COLLEGE OF INTENSIVE CARE MEDICINE
OF AUSTRALIA AND NEW ZEALAND

SECOND PART PAEDIATRIC EXAMINATION REPORT

AUGUST / NOVEMBER 2017

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. Candidates should discuss the report with their tutors so that they may prepare appropriately for future examinations.

The Examination included two 2.5 hour written papers, each composed of 15 ten-minute short answer questions. Candidates were required to score at least 50% in the written paper to be eligible to sit the oral component of the Examination. The oral component comprised 8 interactive vivas and two clinical hot cases.

The tables below provide an overall summary, as well as information regarding performance in the individual sections. A comparison with the previous five examinations is also provided.

The written section of the Examination was held in Auckland, Brisbane, Melbourne and Sydney. The clinical section of the examination was held in Sydney at the Children's Hospital of Westmead, and the vivas were held at the Novotel Sydney Parramatta Hotel.

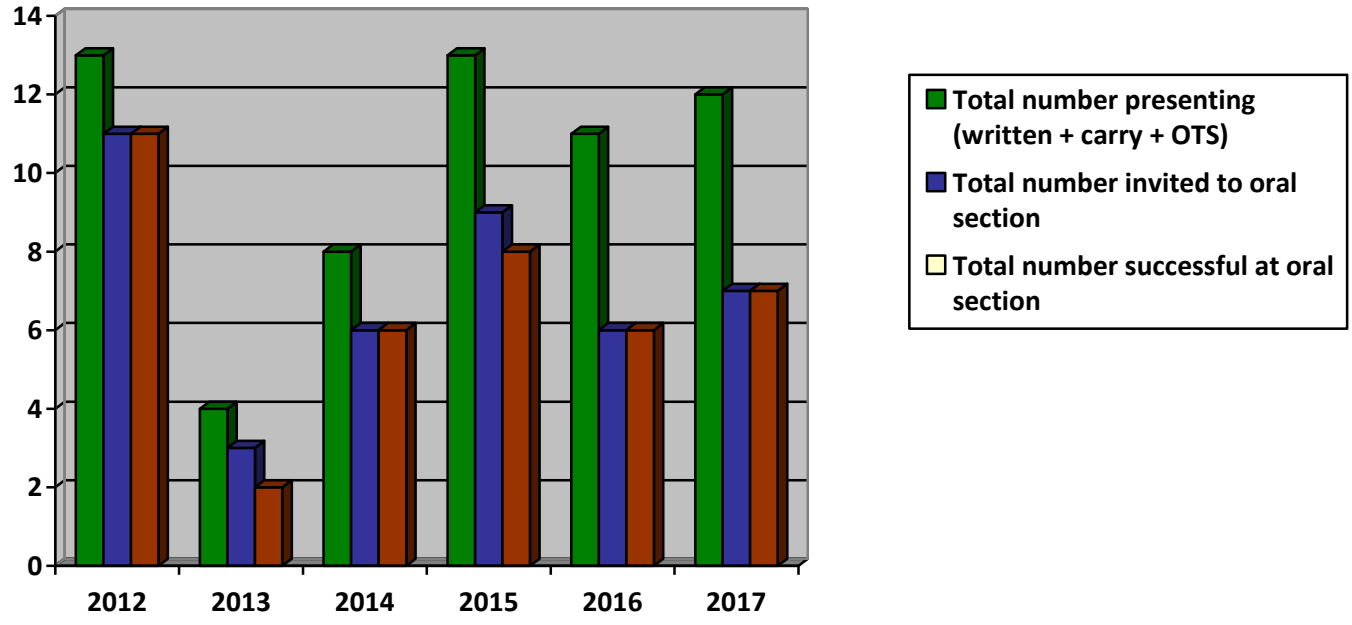
STATISTICAL REPORT

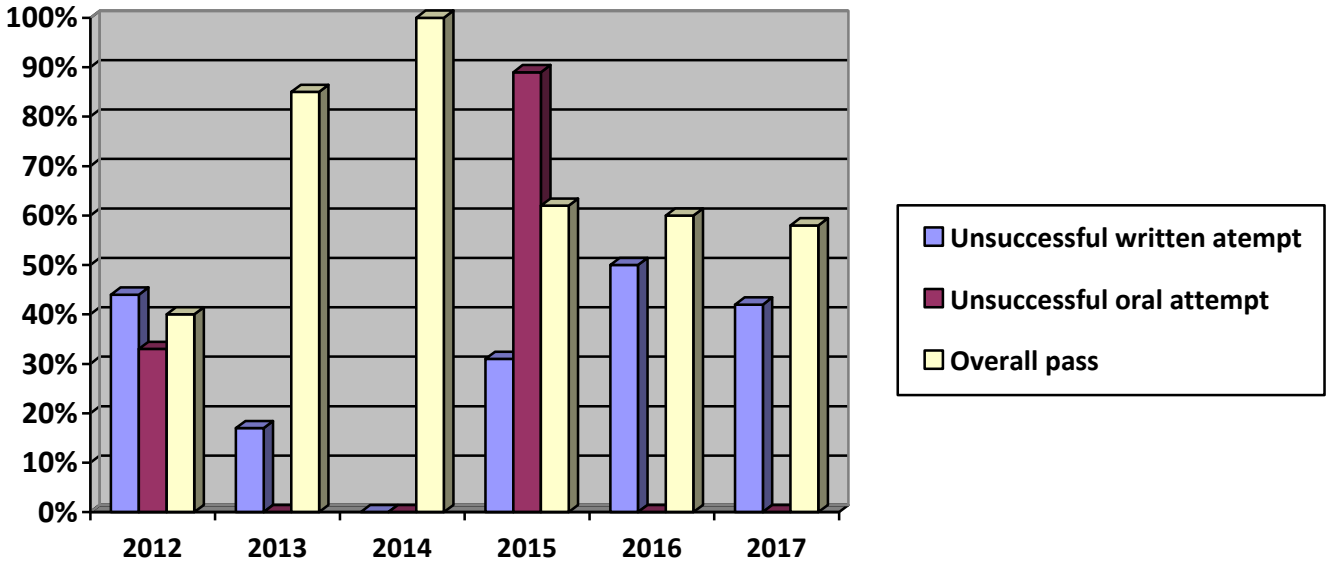
Overall pass rates	**2017**	**2016**	**2015**	**2014**	**2013**	**2012**
Total number presenting (written + carry + OTS)	12	11	13	8	4	13
Total number invited to the oral section	7	6	9	6	3	11
Total number successful at orals	7	6	8	6	2	11
	100%	100%	89%	100%	67%	100%
