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Joint Faculty of Intensive Care Medicine



The Royal Australasian
College of Physicians

DIPLOMA OF FELLOWSHIP PAEDIATRIC FELLOWSHIP EXAMINATION AUGUST/OCTOBER 2008

REPORT

October 2008

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

The Paediatric Intensive Care Fellowship written examination consists of two 2.5 hour written papers (30 short answer questions in total). Candidates are required to score at least 50% in the written examination to be eligible to present for the oral component of the Paediatric Intensive Care Fellowship examination. The oral examination consists of eight structured vivas, and two separate clinical PICU cases.

This is the first Paediatric Intensive Care examination with the new regulations which came into effect in 2008. The main changes to this exam were:

- a) Candidates must have successfully completed four observed clinical examinations of intensive care patients prior to presentation for the Final Fellowship Examination
- b) Data interpretation and radiology which were previously examined in the OSCE may be assessed in the written component of the examination
- c) The procedure and communication stations have been incorporated into the structured viva section of the examination.
- d) Radiology and data interpretation can also be assessed in the structured viva section of the exam.
- e) Non-ICU short cases (cold cases) are no longer examined as part of the fellowship examination
- f) A minimum mark of 50% in the written paper is required to be invited to the oral section.
- g) Candidates must achieve a minimum overall score of 40% in the ICU clinical examination (hot cases) to achieve a pass in the Fellowship Examination.

Four candidates presented for the Written Examination. Three candidates passed and presented for the Oral Examination. All candidates who presented for the oral examination were successful. There was one Overseas Trained Specialist who presented for Assessment. This candidate was also successful.

The court of examiners made the following observations with regards to the performance of the candidates and suggest that future candidates take note of these recommendations.

Written section

The overall impression of the examiners was that candidates could have been better prepared for the written section of the examination. Candidates need to ensure they have an excellent understanding of basic concepts used in day to day critical care practice. Candidates should be able to support their approach to clinical problems with a sound understanding of current and relevant literature.

Clinical Section

Candidates should approach the clinical examination of the patient and presentation of findings in an organized manner. Management should be discussed at a consultant level. Candidates do better if they practice this component of the examination.

WRITTEN EXAMINATION PAPER

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

Feedback from examiners indicated that candidates would have been more likely to pass if they:

- answered the question asked
- demonstrated their priorities
- organised their answer in a way that demonstrated a broader knowledge
- included additional relevant detail

Writing should be legible to allow candidates to gain optimal marks.

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

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

Critically evaluate: Evaluate the evidence available to support the hypothesis.

Outline: Provide a summary of the important points.

List: Provide a list.

Compare and contrast: Provide a description of similarities and differences (eg. Table form).

<p>1. A 3 month old boy presents with a prolonged generalised tonic clonic seizure, fever (39°C) and a bulging fontanelle. His seizure is terminated with intravenous midazolam and a loading dose of intravenous phenytoin has been administered. He is intubated for a CT scan of the head which is reported as normal.</p>	
<p>Would you recommend a lumbar puncture in this case?</p>	<p>NO</p>
<p>List four (4) reasons for your decision</p>	<ol style="list-style-type: none"> 1. Risk of herniation high in meningitis after LP 2. Normal CT does not exclude raised ICP 3. Contraindications – recent seizure and possibly obtunded 4. Low Benefit – Blood cultures positive 40% Meningococcal/ 80% Pneumococcal meningitis. Can perform LP later - PCR
<p>Neuroimaging was performed on day one of illness: List two abnormal findings present in the scan above.</p>	<ol style="list-style-type: none"> 1. Cortical oedema within the distribution of PCA, Rt MCA and both ACA 2. Effaced Basal Cisterns
<p>Blood culture from this patient grows pneumococcus after 22 hours and he remains intubated and ventilated because of ongoing seizures. List three potential long term complications for this child along with the relative risk of each complication.</p>	<ol style="list-style-type: none"> 1. 10% severe disability or death 2. 5% ongoing seizure disorder 3. 25% hearing problems <p>OR 10% behavioural or learning problems <50% chance of normal outcome</p>
<p>List three (3) poor prognostic factors present in this clinical scenario.</p>	<ol style="list-style-type: none"> 1. Pneumococcal organism 2. Ongoing seizures 3. Abnormal MRI

<p>2. A 5 month old boy returns to the paediatric intensive care unit following complete repair of Tetralogy of Fallot. He is initially stable but during the night progressively becomes tachycardic, hypotensive and oliguric.</p>	
<p>List the three (3) most likely causes for this clinical picture.</p>	<ol style="list-style-type: none"> 1. LCOS 2. Bleeding +/- tamponade 3. Pulmonary hypertension +/- hypertrophic poorly compliant RV
<p>Define low cardiac output syndrome (LCOS).</p>	<p>Syndrome occurs 6-18 hrs post op (25% incidence) clinical features – tachycardia, oliguria, hypotension and poor perfusion</p>
<p>List two (2) major risk factors for LCOS.</p>	<ol style="list-style-type: none"> 1. post cardiopulmonary bypass 2. myomectomy
<p>Briefly outline your management of LCOS in this patient.</p>	<ol style="list-style-type: none"> 1. increase preload with careful filling and optimize AV synchrony (pacing) 2. reduce afterload with vasodilators +/- ensure PFO to unload R side consider inhaled nitric oxide although not usually with post TOF 3. optimize systolic function (inotropes –

	dobutamine/adrenaline) 4. optimize diastolic function (inodilators/lusitropic eg milrinone) 5. continue ventilation with optimal PEEP/high FiO ₂ 6. optimal sedation 7. consider reopen sternum 8. consider VA ECMO 9. consider cooling 10. Renal Support (Frusemide/PD)
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3.1 A 3 day old male (born at 38weeks gestation) presents to the Emergency Department with seizures. Clinical examination reveals hepatomegaly. The liver feels soft and is only slightly enlarged. His mother gives a history of poor feeding since birth. Initial arterial blood results are given:

Describe the acid base disturbance	Acidaemia High anion gap metabolic acidosis (predominantly lactic acid) Minimal respiratory compensation – decreased respiratory drive or lung disease	
Tabulate your differential diagnoses and list the relevant factors from the available history and biochemical results which support each clinical diagnosis.	1. Inborn Error of Metabolism	
	Organic acidaemia	Age/lactate/glucose
	Fatty acid oxidation disorder	Age/lactate/glucose
	Respiratory chain disorder	Age/lactate/glucose
	Glycogen storage disease (Type 0)	Common – could explain glucose/lactate
	Hyperinsulinism	
	2. Cardiac Anomaly (HLHS, severe coarctation of aorta)	Age/lactate/acidosis
	3. Sepsis (Group B Strep, E. coli, Gram Negative Bacillus)	Age/lactate/seizure

3.2 The seizure is terminated with a 5ml/kg intravenous bolus of 10% dextrose and an intravenous glucose infusion is commenced at 5mg/kg/min. The baby has an adequate airway, deep respirations and is haemodynamically stable. The white cell count, C reactive protein (CRP) are within normal limits. Lumbar Puncture is performed and the cerebrospinal fluid analysis is normal. He is admitted to the Paediatric Intensive Care Unit breathing spontaneously with 1 litre per minute of oxygen via nasal prongs. Repeat arterial blood results are given:

Interpret the changes	Improved Respiratory compensation Normal glucose with minimal dose – hyperinsulinism unlikely Lactate not improving – metabolic cause most likely Sepsis less likely – but still possible
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Name the most urgent priority of management.	Ensure adequate glucose delivery or Metabolic consult (is this an alternative?)
List six (6) essential investigations required to confirm the diagnosis.	Urine ketones Serum amino and urine organic acids Plasma acyl carnitine profile Liver function tests Lactate pyruvate ratio Cardiac Echo
Outline your initial nutritional management.	Minimum 5mg/kg/min glucose IV Stop breast feeding but store EBM Withhold protein/fat until diagnosis clearer

4. A 7 day old infant is admitted to the paediatric intensive care unit following an arterial switch operation. As a result of intraoperative complications the child has failed to separate from cardiopulmonary bypass and is now on veno-arterial ECMO through an open sternum. Blood loss in the first 2 hours is 10 ml/kg/hr.

