candidates were confused about the concept of fluid responsiveness, and frequently equated fluid responsiveness to a low CVP. They could not explain why CVP was not a reliable measure of fluid status or responsiveness.
- Many candidates were not familiar with the VISEP study (candidates were not required to know the name of the study but an awareness of a large RCT on starches and their potential problems was important).
- Many were unaware of the composition and associated drawbacks of Compound Sodium Lactate solution

VIVA 5

A 75-year-old man has suffered chest trauma with multiple fractured ribs after falling off a ladder. There is no other significant injury after a tertiary survey and a trauma radiology series. His past history includes a history of depression treated with sertraline, chronic renal dysfunction with a creatinine of 190 $\mu\text{mol/L}$ (normal range 60-120 $\mu\text{mol/L}$) and a heavy (10 standard drinks/day) alcohol consumption. He has just arrived in the ICU via radiology and is intubated and ventilated.

- 1. For this patient, what are the pharmacological options that you would consider for adequate sedation and analgesia, and why would you choose them?**

The rest of the viva focussed on the value of daily cessation of sedation, the management of encephalopathy and the pharmacology of dexmedetomidine.

Areas of weakness identified by examiners:

Few candidates seemed to have a structured approach and some were not familiar with dexmedetomidine and the recent trial data. No broad overview of sedation and analgesia agents with reference to the above patient considering the simplicity of the question. Many not familiar with dexmedetomidine pharmacology regardless of practical experience with the drug

VIVA 6

You are the intensivist caring for Mrs June Hay, a 56 year old lady recently admitted comatose to the ICU following a subarachnoid haemorrhage, but who had made good progress to the point of obeying commands and had been discharged to the ward with a tracheostomy in situ.

She was readmitted to ICU following a prolonged resuscitation in the ward. It transpired that she had suffered a major anaphylactic reaction to Flucloxacillin that had been prescribed by an intern for a presumed infection around the tracheostomy site. This was despite the fact that she had clearly documented penicillin allergy and she wore a Medic-Alert bracelet indicating her allergy. The husband has been appraised about the drug error.

It is now 3 days later, she is deeply comatose and has clearly suffered irreversible neurological damage based on clinical assessment and CT scan studies.

You organize a meeting with him to discuss his wife's condition and to outline your management plan.

Areas of weakness identified by examiners:

This station was not well performed by the candidates.

- Candidates on the one hand were giving reassurance to the next of kin about likely patient recovery and in the next breath went on to discuss brain death and organ donation
- Lack of empathy on the part of some of the candidates was mentioned by the actors
- Few candidates expressed regret and sorry over the turn of events although things happened outside the ICU.

VIVA 7

Radiology station: 7 X-rays were shown. The X-rays included chest Xrays of thoracic trauma, pneumonia, COPD with respiratory failure and the CT scans included that of brain injury, pericardial tamponade and free abdominal gas contrast extravasation in to the abdominal cavity.

Areas of weakness identified by examiners:

- Failure to identify common pathologies
- Diagnosing PE on a CT chest where contrast had not been given.
- Candidates did not always use the information given to them about each Xray eg CT abdomen post rectal contrast
- Candidates did not recognise significant free intraperitoneal air on abdo CT.

VIVA 8

Procedure station was about central venous access.

Areas of weakness identified by examiners:

Inability to clearly describe anatomical relationships

Clinical Section - Princess Alexandra Hot cases

1) Gd V SAH ACOM aneurysm

Severe neurogenic pulmonary oedema and shock over first 5 days precluded coiling

Aneurysm remains unsecured

- Identification of cause of collapse
- EVD
- Blood stained CSF
- -Raised A-a gradient
- Nimodipine infusion

Areas of weakness identified by examiners:

- Inability to perform a proper CNS examination
- Not being able to state a clear GCS
- Missing the presence of an EVD
- Lack of a management plan: - family discussion, prognostication

2) 37 year old lady presented with L hemiparesis GCS 8 due to medullary haemorrhagic CVA.