Overall pass rate	7/12	6/11	2/4	6/8	2/4	11/13
	58%	**55%**	**62%**	**75%**	**50%**	**85%**

Clinical Pass Rates	2017		2016		2015		2014		2013		2012	
	Pass rate	Highest individual mark	Pass rate	Highest individual mark	Pass rate	Highest individual mark	Pass rate	Highest individual mark	Pass rate	Highest individual mark	Pass rate	Highest individual mark
Hot Case 1	71%	75%	100%	80%	78%	80%	83%	90%	67%	63%	100%	83%
Hot Case 2	86%	76%	100%	95%	56%	85%	83%	80%	67%	67%	100%	87%
Total number successful in the Hot Case section	6/7		6/6		8/9		5/6		2/3		11/11	
Overall Hot Case pass rate	86%		100%		89%		83%		67%		100%	

Vivas Pass Rates	2017		2016		2015		2014		2013		2012	
	Pass rate	Highest individual mark	Pass rate	Highest individual mark	Pass rate	Highest individual mark	Pass rate	Highest individual mark	Pass rate	Highest individual mark	Pass rate	Highest individual mark
Viva 1	100%	70%	67%	80%	44%	60%	100%	80%	67%	63%	100%	90%
Viva 2	86%	78%	100%	85%	44%	70%	67%	88%	100%	70%	82%	80%
Viva 3	86%	85%	0%	49%	33%	85%	100%	85%	33%	70%	82%	80%
Viva 4	86%	78%	67%	90%	67%	83%	50%	54%	67%	85%	100%	90%
Viva 5	43%	76%	100%	88%	67%	80%	67%	70%	100%	85%	82%	100%
Viva 6	100%	70%	100%	83%	89%	80%	83%	73%	33%	68%	91%	90%
Viva 7	86%	85%	83%	80%	89%	95%	100%	90%	33%	80%	100%	90%
Viva 8	57%	90%	83%	95%	100%	95%	100%	85%	67%	53%	64%	64%
Total number successful in the Viva section	6/7		6/6		8/9		6/6		2/3		11/11	
Overall Viva pass rate	86%		100%		89%		100%		67%		100%	