Briefly outline your approach to investigation of this problem.	Examine patient Hypovolaemia or Tamponade? Both have low BP, low inlet P. Tamponade will have high atrial P Signs of generalized bleeding Collection, bulging of sternal membrane Check heparin dose is appropriate Investigations FBC (Hb & platelets) ACT, INR, APTT CXR (Pleural collection) Cardiac Echo if suspicion of mediastinal collection
Briefly outline your management of this problem.	Aggressive medical management Transfuse to maintain Hb >100, platelets >100 Transfuse FFP if generalized coagulopathy Transfuse Cryoprecipitate to maintain fibrinogen >1.5 Reduce heparin, aim for reduced ACT (140-150). Consider stopping heparin temporarily Add antifibrinolytic (Aminocaproic acid, Tranexamic acid). If suggesting Aprotinin, must discuss risks. Consider FVII after discussion with surgeons Early communication with surgeons - consider surgical re-exploration if bleeding is ongoing Beware bleeding that ceases abruptly Ensure chest drains patency - If bleeding stops suddenly consider mediastinal clot/tamponade

5.1 Define Acute Respiratory Distress Syndrome (ARDS).	Acute and persistent PF ratio <200 Bilateral Opacities No evidence of high LAP
5.2 Briefly outline the current evidence for each of the following four strategies in ARDS management:	
1 Ventilation with low tidal volume.	-Strong evidence to support -ARDSnet (NEJM 2000) 6ml vs 12ml study- good quality RCT, significant mortality effect -AMATO NEJM 1998 small study but significant difference. High control group mortality tho. -ARIES network (Villar) CCM2006 small but positive - Animal work including Dreyfus - cytokine work giving a plausible mechanism
2 Surfactant administration.	- reasonable evidence for calfactant administered directly (JAMA 2005) but ? generalisable to other agents probably not for man made. - no evidence to support nebulised following large negative adult study - some support from deficiency studies of ARDS lung - some support from neonatal lung disease
3 Steroid therapy.	- highly controversial -multiple studies with different outcomes - several large negative studies (ARDSnet NEJM 2006) - best positive studies both Meduri - chest 2007 (small and ? biased as unusual design) - 1998 original study supportive of 2mg/kg in 2 nd week
4 Open lung strategy.	Includes PEEP and recruitment studies -PEEP ARDSnet ALVEOLI 2004 NEJM didn't show a difference with higher PEEP - recruitment studies also negative "high PEEP" used in several protective ventilation studies (Amato, ARDSnet, ARIES) all of which showed benefit so useful if used with low TV - plenty of animal work suggesting repetitive closure of alveoli bad - is a well accepted but unproven strategy

6.1 List the risk factors for necrotising enterocolitis (NEC) in term infants in a paediatric intensive care setting.	<ol style="list-style-type: none"> 1. Congenital heart disease with inadequate systemic perfusion (HLHS, Aortic arch obstruction) 2. Congenital heart disease with run-off from systemic circulation (A-P window, pulm atresia/stenosis. Surgical Aortopulmonary shunts) 3. Low cardiac output/Hypoxic ischaemic events 4. Polycythaemia, hypoglycaemia, IUGR have all been suggested, but are not consistently found to be risk factors
6.2 List the features required to confirm the diagnosis of NEC.	Bell's staging classification is the most widely-cited set of diagnostic criteria for NEC (stage 1a [suspected] – 3b [extremely sick with haemodynamic compromise and perforated

	<p>gut]). Don't expect candidates to have detailed knowledge of this. However, would expect:</p> <p><i>Suspicious of NEC</i></p> <p>Feed intolerance</p> <p>Abdominal distension</p> <p>Thickened bowel wall on AXR</p> <p>Temperature instability, apnoea</p> <p>PR bleeding in the absence of a fissure</p> <p><i>Evidence of definite NEC</i></p> <p>Pneumatosis intestinalis, portal vein gas or pneumoperitoneum on AXR</p> <p>Abdominal tenderness, peritonitis, abdominal wall discoloration</p> <p>Metabolic acidosis, DIC</p>
6.3 Briefly describe the principles of management of NEC in the PICU	<p>Stop feeds, start naso/orogastric drainage</p> <p>IV fluids, Parenteral nutrition when available</p> <p>Blood cultures</p> <p>Broad spectrum antibiotic therapy. Important to cover E coli, Enterobacter, Klebsiella, Anaerobes. (should suggest an appropriate regimen eg Pen, Gent, Metronidazole)</p> <p>Surgical evaluation</p> <p>Serial abdominal examination and abdominal X-rays</p> <p>Fix any predisposing factors (consider surgery for CHD)</p> <p>If perforation develops or becomes extremely unwell – surgical intervention: Laparotomy with resection or primary peritoneal drainage</p>

7. A 14 year old girl is admitted to ICU with a three day history of jaundice followed by increasing confusion and drowsiness. She has been intubated and ventilated because of a severely depressed conscious state. Initial laboratory results are as follows:

Describe your approach to investigation of this child.

1. History

Any history to suggest deterioration of cognition, episodic metabolic disease, previous self-harm. Prescribed and non-prescribed drugs (especially paracetamol, valproate), recent anaesthetics

2.Examination

Look for signs of other organ dysfunction, Hemochromatosis, Wilson disease.

Evidence of cerebral oedema

3.Lab tests

(a) Define the extent of liver dysfunction and coagulopathy– LDH, Ammonia, Alpha fetoprotein, lactate, glucose; D-dimers, ?Factor V

(b) Other organs involved – renal function

(c) Infectious causes – Hep A,B, ?D, EBV, CMV Herpes viruses.

Serology, culture, PCR.

(d) Metabolic causes – caeruloplasmin, Cu (serum & urine), Ferritin, Orotic acid, Ammonia

(e) Toxic causes – Paracetamol and Salicylate level

(f) Autoimmune – Coombs test

4.Imaging

CXR, abdominal ultrasound, cardiac echo

	<p>EEG CT brain Liver biopsy should be avoided at this stage</p>
Describe your management of this child.	<p><i>1.Support</i> Ventilate, to protect airway and maintain normal PaCO₂ Avoid hypovolaemia – (will have low SVR) Metabolic support – Adequate glucose Nutrition – attempt enteral nutrition early Lactulose to lower colonic pH Treat coagulopathy if bleeding or if procedure planned <i>2.Anticipate potential complications</i> Raised ICP Pulmonary oedema Hepatorenal syndrome Bleeding Need to adjust some drug doses <i>3.Treat any identifiable cause</i> Paracetamol poisoning, haemochromatosis, herpesvirus <i>4.Liaise with and transport to liver transplant facility early</i> <i>5.Liver Support Systems</i> Eg MARS or haemofiltration are used in some but not all units. They may have a role in removing ammonia or in bridge to liver transplantation.</p>