CT shows hypodense pons; tonsillar herniation and ?dense basilar (though flow OK on CTA)

Areas of weakness identified by examiners:

- Inability to perform a proper CNS examination
- Not being able to state a clear GCS
- Lack of a management plan: - family discussion, prognostication

3) A 65 year old man admitted with sepsis and multi-organ dysfunction 3 weeks previously..

Diagnosis of staph bacteremia and C5-6 discitis requiring surgery and is now in the recovery phase.

Re-intubated within a few hours of extubation yesterday. Please assess and make a plan for the next week.

Issues

- Awake patient with clear weakness in upper limb, proximal more than distal.
- Long tract UMN signs
- Flucloxacillin rash
- Raised a-a gradient
- PICC line
- Long term management issues regarding tracheostomy

Areas of weakness identified by examiners:

- Performing a superficial PNS examination and failing to recognise that neurological exam was a core part of formulating a management plan.
- Several candidates failed to identify UMN signs in the lower limbs including clonus, upgoing plantars and pathologically brisk reflexes. Several candidates, despite demonstrating brisk reflexes suggested CIPN as a diagnosis.
- Several candidates missed a drug rash
- Candidates were not able to come out and clearly say that patient needs a tracheostomy,

- When shown a CXR with bilateral infiltrates, inability to comment on the possibility of aspiration or sputum retention as possible cause of readmission

4) 29 year old, Day 61 in ICU, presented following MVA with C6/7 fracture dislocation and compound fracture left 2nd metacarpal (ORIF)

- Issues of quadriplegia
- Slow respiratory wean
- Left lower lobe collapse

Areas of weakness identified by examiners:

Poor neurological examination

Failure to outline complications of quadrilegia

No coherent approach to a failure to wean case

5) 81 year old lady, presented after a fall, => GCS dropped to 7 in ED with dilated left pupil and haemoserous fluid R ear.

- Slow respiratory wean
- Focal neurology
- Failed NG feeds – plan for nutritional supplementation

Areas of weakness identified by examiners:

- Poor neurological examination
- No clear plan for nutritional management
- Few candidates mentioned post pyloric feeding
- Candidates commented on tracheostomy decannulation without establishing clearly the presence of a cough reflex.

6) 65 year old man, Day 26 in ICU, admitted with respiratory failure secondary to probable right lower lobe pneumonia (nil +ve micro / non infectious causes found) and acute on chronic renal failure. Background IHD with stents x 2; HT; left ICA stent

- Slow wean
- Comment on ongoing respiratory pathology
- Management of clopidogrel therapy

Areas of weakness identified by examiners:

- No coherent approach to a failure to wean case
- Poor approach to management of sepsis
- Candidates did not have a rational approach to continuing clopidogrel therapy

7) Multitrauma

- Resuscitation from shock
- Uncleared C-spine
- Evidence of large arterial sheath femoral artery suggestive of angiogram +/- embolisation
- CT scan – interpretation
- ABG – mixed respiratory and metabolic acidosis

Areas of weakness identified by examiners:

- Several candidates missed a large arterial sheath and failed to identify the possibility of an angiogram +/- embolisation
- Inability to perform a clear neurological examination
- Patient had a clear pericardial sound, missed by a number of candidates.
- Candidates did not recognise a ruptured spleen on CT.

Royal Brisbane Hot Cases

1) A 45 year old male presented with unconsciousness 10 days ago. CT scan showed extensive SAH. Candidates were asked to assess neurological state and outline plan of management.

2) 17 year old pedestrian admitted 48 hrs ago following an MVA. Deeply unconscious at the scene, difficulty in securing the airway due to blood in the airway. Candidates were asked to assess neurological state and outline plan of management.