Overall Performance





EXAMINERS' COMMENTS

Written Paper

Ten of the thirty short answer questions had a pass rate of less than 50%. Topics covered by questions with a pass rate of less than 30% related to parechovirus infection, octreotide, the atrioventricular node, upper airway obstruction and the anatomy relevant to insertion of a RIJV catheter.

The most common reasons for candidates to fail questions were:

- Insufficient knowledge of the topic
- Insufficient detail or incomplete answer
- Failure to answer the question asked
- Answer not at consultant level

Once again, candidates are reminded that it is crucially important to write legibly; examiners need to be able to read written answers.

Candidates are reminded to read the questions carefully and thoroughly and to include in their answer only information that is relevant to the question. The allocation of marks in multipart questions is shown to allow candidates to organise their answers appropriately. The glossary of terms is provided to help candidates to understand the type of information and structure required in the answer.

Hot Cases

Hot cases run for twenty minutes, with an additional two minutes at the start of each case for the candidate to read a written introduction. The written introduction is to allow candidates greater opportunity to plan a focused approach to the case.

The following comments are a guide to the expected standard for performance in the hot cases:

- Candidates should address and answer the question asked in the introduction.
- Candidates should interpret and synthesise information, rather than just describing the clinical findings.
- Candidates need to seek information relevant to the case in question.
- Candidates should be able to provide a sensible differential diagnosis and appropriate management plan. A definitive diagnosis is not always expected, and in some cases, may yet to be determined.
- Candidates should not rely on a template answer or key phrases, but answer questions in the specific context of the case in question.
- Candidates must be able to describe, with justification, their own practice for specific management issues.

Candidates who performed well in the hot cases were able to demonstrate the following:

- A professional approach, showing respect and consideration for the patient and family.
- Competent, efficient and structured examination technique and an ability to appropriately adapt the examination to suit the case.
- Pursuit of information relevant to the case.
- An ability to interpret and synthesise their findings appropriately.
- Presentation of conclusions in a concise, targeted and systematic fashion.
- Listing of a differential diagnosis that is relevant to the clinical case.
- Discussion of management issues in a mature fashion, displaying confident and competent decision-making.
- Overall performance at the expected level (competent senior registrar / junior consultant).

Candidates who did not perform at the acceptable standard did so for the following reasons:

- Missing or misinterpreting key clinical signs on examination.
- Asking a large number of questions at the start of the case, many of which were not relevant or necessary.
- Incomplete or poor technique for examination of a system.
- Poor synthesis of findings with limited differential diagnosis.
- Poor interpretation of imaging and data.
- Inability to construct an appropriate management plan for the case in question.
- Limited time for discussion as a consequence of taking too long to present the clinical findings or to interpret basic data.
- Inability to convey the impression that he/she could safely take charge of the unit.

Some candidates were able to elicit and describe the clinical signs and data, but were unable to synthesise all the information and to formulate an appropriate management plan.

The overall pass rate was comparable to previous examinations. Comments noted by the examiners when candidates failed cases included:

- Too slow with initial assessment.
- Spent too long at bedside.
- Missed clinical signs / important abnormalities.
- Unfocussed / hesitant examination.
- Lack of clarity and depth in discussion.

Candidates are advised that they should not sit the Fellowship Examination until they can confidently examine patients, present the relevant clinical findings and discuss management issues at the appropriate level (senior fellow/junior consultant). This aspect of the examination requires specific and frequent practice.

Vivas

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.

WRITTEN EXAMINATION REPORT

Instructions to Candidates

a) Write your answers in the blue books provided.

b) Start each answer on a new page and indicate the question number. It is not necessary to rewrite the question in your answer book.

c) You should aim to answer each question in ten minutes.

d) The questions are worth equal marks.

e) Record you candidate number and each question number on the cover of each book and hand in all books.