8. Critically evaluate the use of intensive insulin therapy for glycaemic control in critically ill children.	<p>Knowledge of Van den Berghe studies in adults – reduction of mortality in surgical ICU, morbidity in medical ICU. Potential explanations for the above (both mechanisms of effect and confounders) Prevalence of hyperglycaemia in children in ICU, and associations with adverse outcomes (recent PSG paper in PCCM) Interpretation – not a proven causative relationship No evidence currently to support tight glycaemic control in children. Potential harm of doing so Resolution – practicalities of doing a definitive RCT: outcome measures, enormous sample size required.</p>
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9. A term newborn following repair of gastroschisis develops persistent tachycardia, oliguria and worsening metabolic acidosis.	
Briefly discuss the pathophysiology of abdominal compartment syndrome	<p>Abdominal cavity is closed, non-expandable compartment Increase in pressure within compartment: <i>Primary</i> – due to intra-abdominal injury <i>Secondary</i> – massive fluid resuscitation/capillary leak Compromise of bloodflow to intracompartmental tissues (capillary, then venous, ultimately arterial) Venous congestion, swelling</p>

	<p>Ischaemia, inflammation, swelling Affects liver, kidney, gut Diminished venous return to the heart (via IVC compression) Diaphragm not rigid – increased pressure transmitted to the thorax leading to reduced lung volumes and increased total compliance.</p>
Describe how you would confirm this diagnosis of abdominal compartment syndrome.	<p>Bladder pressure Urinary catheter Catheter tubing connected to pressure transducer via 3-way tap (or needle in sampling port) 1ml/kg saline into bladder (up to 50ml), clamp catheter Zero transducer at mid-axillary line Confirm system works by variations in tracing with respiration or increase in pressure with gentle pressure on abdomen. Read pressure at end expiration Abdominal compartment syndrome: i. intraabdominal pressure ≥ 20 ii. new organ dysfunction (The above criteria are for adults – many people use a lower pressure in children: ≥ 15 would be reasonable)</p>

10. A 6 day old male infant is admitted to the Paediatric Intensive Care Unit with obtundation and is found to have a serum Ammonia of 1500 $\mu\text{mol/l}$.

Outline the specific preparations for initiating continuous veno-venous haemo-diafiltration (CVVHDF) for this child.

1. Confirm diagnosis - blood and urine metabolic screen
2. Consent required. Describe the possible complications.
3. Check Coagulation studies
4. cross match blood
5. check biochemistry
6. Pre filtration cranial USS or CT to exclude intra cranial haemorrhage
7. Prepare for intubation as sedation unlikely to be adequate or safe
8. Ultrasound guided percutaneous or surgically inserted filtration catheter (6.5 fr Double lumen or consider 2 x 5 fr) preferably via internal jugular with tip in right atria or femoral if IJ not possible.
9. Check position with imaging or echo
10. Check easy flow of blood
11. Small volume circuit for CVVHDF
12. Small volume filter
13. Blood prime or with Blood available.
Consider buffering of prime with NaHCO_3
14. Bicarbonate based replacement fluid instead of lactate based solutions
15. Resuscitation fluids non protein such as normal saline in 20 ml/kg aliquots
adrenaline infusion prepared – for hypotension on initiation

	16. Fluid heating devices or indirect heating for child (baer hugger) 17. Prescribe appropriate nutrition	
Write your orders for CVVHDF for this child.	Heparin Load	50-100 units/kg
	Heparin Dose range	2-20units/kg/hr ACT 1.5 normal (160 – 180)
	Blood Flow	20-40 mls/min
	Replacement fluid	Lactate free 10-50 ml/kg/hr
	Dialysate	Lactate free 20-50 ml/kg/hr
	Filtrate	Aim for neutral balance once nutrition and infusions considered
	Vas Cath size	6.5 Fr or 2 x 5Fr

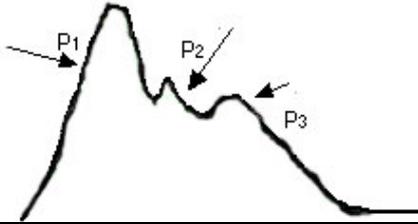
11. A 12 year old girl is admitted following a high speed motor vehicle accident. She has a closed head injury, numerous long bone fractures and a pulmonary contusion.

List two (2) indications for intra cranial pressure monitoring (ICP).

1. Severe traumatic brain injury with a GCS < 9
2. Mild to moderate traumatic brain injury GCS 9-12 where serial monitoring will be precluded by sedation or anaesthesia.

In tabular form compare the advantages and disadvantages of three (3) methods of ICP monitoring.

Monitoring Device	Advantages	Disadvantages
Intra ventricular drain with fluid coupled catheter and external strain gauge	Cheap Accurate No drift Able to drain fluid Can be recalibrated	Can't measure and drain at the same time Can be difficult to insert
Intraventricular device with micro strain gauge or fiberoptic	accurate Able to drain fluid	Not as cheap Require calibration before insertion but drift Can be difficult to insert
Parenchymal tissue monitor	Accurate Ease of insertion	Must be calibrated before insertion Drift after 5 days Not as cheap cant measure regional difference Unable to drain

			fluid
	Subdural Devices	Ease of insertion Initially accurate	Must be calibrated before insertion Drift after 5 days Unable to drain fluid
	Fluid coupled subarachnoid devices	Cheap Able to be recalibrated	Not as accurate Unable to drain
	Epidural devices	Cheap	Not accurate Doesn't reflect regional differences
Identify the three (3) points on the intra cranial pressure trace shown below and describe what they represent	 <p><i>P1</i> = (percussion wave) represents arterial pulsation <i>P2</i> = (tidal wave) represents intracranial compliance <i>P3</i> (dicrotic wave) represents aortic valve closure In normal ICP waveform <i>P1</i> should have highest upstroke, <i>P2</i> in between and <i>P3</i> should show lowest upstroke</p>		

12. An 11 month old female with confirmed Di George syndrome is currently ventilated for diaphragmatic paralysis secondary to phrenic nerve injury post cardiac surgery. She has a right sided intercostal catheter draining 1-2 mls/kg/hour despite fasting. She is receiving total parenteral nutrition.

List the immunologic abnormalities to be expected in this infant.	<u>DiGeorge Ch22 microdeletion and thymic hypoplasia</u> Deficiency of T cells number and or function Poor B cell function from lack of T cell help +/-Abnormal antibody levels and responses Poor response to vaccination Probable chylous losses Further reduction in lymphocyte numbers Further reduction in immunoglobulin levels <u>Nutritional deficiencies</u> Impaired neutrophil function Further reduction in cellular immunity
List the immunologic investigations that you would perform.	Referral to clinical immunology Lymphocyte count and subsets Lymphocyte responses Total immunoglobulins and subclasses Titres to vaccines (if given) ie an assessment of responsivity
Briefly outline the impact of these complications on her	<i>Specific</i> hypovolaemia/hypoalbuminaemia

PICU stay.	<p>acidosis from chyle loss</p> <p>Immune suppression - increased risk of and from nosocomial and opportunistic infections</p> <p>Need to broaden coverage when sick</p> <p>growth failure – nutrition related</p> <p>some drugs lost in chyle eg digoxin, amiodarone</p> <p>Need for therapeutic adjustments – prophylaxis to PCP, candida and potentially CMV, RSV</p> <p>Need for specific immunologic therapy – immunoglobulin prophylaxis vs treatment (recent changes to CSL provisions)</p> <p>need to adjust vaccination ie no live viruses</p> <p><i>General</i></p> <p>strict handwashing (+/- barrier nursing)</p> <p>ICU admission likely to be prolonged</p> <p>Stressful for parents and staff especially when nosocomial sepsis occurs</p>
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13. A 3 month old child presents to your Paediatric Intensive Care Unit with respiratory failure secondary to pneumonia. He is unimmunised. He has had two previous chest infections and several bouts of diarrhoea. He appears malnourished, although his mother states that he has a good appetite. Physical exam is unremarkable apart from decreased air entry and bronchial breathing over his right lung base. His initial haemoglobin is 10.8g/dL and his white blood count is $4.7 \times 10^9/L$. An immunodeficient state is suspected.