Other issues – comment on CT head, management of ICP, family discussions

Areas of weakness identified by examiners:

- Poor systematic examination of the relevant neurology. Application of pain to a paralysed fully sedated patient.
- CT scans: difficulty with simple diagnosis including distinguishing between an extradural and subdural
- Inability to summarise the neurology and formulate a management plan including a realistic view of the prognosis for discussion with the family.

3) 47 year old man, brought in after an MVA. Has a T11 fracture, tear drop fracture C2 and an aortic injury. Candidates were asked to assess general examination, neurological state and outline plan of management.

- Cause of weakness
- Nosocomial pneumonia
- Criteria for extubation
- DVT prophylaxis in acute phase

Areas of weakness identified by examiners:

- Poor general neurological examination
- Could not clearly articulate criteria for extubation
- Missed the presence of a pneumonia
- Failure to have a DVT prophylaxis plan

4) A 33 year old man presented with weakness and progressed to developing respiratory failure. Candidates were asked to assess neurological state and determine cause of weakness.

- D/D of LMN weakness expected
- Criteria for intubation in GBS
- Autonomic dysfunction
- Neuropathic pain management

Areas of weakness identified by examiners:

- Poor general neurological examination
- Failure to recognise autonomic dysfunction
- Failure to spell out when they would intubate a patient with GBSy

5) A 64 year old man was 7 days in ICU post AVM resection. , returned to OT 3/7 later for a craniotomy Candidates were asked to assess general examination, neurological state and outline plan of management.

Areas of weakness identified by examiners:

Failure to comment on ICP monitor, CT scan (extensive pneumocephalus), tracheostomy, nosocomial pneumonia,

6) A 65 year old lady presented with RIF pain and abdominal wall cellulitis. Assess her for ongoing management.

Issues: Abdominal surgery, vac dressing, antibiotic cover, nutrition, ventilatory wean, tracheostomy.

7) A 36 year old lady who has had gastric bypass surgery, and follow up laparotomies for bleeding and failed to thrive. Candidates asked to assess patient, identify ongoing management issues.

Slow wean

Enterobacter in abd fluid

On TPN

Ongoing temperatures

Areas of weakness identified by examiners:

- Failure to identify multiplicity of problems
- Lack of clear management plan
- Lack of clear antibiotic plan
- Candidates failed to clearly state how they would investigate new sepsis

8) A 61 year old man with DM, HT and PVD, presented with sepsis and renal failure. He is now recovering from this. Candidates asked to assess suitability for extubation.

- Ongoing encephalopathy
- Productive sputum
- Tachypnoeic, requiring high PS and low TV.

Areas of weakness identified by examiners:

- Lack of a clear plan for when they would extubate a patient
- No clear plan for when they would consider a tracheostomy

9) 48 year old female, admitted last night with hypotension, respiratory failure and reduced LOC. She had left thumb cellulitis commenced on flucloxacillin and she has now developed a generalised rash.

- Toxic epidermal necrolysis
- Morbid obesity
- SIRS/shock
- ARDS

Areas of weakness identified by examiners:

Candidates did not look comfortable at the bedside; they looked like they don't examine a patient as part of their daily work. These candidates fiddled with the bed sheets, didn't expose the patient adequately, missed skin biopsy site sutures, struggled to exam a morbidly obese patient from just the right side of the bed and performed disjointed exams moving from the hands to face to legs to chest to leg to face in an illogical sequence.

Some took unsafe approaches with their discussion of technique to intubate the patient or overdosed the patient with dangerous amounts of intubating drugs, despite an opportunity presented to clarify their chosen drug amounts.

10) A 50 year old man who collapsed at a bus stop and was in a cardiac arrest when paramedics arrived. Assess for possible causes of cardiac arrest

Issues

- Causes of cardiac arrest
- Management post cardiac arrest
- C-spine clearance
- Complications of cardiac arrest

Areas of weakness identified by examiners:

- Missed Codman catheter
- Missed toxicology as a possible cause of arrest
- Poor exam technique
- Focussed only on the cardiac causes

B. Venkatesh
Chair of Examinations

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