Glossary of Terms

Critically evaluate:	Evaluate the evidence available to support the hypothesis.
Outline:	Provide a summary of the important points.
List:	Provide a list.
Compare and contrast:	Provide a description of similarities and differences (E.g. Table form).
Management:	Generic term that implies overall plan. Where appropriate, may include diagnosis as well as treatment.
Discuss:	Explain the underlying key principles. Where appropriate, this may include controversies and/or pros and cons.

Notes

Where laboratory values are provided, abnormal values are marked with an asterisk (*).

Images from the SAQ papers are not shown in this report.

Question 1

a) Define and explain the target arterial saturation immediately following the Norwood (Stage 1 palliation) procedure for hypoplastic left heart syndrome, with reference to the Fick principle. (40% marks)

b) List reasons for a low arterial oxygen saturation following the Norwood procedure. (30% marks)

c) List the potential causes of elevated serum lactate following cardiopulmonary bypass. (30% marks)

Comments

50% of candidates passed this question.

The first part of this question required candidates to explain how the target systemic saturation (~75%) reflects a balanced circulation (Qp/Qs ~1) in the presence of complete intracardiac mixing, using the Fick principle. Candidates who clearly understood the underlying physiological principles and assumptions scored highly. Others seemed unable to link the underlying principle and the clinical target.

The remaining two sections were better answered. Candidates who scored highly had an organised approach to each question making their answers more comprehensive. For example, listing causes of pulmonary venous desaturation, central venous desaturation and inadequate pulmonary blood flow in response to part b).

Reference(s)

Cardiology in the Young 2004 14(S1):52 – 60.

Question 2

You are called to assist in the operating theatre with a 6-year-old boy currently anaesthetised for elective adeno-tonsillectomy. He is being resuscitated for presumed anaphylaxis. Following inhalational induction with sevoflurane, intravenous fentanyl, and atracurium, he developed a widespread urticarial rash, bronchoconstriction and hypotension. These have partially responded to fluid boluses and subsequent peripheral adrenaline infusion at 0.5 mcg/kg/min.

Current ventilator settings:

SIMV, FiO_2 1.0, PIP 25 cmH_2O, PEEP 5 cmH_2O, tidal volume 10 ml/kg

Current vital signs:

Heart rate	160 beats/min
Blood pressure	58/30 mmHg
O_2 saturation	93%

a) Describe the pathophysiology of anaphylaxis. (20% marks)

b) Outline your patient-specific and overall management of this situation. (80% marks)

Comments

67% of candidates passed this question.

The underlying pathophysiology of anaphylaxis was poorly understood by some candidates, who did not explain the mechanism of airway obstruction or cardiovascular collapse. Candidates were expected to address basic crisis management principles, ongoing resuscitation, confirmation of diagnosis and treatment of refractory anaphylaxis in the second part of the question.

Question 3

As part of your recent PICU appointment you have been allocated the transport portfolio. Your hospital needs to replace their transport stretchers and equipment as they are not suitable for purpose and no longer comply with federal aviation requirements. You need to liaise with a local engineering firm to organise replacement stretchers and the corresponding new transport equipment.

a) List the essential components of a transport stretcher that is to be used for retrieval work. (50% marks)

b) List the equipment that will need to be accommodated on the stretcher. (50% marks)

Comments

100% of candidates passed this question.

A straightforward question where candidates were required to organize their thoughts about how to approach a practical equipment problem and to provide simple lists in response. In the most part this was well done, although many answers were far from comprehensive.

Reference(s)

Guidelines for Transport of Critically Ill Patients. IC-10(2015) CICM Guideline 2015.

Question 4

Discuss the factors that contribute to systemic oxygenation during venovenous ECMO.

Comments

75% of candidates passed this question.

Answers to this question varied in both depth and scope of understanding. The expected answer should have covered both why and how the following all contribute to oxygenation on VV ECMO: ECMO circuit factors, recirculation of oxygenated blood, patient lung disease, patient cardiac output, Hb, SvO_2, O_2 consumption.