List four (4) possible diagnoses.

Inherited Immunodeficiency

X-linked agammaglobulinaemia

Common variable immunodeficiency

Transient hypogammaglobulinaemia of infancy

Severe combined immunodeficiency

Acquired Immunodeficiency

HIV

List four (4) investigations required to diagnose the respiratory pathology.

CXR

Sputum and blood cultures

Nasopharyngeal aspirate for respiratory viruses

Sputum for pneumocystis and TB

List six (6) investigations required to elucidate the cause and severity of the immunodeficient state.

HIV (if +ve then viral load)

FBC + differential

Immunoglobulins

Lymphocyte subclasses

Lymphocyte stimulation assays

Serology for CMV, EBV, Hepatitis

Briefly outline the management principles for this patient.

Support ABC

Appropriate antibiotics for pneumonia

Isolation

Avoid live vaccines

Blood transfusion – CMV –ve and irradiated

PCP prophylaxis

	May require IVIG or BMT if inherited immunodeficiency HIV +ve antiretroviral
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14. A 4 month old child underwent surgical correction of a congenital cardiac defect. His post operative course was complicated and he spent 10 days in your paediatric intensive care unit. He was extubated 24 hours ago and was discharged to the ward from the PICU only four hours ago. He is now irritable and crying constantly. He has frequent diarrhoea and the nurse reports twitching movements.

Briefly describe the cellular basis of opioid and benzodiazepine tolerance and withdrawal phenomenon.	<p>Candidate should present a brief description of mechanism of tolerance and withdrawal with more detail than just mention of effect on opioid and GABA receptors.</p> <p>Prolonged use of opiates results in change in receptor morphology and promotes alternate pain pathways egs via NMDA system. Methadone blocks NMDA receptors in addition to its action on opioid receptors thereby limiting development of tolerance. Opiate withdrawal induces a state of neuronal hyperexcitability in the brain which has been linked to alteration in a number of second messenger systems and neurotransmitters. Morphine withdrawal also produces a complex endocrine alteration including the activation of the hypothalamus – pituitary – adrenocortical axis..</p> <p>Prolonged benzodiazepene use causes down regulation of inhibitory GABA receptors. Stopping the drug results in a decrease in GABA mediated neuroinhibition resulting in unopposed excitatory neurotransmission (glutamate, norepinephrine, Dopamine systems) and the onset of withdrawal symptoms.</p>		
Outline a management plan for this patient.	<p>Exclude other causes. Treat symptoms with Opiate and/or benzodiazepenes. When asymptomatic, wean opiates/benzodiazepines slowly over 5 – 10 days preferably via enteral route.</p>		
In tabular form, compare and contrast the pharmacology of Morphine and Methadone.		Morphine	Methadone
Oral Absorption		Variable	Good
Bioavailability		40%	80%
T $\frac{1}{2}$		2-4 hours	6 – 60 hours
Duration of analgesia		2-4 hours	6 – 12 hours
Active metabolites		YES	NO
Renal excretion		90%	10%
Liver excretion		10%	90%
NMDA receptor blockade		NO	YES

<p>15. A 2 year-old boy (10 kg) is referred to your unit from a country hospital approx 250 km away. Found by grandmother 1 hour ago next to her Carvedilol blister pack with 6 x 25 mg tablets missing. There was white residue on the floor and around the Child's mouth. The child is alert and has a resting heart rate 65bpm. The blood pressure has not yet been taken. His blood sugar is 4.7 mmol/l. The starting dose of carvedilol is 0.08 mg/kg.</p>	
<p>List the principles of management for an ingestion in this age group.</p>	<p>Paediatric – uncooperative, single agent, NAI Support vital functions – assess and manage airway, breathing, circulation Confirm the diagnosis and/or assume worst case scenario – history, exam, levels Remove the poison from body – issues in age group of emesis, lavage, activated charcoal, whole bowel irrigation, extracorporeal methods Antidote if available SEEK SPECIALIST ADVICE ie POISONS INFORMATION</p>
<p>Outline the specific therapeutic manoeuvres which are appropriate in this situation.</p>	<p>Small child in a rural setting with a potentially life threatening ingestion - evidence of early toxicity (low heart rate) Carvedilol - beta blocker, potentially significant ingestion, borderline benefit from interventions with respect to timing, modest risk from decontamination procedures, distance and transport, skillmix available Assess and manage airway breathing and circulation (currently safe) Prepare for transport– intubation if deteriorates or for decontamination Decontamination vs airway protection electively (pro and con) Monitoring of ECG (QTc prolongation, torsades and bradyarrhythmic arrest) NIBP vs IABP IV access vs bone needle if fails Adrenaline available and dose IV vs CVC Glucagon theoretical and often not available Pacing ? available</p>
<p>The referring clinician asks about gastric lavage and/or activated charcoal – how do you respond? Compare and contrast these interventions</p>	<p>Controversial . Risks may outweigh benefits as 1 hour along and need to clarify airway skill base and local support BEWARE loss of airway reflexes GASTRIC LAVAGE Little evidence unless very recent life threatening eg colchicines iron NOT tolerated by a toddler needs oral or nasal tube lying down and lots of water Vomiting and aspiration risk Water intoxication, temperature issues ACTVATED CHARCOAL Better evidence up to 2 hours Some children will drink but likely to require airway</p>

	protection Vomiting and aspiration risk Aspiration pneumonitis with charcoal VERY BAD Late use can be justified in some ingestions eg Theophylline – intestinal sump effect
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16. A 14 year old girl presents to your emergency department after a short history of feeling extremely unwell for four hours. She is confused, tachycardic and tachypnoeic. She feels warm peripherally but is hypotensive. Severe sepsis is the working diagnosis.

Define the following terms: Sepsis, Septic shock, Systemic Inflammatory response syndrome (SIRS).

Sepsis: SIRS in the presence of or as a result of suspected or proven infection
Septic Shock: Septic shock is sepsis with cardiovascular dysfunction despite the administration of > 40ml/kg of isotonic fluid in one hour
SIRS: widespread inflammatory response that may or may not be associated with infection. The presence of 2 or more of the following criteria (one of which must be abnormal temperature or leukocyte count)

- core temp > 38.5°C or < 36°C
- tachycardia (MHR > 2 SD above normal for age or for children < 1 yr – bradycardia)
- Mean respiratory rate > 2 SD above normal for age
- WBC increased or decreased for age, or > 10% immature neutrophils

List four (4) key principles of management of septic shock in children.

Assess and support Airway and Breathing
 high flow oxygen, early intubation & ventilation
 Rapid & vigorous large volume intravenous fluid resuscitation – 20mls/kg 0.9% saline repeated until perfusion improves or signs of overload
 Colloids controversial but may be considered
 > 60ml/kg fluid resuscitation and still not improved – vasoactive infusions – type determined by assessment of PVR
 Noradrenaline/Adrenaline/Dobutamine
 Early appropriate intravenous antibiotic therapy

Briefly discuss the evidence for early goal directed therapy in paediatric septic shock.

Baseline is improved DO₂ and measure oxygen extraction
 Mention definition of goals: CVP, Hb, central SvO₂, fluid management plus inotropes.
 Rivers NEJM (2001) -single centre study,.Outcome for adults with sepsis may be improved with goal-directed therapy. Compared to those who received standard treatment, patients who received goal-directed therapy had significantly less in hospital mortality (31 versus 47 percent) and less organ dysfunction.
 Lack of randomized studies of goal-directed therapy for children with septic shock. de Oliveira ICM 2008, single centre South American Study - paediatric study
 Observational evidence in children with septic shock suggests that outcomes are improved for those who receive early aggressive fluid therapy (Carcillo, 1991) Children with septic shock who received >40 mL/kg of

	fluid had significantly improved survival compared with those who received < 40ml/kg. There was no increase in the incidence of pulmonary edema or acute respiratory distress syndrome with increased volume administration.
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17.1 Define the terms “bias” and “confounding” with regard to epidemiology and explain the difference between them.

	<p>Bias = any systematic error in an epidemiologic study that results in an incorrect estimate of the association between exposure and risk of disease.</p> <p>Bias: - may mask an association or cause a spurious one - may cause over or underestimation of the effect size</p> <p>Increasing the sample size will not eliminate any bias. A study that suffers from bias lacks internal validity.</p> <p>Confounding = mixing of the effect of the exposure under study on the disease (outcome) with that of a third factor that is associated with the exposure and an independent risk factor for the disease</p> <p>The consequence of confounding is that the estimated association is not the same as true effect.</p> <p>Bias involves error in the measurement of a variable; confounding involves error in the interpretation of what may be an accurate measurement.</p>
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17.2 Describe some common causes of bias and confounding in medical research

	<p>Two major classes of bias are:</p> <ol style="list-style-type: none"> 1. Selection bias 2. Observation/information (misclassification) bias <p>The major types of bias in the observation bias group include recall bias, interviewer bias, follow-up bias and misclassification bias.</p> <p>In confounding bias the actual data collected may be correct but the subsequent effect attributed to the exposure of interest is actually caused by something else. Classic example of confounding is the initial association between alcohol consumption and lung cancer (confounded by smoking, which is associated with alcohol use and an independent risk factor for lung cancer). Likewise, an association between gambling and cancer is confounded by at least smoking and alcohol.</p> <p>An example is the confounding by age of an inverse association between level of exercise and heart attacks (younger people having more rigorous exercise) causing overestimation. The same association can also be confounded by sex (men having more rigorous exercise) causing underestimation of the association.</p>
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18. You are called urgently to the Paediatric Intensive Care Unit. A patient has inadvertently been given a bolus of potassium chloride via a syringe driver resulting in cardiac arrest.

List the key steps in the management of this *clinical situation*.

Acute management would include cardiopulmonary resuscitation following the appropriate algorithm and measures to lower K⁺ levels and reduce effects on the myocardium. The algorithm for asystole should be followed. Other measures would include:
 Calcium chloride intravenously to reduce effects of hyperkalaemia on the myocardium.
 Sodium bicarbonate (1 mmol/kg)
 Glucose (1 gram/kg) and insulin (0.2 units/kg) can be given over 15 minutes.
 As the event has been witnessed and presumably CPR has commenced immediately outcome may still be good even with prolonged arrest. If spontaneous circulation is not rapidly established consideration should be made for extracorporeal support.

Briefly outline your approach to managing this *critical incident*.

The family need to be immediately informed of the critical incident including prognosis. They should be offered access to their child during resuscitation. The treating consultant should admit that an error has been made and that it will be dealt with. The staff involved will need support without accusation or blame. They may need to be relieved of their duties due to stress and should avoid contact with the angry family, if possible.
 The details surrounding the incident need to be investigated fully. The principles of approaching this are those that apply to any critical incident.
 Is this a recurrent/potentially recurrent problem?
 What steps can be taken to reduce its recurrence? This will depend on the circumstances but could involve measures like replacing syringe pumps, increasing checking procedures, assessing staff competency, reducing the use of intravenous potassium.
 A plan should be set in place including any recommended changes.
 Reassess the implementation of plan and success at a later date.

19. Critically evaluate the role of blood transfusion in intensive care including evidence for transfusion triggers.

Hb level is important for oxygen delivery
 Anaemia is common in critically-ill children due to bleeding, sampling, reduced production due to illness, increased destruction, dilution and nutritional deficiencies
 Oxygen carrying capacity ($[\text{Hb}] \times \text{O}_2 \text{ sat} \times 1.34 + \text{PaO}_2 \times 0.003$)
 may be improved by transfusion but oxygen delivery/consumption

	<p>may not necessarily be improved due to low in 2,3 diphosphoglycerate reduced deformability (proportional to age). Stored blood contains preservatives (eg, citrate) which may be harmful.</p> <p>Risks of transfusions include a) viral transmission: Hepatitis B, hepatitis C, HIV, HTLV</p> <ul style="list-style-type: none"> b) immunomodulation c) acute haemolytic reactions d) anaphylaxis e) bacterial contamination f) prion transfer <p>Hebert et al NEJM 1999 showed that when > 800 critical care patients were randomised to a restrictive strategy (aim for Hb 7.0 grams/dL) versus a liberal strategy (aim for Hb 9.0 grams/dL) there was no difference in mortality. Subjects in the restrictive strategy required less transfusion and those that were younger (<55 years) with lower Apache score may have had a better outcome.</p> <p>Evidence in children. Lacroix et al NEJM 2007 randomised over 600 children who were haemodynamically stable (not excessively bleeding or hypotensive) to a restrictive strategy (aim for Hb 7.0 grams/dL) or a liberal strategy (aim for Hb 9.0 g/dL). There were no differences in primary outcome (onset of new organ failure) or mortality between the groups. Children in restrictive strategy required less volume of blood transfused and 54% required no transfusions (versus 2% in the liberal strategy group).</p>
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20. An 18 month old child who was resuscitated following an immersion injury remains intubated and ventilated in the paediatric intensive care unit. 48 hours post injury he has reactive pupils but no spontaneous movements. His cough is poor with absent gag reflex. He makes weak gasping efforts when disconnected from the ventilator. His parents want 'everything done'.

Briefly discuss your approach to this situation.

Collect sufficient information to be convinced of prognosis – history/examination over time/investigations

Ensure family has adequate and appropriate family and spiritual support for any interviews

Provide the family with the facts as ascertained and the issues where uncertainty remains

Clearly state the prognosis

Answer questions

Arrange repeat/followup interview

Consider involving hospital ethicist/counselor to help family come to terms with situation

Avoid conflict

Allow time for family to come to terms

Ensure cultural/religious/language issues are addressed in a manner that allows the above to happen.

21. A 3 year old boy sustained a complete cord transection at C6-7 level. One week later, despite a clear chest radiograph, he remains ventilator dependent.	
a. Describe the abnormalities in lung mechanics and lung function likely to be present,	increased chest wall and abdominal compliance, decreased lung compliance (FRC reduced) increased residual volume, ERV =0 initially, VC reduced - a restrictive lung defect. Early diaphragm fatigue, ineffective cough, secretion retention
b. Briefly outline a strategy to achieve separation from the ventilator.	strategy- optimal lung toilet (physio/suction), "cough machines", keep supine (VC reduces by 40% with sitting as lax abdo tone leads to reduction in zone of apposition), use abdominal binder if sitting, await improved diaphragm

22. 1 Define the term "maintenance fluid".	fluids prescribed to replace losses due to NORMAL evaporation and excretion where loss is likely to lead to changes in cell volume (ECF osmolality alters) or intravascular volume (total body sodium alterations).
22. 2 Briefly outline the important considerations for safe prescription of intravenous fluids.	factors that may modify losses- REE, decreased insensible losses if ventilated, BMI, variation in renal diluting/concentrating capacity eg in the newborn. importance of non osmotic stimuli to ADH - eg pain, narcotic use, nausea, CNS, resp and other diseases, etc.