Reference(s)

ASAIO journal 2015; 61:115-21.
Physiology of ECLS. Ch 1 in Extracorporeal Life Support for Adults. Springer, New York, 2016. Ed Schmidt.

Question 5

You are asked to review an unimmunised 7-year-old girl in the Emergency Department with trismus that has developed over the last 18 hours. The initial diagnosis is generalised tetanus.

a) What is the differential diagnosis? (20% marks)

b) How is the diagnosis of tetanus made? (20% marks)

c) What organism is responsible, and how does it produce the clinical signs of generalised tetanus? (30% marks)

d) Outline the treatment of tetanus. (20% marks)

e) List the potential complications of tetanus. (10% marks)

Comments

58% of candidates passed this question.

There was generally a poor understanding of the diagnosis, pathophysiology and treatment of tetanus. This is a topic that has been examined before in the written paper, and candidates are expected to have a working knowledge of this infection.

Reference(s)

Oh's Intensive Care Manual Ch 55.

Question 6

An 18-month-old girl is admitted to PICU following tracheostomy for severe micrognathia and obstructive sleep apnoea.

On day 4, she develops an increased oxygen requirement (FiO_2 from 0.3 to 0.6), associated with increased secretions from the tracheostomy tube.

Her chest X-ray (Figure 1) is shown on page 5.

(Image removed from report.)

a) List the important findings on this chest X-ray. (20% marks)

b) List the potential causes of her deterioration. (30% marks)

c) Outline your management. (50% marks)

Comments

92% of candidates passed this question.

This was a straightforward clinical question about causes and treatment of deterioration in a mechanically ventilated patient. Candidates scored lowest in the management section, where the answer should have included investigation with an aim to diagnosis, and broader strategies than simple adjustment of ventilation (e.g. decompression of the stomach, measures to avoid aspiration, etc.).

Question 7

You are asked to review a 3-week-old child with classical features of parechovirus infection in the Emergency Department.

a) List the common clinical features of parechovirus infection. (20% marks)

b) What are the common laboratory and radiology findings with parechovirus infection? (30% marks)

c) Outline the severe complications of parechovirus infection. (30% marks)

d) Outline the epidemiology of parechovirus infection in infants. (20% marks)

Comments

25% of candidates passed this question.

Many candidates had only superficial knowledge of this topic and answered with generic statements about enteroviral syndromes and their complications. Details, particularly of neurologic manifestations and complications, were sparse.

Reference(s)

Journal of Clinical Virology 60 pp 84-89.
Parechovirus Encephalitis and Neurodevelopmental Outcomes. Pediatrics 137 (2) e:20152848.

Question 8

a) List four methods of temporary cardiac pacing. (10% marks)

b) Explain each of the following terms or acronyms relating to temporary cardiac pacing:

i. Sensitivity (sensing threshold)
ii. Capture threshold
iii. PVARP
iv. Maximum tracking rate (upper rate / upper rate limit)
v. Cross-talk (60% marks)

c) List five causes of loss of pacemaker capture. (30% marks)

Comments

33% of candidates passed this question.

Response to this question was disappointing. Candidates are reminded that the use of postoperative temporary cardiac pacing is a core skill in PICU. Use requires understanding not only of the modes but also troubleshooting, pacing complications and adjustments for rapid pacing rates. Detailed understanding of problems with sensing, capture and pacemaker function are expected.

Reference(s)

Anaesthesia, 62(3), pp.264-271.
Pediatric Critical Care Medicine, 11(1), pp.133-138.

Question 9

A 2-year-old male infant is admitted to the ICU following hot water immersion, with superficial and partial thickness burns to his trunk covering approximately 25% of body surface area. The burns are covered with silver sulphur diazene dressings and surveillance swabs are taken.

Initial investigations are shown below:

Parameter	Patient Value	Normal Range
C-reactive protein	108 mg/L*	< 5
White cell count	10.7 x 10^9/L	6.0 – 17.5
Neutrophil count	6.0 x 10^9/L	1.0 – 8.5

Over the next 48 hours he experiences several episodes of fever (maximum temperature 39ºC) and tachycardia, and develops a need for supplemental oxygen.