23. Outline the indications, complications and evidence for decompressive craniectomy in traumatic brain injury.	
indications,	Diffuse cerebral oedema Intracranial hypertension resistant to medical measures Early – within 24-48 hours No benefit in irretrievable injury (GCS 3)
complications	Bleeding Infection Trauma to exposed brain CSF fistula Bone resorption after reconstruction
and evidence for decompressive craniectomy in traumatic brain injury.	<u>ICP</u> Multiple clinical reports that decompressive craniectomy decreases ICP <u>Outcomes</u> Single trial in children of conventional medical vs conventional medical + craniectomy (no equivalent adult published prospective randomised trial). Small numbers, but evidence of better outcomes at 6 months. Cochrane review (2006) states “ <i>this treatment maybe justified in patients below the age of 18 when maximal medical treatment has failed to control ICP</i> ”. Pediatric TBI guidelines (PCCM 2003) state “... <i>should be</i>

	<i>considered in pediatric patients with severe TBI and intracranial hypertension refractory to intensive medical management”.</i>
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23. A 2 year old male infant is admitted to the paediatric intensive care unit with a history of fever and cough for four days. He has moderate respiratory distress requiring mask CPAP to maintain oxygen saturations > 90%:	
a.. List three (3) abnormal features on the chest radiograph.	Loss of Left Heart Border Loss of Left Hemidiaphragm Left Lower Zone consolidation probably lower lobe Fluid Meniscus Left Lung Air Bronchogram behind heart on Left Note no hyperinflation No cysts
b. List the steps you would take with regard to management of this condition.	Child needs Airway Breathing and Circulation supported Adequate analgesia and anti pyretics are appropriate Antibiotics to cover Strep pneumonia and Staphylococcus. Full blood count and coagulation check Insertion of intercostal catheter is appropriate 12 Fr pig tail, larger not required. Ultrasound guidance is recommended for insertion Chest xray performed after insertion of chest drain
c. Compare and contrast Video Assisted Thoroscopic Surgery (VATS) with intrapleural instillation of thrombolysin.	Intrapleural Fibrinolytics shorten hospital stay and are recommended for any complicated effusion. No evidence that any of three fibrinolytics are more effective than the others. Urokinase only one used in Randomised controlled trials in children, therefore Urokinase twice daily for three days, 40 000 units in 40 mls for greater than 10 kgs, 10 000 in 10 mls for less than 10 kgs. Surgical options are useful if failure of chest tube drainage, antibiotics, and fibrinolytics. Video assisted thoroscopic surgery is very dependant on the local capacities. There is evidence that in services with well developed VATS programmes there is a shorter length of stay and this benefit is greatest when used early rather than delayed.

25. An 8 month old child develops oliguria secondary to meningococcal sepsis.			
a. List the four (4) key indications for renal replacement therapy.	<ol style="list-style-type: none"> 1. severe acidosis/ hyperkalaemia 2. fluid overload (pulmonary oedema, ascites) 3. uraemia 4. nutrition/volume transfusion 		
b. Compare and contrast the use of peritoneal dialysis and continuous venovenous hemofiltration in this patient.		PD	CVVH
	Complexity	Simple	More complex
	Cost	Cheap	More expensive
	Effectiveness	Limited	Very effective
	response	Slow	Rapid
	Manpower	minimal	More req
Complications	Mainly drainage problems short term Long term peritonitis	Complications of CVL insertion Heparin complications Citrate complications	

	Surgery req	Yes	No
	contraindications	Peritonitis Adhesions Pleural leak Gut ischaemia Abdo distension	nil

26. A 13 year old male is admitted to PICU with septic shock and is growing gram positive cocci from a blood culture. He has no previous medical history. Examination reveals a diastolic heart murmur.

a. List the diagnostic criteria for bacterial endocarditis.	<p>Duke Criteria</p> <p>Major - Positive blood culture of organism consistent with BE</p> <p>Evidence of endocardial involvement</p> <p>Minor - Predisposition</p> <p>Fever</p> <p>Vascular phenomena</p> <p>Immunologic phenomena</p> <p>Microbiological findings not meeting major criteria</p> <p>Echo findings not meeting major criteria</p> <p>Infective endocarditis if 2 major criteria or 1 major and 3 minor or 5 minor</p>
b. List the additional investigations required to confirm this diagnosis.	<p>For Infective Endocarditis</p> <p>Further blood cultures + antibiotic susceptibility</p> <p>CXR</p> <p>ECG</p> <p>Echocardiography – TTE or TOE</p>
c. Briefly outline the indications for surgery.	<p>Refractory CHF</p> <p>Significant valve dysfunction on ECHO</p> <p>Uncontrolled infection</p> <p>Perivalvular extension</p> <p>? large vegetation with embolic episode</p> <p>Low threshold in Staph Aureus and in prosthetic valve</p>

27. You are asked to review a previously well 4 year old boy in the Emergency Department who presents with drooling and muscle weakness. He became unwell this morning after playing outside. On examination he is sweaty, has bilateral miosis, copious oral secretions, and muscle twitching.

What is the most likely diagnosis?	Toxicity due to organophosphate poisoning
a. List the tests required to confirm this diagnosis.	RBC acetylcholinesterase and plasma pseudocholinesterase
b. Briefly outline your treatment of this patient.	<p>Immediate attention to ABC – May involve intubation and ventilation</p> <p>Establish monitoring of SpO₂, ECG, BP, ventilation, LOC</p> <p>Decontaminate patient while avoiding contaminating staff.</p> <p>Definitely remove clothing and wash skin. Possibly activated charcoal.</p> <p>Give atropine – May require large doses. Start at 20mcg/kg iv –</p>

	<p>end point is increasing HR, reversal of miosis, drying of secretions. Continue atropine until these occur – may give by infusion.</p> <p>Pralidoxime – 20-50mg/kg as bolus over 30min then infuse at 10-20mg/kg/hr or repeat bolus dose every 6hrs. Not in carbamate poisoning</p>
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28. A 12 year old girl with penetrating chest trauma has been evacuated from Timor-Leste to your Paediatric Intensive Care Unit. Her mother was refused entry to Australia because her chest radiograph confirmed active tuberculosis.

a. List the infection control precautions required.	<p>The crucial elements of infection control are: 1. nursed in single room</p> <p>2. negative pressure room (check negative pressure is being effected)</p> <p>3. airborne additional precautions: door closed, duckbill mask worn by HCW</p>
b. With regard to tuberculosis, list the steps you would take to exclude the presence of active disease in this patient.	<ol style="list-style-type: none"> 1. examination for evidence of TB; fever, cough, weight loss, chest signs, lymphadenopathy 2. CXR for evidence of TB infection/disease 3. If above abnormal, 3 early morning gastric aspirates OR bronchoscopy and BAL (if feasible) for mycobacteria stain and culture and PCR if available from lab. PCR not important. <p>Mantoux or quantiferon gold test are not useful for diagnosing DISEASE. But if disease excluded by above tests, then she should have one of the above to exclude infection. If infected without disease, she would warrant 6 months of isoniazid therapy</p>

29.1 List how pH, PCO₂ and PO₂ are measured by a blood gas analyzer 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

29.2 The image below 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?	Infra-red absorption spectrophotometry
b. List 3 uses for capnography in intensive care.	<p>Airway disconnection alarm</p> <p>Confirmation of ET tube placement in airway</p> <p>During CPR to assess adequacy of cardiac compression</p> <p>Recognition of spontaneous breath during apnoea test</p>

	Neurosurgical patient to provide protection against unexpected hypercapnia
c. What factors influence the gradient between end-tidal and arterial PCO₂	<p>Low cardiac output or cardiogenic shock Pulmonary embolism Cardiac arrest Positive pressure ventilation and use of PEEP High V/Q ratios. <i>Candidates who mention increased alveolar dead space should also get some credit.</i></p>

30. A 6 year old boy is admitted to the Paediatric Intensive Care unit within two hours of being involved in a high speed motor vehicle accident. His Glasgow Coma Score was assessed at the scene as 6. CT Brain Scan shows diffuse axonal injury. His initial Intracranial Pressure (ICP) is 12 cmH₂O. The consultant neurosurgeon requests prophylactic cooling to 32⁰C for 24 hours.

Briefly discuss the evidence for and against prophylactic cooling in traumatic brain injury in children.

Basic principle: physiological (experimental) evidence: reduced swelling, reduced oxygen requirement, induction of apoptosis, reduction of NIRS, reduced coagulation, reduced blood flow, increased infection risk, reduced neutrophil function
Pro: adult trials with conflicting results: temp and length of cooling in different trials,
Con: NEJM 2008 larger paediatric trial, only for 24 hours, rapid re-warming, requires another trial for longer than 24 hours
Infection risk, bleeding risk

ORAL SECTION

Structured Viva Section

There were 8 stations of ten minutes each for structured Vivas. There were two minutes provided to read an introductory scenario (which included the initial question) outside each viva room. This same information was also provided inside the viva room. Candidates should be able to demonstrate a systematic approach to the assessment and management of commonly encountered clinical problems. Candidates should also be prepared to provide a reasonable strategy for management of conditions that they may not be familiar with. Feedback from examiners suggested that common deficiencies encountered included ones related to knowledge deficits (and awareness of these deficits), questionable judgement, and poor exam technique. The topics covered in the Viva stations, including introductory scenario and the initial question were as follows:

<p>Viva 1: A 12 year old boy is a restrained passenger in the rear seat of a vehicle involved in a head on collision where both vehicles were travelling at 100 kilometers per hour. At the scene he is noted to have a GCS of 10-11 and has laboured breathing. You are called from the scene for advice.</p>	
Describe your approach to this patient.	APLS approach with attention to Airways and cervical spine, Breathing and then Circulation. Improve the airway as much as possible whilst supporting cervical spine and then apply O ₂ , obtain 2 large bore cannulas, storing blood for Xmatch, FBC, coags and electrolytes. If stable move on to Secondary survey but most likely transport quickly
In the face of ongoing desaturation a decision is made to intubate soon after arrival in the unit. What considerations should be made for this procedure?	One person to protect the cervical spine but stabilizing without traction. The use of agent that would not produce haemodynamic instability but give rapid onset conditions for intubation. Consider Sellick maneuver by an experienced assistant. Tube size 6.5 and 7 and 7.5 and laryngoscope. Check tube as it goes through and then CO ₂ check. Listen to chest and exclude tension pneumothorax
There is noted to be reduced air entry on auscultating the Left hemithorax and less chest movement. Some dullness to percussion is noted. The trachea is not deviated. What are the possible causes?	Most likely moderate haemothorax or haemopneumothorax, Lung Collapse or traumatic rupture of the diaphragm.
What are the considerations would you make in managing this condition?	Surgical procedure is required, decompress the stomach and place on free drainage, Appropriately cross match blood for this child, if stable consider CT head and consider Intra cranial monitoring during the anaesthetic. Need to maintain blood pressure and oxygenation throughout. Consider other procedures required at the same time, ie orthopaedic injury.
On day 2 he still has his stiff neck collar on. Describe your approach to managing the cervical spine.	If unable to perform clinical examination (Sedation/mental state, distracting injuries), then preferably MRI scan, otherwise high res thin cut CT scan.
The MRI shows some C1-C2 ligamentous changes and he is	Spinal Stabilisation procedures. And management of airways and breathing.

noted to have no gag or swallow. How would you proceed from this point?	
What components of long term management would be useful in this child's care?	Early involvement of rehabilitation team with speech review of swallowing and airway as well as developing communication techniques, joint protection by the physiotherapy team to ensure limb preservation, attention to pressure area care, Bowel and Bladder care.

Viva 2: George is a 18 month old boy, weighing 12 Kg, who has a past history of biliary atresia with a failed Kasai operation. He has just been admitted after undergoing an 8 hour liver transplant procedure. His abdomen has not been closed. At 12 hours the registrar reports that his condition has deteriorated with hypotension and decreased urine output. He has started an adrenaline infusion.

Describe your approach	Assess fluid status (Abdominal girth, drain losses, haemodynamic information- HR, CV, urine output, fluid status. Is he intravascularly depleted?). Fluid bolus if needed. 30 marks Liver function -these have worsened ABGs- .4 FI02, Fully ventilated 20/5, rate 20 pH 7.15 P02 90 pC02 37 BE -12 Lactate 5 Metabolic acidosis. Previous gases should be assessed. There has been worsening acidosis over the last 6 hours.
Discuss the possible causes.	Graft failure - primary non function, acute hepatic artery thrombosis, acute portal vein thrombosis Sepsis- think of gut perforation Intra-abdominal haemorrhage
What investigations and management would you initiate?	Urgent Doppler ultrasound for hepatic artery DISIDA scan Cultures and antibiotics (covering enteric organisms) Notify transplant team, especially surgeon
Child recovers with fluid resuscitation and all tests are satisfactory. On day 5 his abdomen is closed and his ventilation is being weaned, when he has a generalized seizure. What investigations and management do you wish to undertake. What are the possible causes?	Consider anticonvulsants Check BP Check blood glucose, magnesium and calcium. If on Tacrolimus, check level Cerebral imaging

	Possible causes- Tacrolimus toxicity, low magnesium, hypertension, intracerebral haemorrhage, sepsis
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Viva 3: You are asked to urgently review a 3yr old boy on the oncology ward who has collapsed after returning from a failed central line insertion in OT.	
What differential diagnoses are you considering?	Tamponade, Bleeding and hypovolaemia, Pneumothorax, Septic Shower, Anaesthetic problem
Describe your focused assessment.	Brief Hx of events plus Vital signs PLUS Trachea, percussion note and breath sounds. Heart sounds and JVP, Pulsus paradoxus. Vasodilated/febrile,
You discover, muffled heart sounds, pulsus paradox and distended neck veins, BP 60/40, HR 200. What are your management priorities?	ABC but ventilation and filling may make worse.
What urgent Ix do you want and how would you organize it?	ECHO ?, CXR, talk to cardiology ?? surgeon
Describe your technique to drain the effusion and risks.	Subxiphoid with echo or fluro guidance . Discuss injury ECG lead. Drain +/- pigtail. 6f cook.
How would you approach the issue of sedation for the procedure?	

Viva 4: You are the consultant on duty for retrievals for your PICU. A GP phones to tell you he has a 3 yo boy who was playing with his two older siblings in a shed on their farm. There was a petrol fire but no explosion. He is in the emergency room of the local hospital. He has facial and upper limb burns, is crying with pulse oximetry of 94% in air. The hospital is approximately 3 hours away by fixed wing aircraft.	
What will you discuss with him?	Initial assessment of ABC and resuscitation plan Evidence and risk of airway injury, need for definitive airway protection Skills assessment Resuscitation and endpoints Transport logistics
The GP has anaesthetic experience and can (and does) intubate the child The small peripheral cannulae from the foot is lost and cant be resited What options does he have?	management of the ventilated patient settings, sedation, analgesia, ventilator available vs hand ventilating management of the burns cleaning, covering cooling staffing parents other transport options – move or not, road car

<p>Viva 5: You have sent your registrar to retrieve a 2 yo with a history of increasing respiratory distress, grunting respirations and an oxygen requirement. His mother states he has not had a wet nappy for now over 12 hours. You are telephoned for advice by the registrar who asks whether she should give a fluid bolus.</p> <p>The vital signs are: Temp 38.9 C, Heart rate 220 bpm, Respiratory rate 56 breaths per minute, BP 85/54. The child has not voided for over 12 hours.</p>	
What advice would you give?	ascertain conscious state , circulatory state (cap refill, pulse volume, etc), exclude signs of fluid overload and CCF, if prescribe give small aliquots with frequent re-assessment
On arrival in the ICU the child is alert with obvious respiratory distress and grunting but is pink in oxygen. . His eyelids look puffy. There is decreased air entry on the R, with dullness to percussion and bronchial breathing. Xray and labs then provided. What is/are the likely diagnoses and management priorities?	Bacterial pneumonia/likely pneumococcal ; HUS Acceptable respiratory/cardiovascular state, neuro etc but likely renal failure / HUS thus priorities how to place vascath for volume overload – thrombocytopenia, age, need for GA, coagulopathy etc. Size catheter, site ,
The child is noted to have a coagulopathy What is the most likely cause of the abnormalities shown?	The results show abnormal INR/APTT, normal fibrinogen and D-dimers and abnormal factors suggestive of fat soluble vitamin deficiency.

<p>Viva 6: Courtney, aged 9 is admitted to ICU following biopsy of a suprasellar tumour. You are to take over her management from the anaesthetist.</p> <p>On arrival in ICU her electrolytes are:</p> <p>Na 153 mmol/l(134 – 143) K 3.2 mmol/l(3.3 – 4.6) Cl 119 mmol/l(102 – 112) Bicarb 25 mmol/l(20 – 31) Urea 3.6 mmol/l(2.5 – 6) Creat 48 mmol/l(40 – 90)</p> <p>She has been extubated post operatively, but is very drowsy.</p>	
What are the likely diagnoses for her electrolyte abnormality?	This could be diabetes insipidus, or saline resuscitation in the OT.
How would you manage this?	Monitor electrolytes (and urine specific gravity) very closely. Monitor urine output, and weight closely, and consider using vasopressin. Give normal maintenance fluids. (Half normal saline? Saline?)
What would be your indication for using vasopressin?	High urine output (>4 mls/kg/hr) (with low SG< 1.005 plus urine osmo < ½ serum osmo & or < 150 mosmo/l), with low urinary sodium, and a rising serum sodium. osmolality
At 72 hours post operative, she is on nasal DDAVP, and commences seizing. Her serum	Rapid drop in serum sodium is probably due to water intoxication caused by too much fluid and

sodium is now 118 mmol/l . What is likely to have happened, and how should it be managed?	the vasopressin infusion. Stop the vasopressin. Decrease or stop all fluid intake. (cerebral salt wasting)
24 hours later, her pupils become fixed. What has happened, and how should you proceed?	Serious likelihood of cerebral oedema. (and brain death) Urgent imaging (CT or MRI)
Outline your criteria for brain death in this case.	Explanation of brain death etc.

Viva 7: An ex 26 week IVF child, now 18 months old with bronchospasm was transported by your team from another hospital and arrived in the middle of the night. You were informed (via phone) by your senior registrar that the patient did not require ventilation but was very wheezy despite having received steroids, ipratropium, and iv salbutamol. You (the consultant) instructed the registrar to put patient on an aminophylline infusion. The registrar made 10x error in loading dose which was not picked up by nurse who was from a bureau/agency and not picked up by nurse who checked the drug. The child fitted during the loading dose while the mother was present and required diazepam then intubation and ventilation. The child is now stable though somewhat tachycardic and requiring a reasonable amount of ventilation due to possible aspiration. You are called to explain to the very anxious and somewhat hostile mother what has happened.

Points to be Covered

- Introduction – States name, position, responsibilities
- Aim of Meeting – Makes clear why the meeting is taking place and what it wants to achieve. Includes set up ie position
- Empathy – Apologizes and shows empathy towards the patient’s mother
- Clear outline of events without being evasive. Includes why it happened and why should not have happened
- Offers clear prognostic information
- Use of appropriate communication
- Allows questions and answers honestly
- Offers appropriate support services
- Provides summary of what was discussed, offers opportunity for further meetings, and relays a plan of what should happen next
- Indicates that the unit and hospital will follow up with QA review

Viva 8: A 4 week old infant with Pierre Robin sequence who has had a tracheostomy performed earlier today for upper airway obstruction. He has required fiberoptic intubation in the past. He is paralysed sedated and fully ventilated. You are called to the bedside because the ventilator alarm is going off. Ventilation 20/5 x 18, FiO2 0.3. This is a procedure station. It involves a transport ventilator, a ventilatable mannequin and a range of procedural equipment.

Why is the alarm sounding?

Check ventilator – identify High Pressure alarm
Disconnect ventilator and attempt to hand ventilate with 100% oxygen
Look and listen

	Attempt to clear tracheostomy with suctioning
What are the likely causes?	Tracheostomy blocked or dislodged
You are unable to ventilate - what do you wish to do now?	Call for assistance – ENT, anaesthesia Remove tracheostomy and attempt bag mask ventilation with stoma occluded. Attempt reinsertion using stay sutures in this situation because of history of difficult intubation. Equipment required: Suction, tracheostomy tubes, laryngoscope, ETTs,
Unable to reinsert tracheostomy	Attempt to pass catheter/bougie to facilitate reinsertion of tracheostomy tube.
What are Stay Sutures and how do you use them in this circumstance?	Sutures placed in anterior trachea on either side of longitudinal tracheostomy incision. Pull them <u>upwards</u> and laterally to expose trachea.

The Clinical Section: Clinical ICU cases

The Clinical Section (comprising 2 clinical cases – 20 minutes per case) was conducted in the Paediatric Intensive Care Unit at the Royal Children’s Hospital, Melbourne.

Candidates should listen carefully to the introduction given by the examiners and direct their examination accordingly. Patients were usually presented as problem solving exercises. For maximal marks, candidates should demonstrate a systematic approach to examination, clinical signs should be demonstrated, and a reasonable discussion regarding their findings should follow. The twenty minutes available for each case provides ample opportunity to discuss related investigations and plans of management. Some candidates waste valuable time at the start of the case by spending more than a couple of minutes around the bedside before they actually commence examining the patient. Exposing the patients should be limited to those areas that are necessary for that component of the examination, and respecting the dignity of the patient. Candidates must show appropriate courtesy and respect to patients.

Cases encountered as hot cases were:

14 month old previously well girl admitted to PICU following difficult intubation for prolonged febrile seizure. Intubation complicated by aspiration episode. HFO initiated as rescue therapy several days ago.

Candidate was asked to assess severity of lung disease and outline plan of management.

4 week old boy ventilator dependent following central shunt for hypoplastic left ventricle. Two previous BT shunts failed and extubated for 36 hours.

Candidate was asked to assess suitability for discharge.

10 day old baby, day 1 post Arterial Switch Procedure for Transposition of Great Arteries.

Candidate was asked to assess and outline plan of management for next 24 hours.

Dr Bruce Lister
Chairman, Paediatric Examination Committee

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