Repeat investigations at 48 hours are shown below:

Parameter	Patient Value	Normal Range
C-reactive protein	242 mg/L*	< 5
White cell count	4.9 x 10^9/L*	6.0 – 17.5
Neutrophil count	0.85 x 10^9/L*	1.00 – 8.50

Discuss the differential diagnosis and management.

Comments

83% of candidates passed this question.

This question focused on the differential diagnosis and management of fever in a burns patient. Specifically addressing this was expected - many candidates spent considerable time describing the general management of burns patients. This was awarded some but not full marks. Better responses focused on the specific context presented and how to approach this problem. Points were awarded for considering uncommon but important causes in burns such as toxic shock syndromes.

Reference(s)

J Burns Care Research 2014;35:291-295.
Annals of Plastic Surgery 2010;65.

Question 10

Outline the incidence, epidemiology and management of perioperative stroke in infants and children undergoing cardiac surgery for congenital heart disease.

Comments

33% of candidates passed this question.

Perioperative stroke is common and important. Candidates are expected to be comfortable with risks, acute diagnosis and the complexities of management. Many answers were superficial and failed to provide detail on both investigation and management of anticoagulation. Few answers discussed the role of intervention and the problems this might entail.

Reference(s)

Ann Thorac Surg. 2009, 88(3) 823-9.

Question 11

A 4-year-old Sudanese girl presents with depressed conscious state, headache, irritability and fever for four days.

A single axial image from her cranial CT scan is shown below:

(Image removed from report.)

a) List the pertinent findings on the CT scan image. (20% marks)

b) List potential causes for this clinical presentation. (40% marks)

c) What other investigations will you perform? (40% marks)

Comments

58% of candidates passed this question.

Candidates were provided with a straightforward CT scan, then asked for a 'list' of possible aetiologies and an investigative approach. Better responses could identify the likely aetiologies and how to best confirm them, remembering the importance of the ethnic origin. Whilst African children are at increased risk of particular CNS pathologies, more mundane causes, such as undiagnosed congenital or infectious heart disease, are also possible. Better answers reflected this.

Reference(s)

Lancet Neurology 2014;13;35-43.

Question 12

a) Draw a typical action potential in a cardiac ventricular myocyte, labelling the phases of depolarisation and repolarisation. (50% marks)

b) Describe the principal ionic fluxes that occur in each phase. (50% marks)

Comments

42% of candidates passed this question.

Answers to this question varied greatly in quality. This subject matter is important in understanding the use of anti-arrhythmic drugs and in the pathophysiology of certain rhythm disturbances. Half of the marks were allocated to drawing a simple diagram, which some candidates failed to even attempt. Some candidates were able to convey a good understanding of ionic fluxes and changes in the membrane potential.

Reference(s)

T Oh 7th Ed Ch 22.

Question 13

A previously well 9-year-old boy is admitted to PICU with diabetic ketoacidosis.

Observations on admission are shown below:

Heart rate	140 beats/min
Blood pressure	72/41 (mean 50) mmHg
Glasgow Coma Scale	10/15

His laboratory investigations are shown below:

Parameter	Patient Value	Normal Range
Haemoglobin	165 g/L*	110 – 145
White cell count	36.7 x 10^9/L*	5.0 – 17.0
Platelets	255 x 10^9/L	150 – 400
Sodium	142 mmol/L	135 – 145
Potassium	4.3 mmol/L	3.5 – 5.0
Chloride	107 mmol/L	98 – 110
Urea	15.8 mmol/L*	2.1 – 6.5
Creatinine	330 µmol/L*	10 – 60
Glucose	40.0 mmol/L*	3.6 – 5.4
Phosphate	2.3 mmol/L*	1.1 – 1.8
Betahydroxybutyrate (ketones)	> 10.38 mmol/L*	< 0.30
pH	6.83*	7.35 – 7.45
$PaCO_2$	12 mmHg (1.6 kPa)*	32 – 45 (4.3 – 6.0)
PaO_2	154 mmHg (20.5 kPa)*	80 – 100 (10.7 – 13.3)
Bicarbonate	1 mmol/L*	18 – 25
Base Excess	-30.8 mmol/L*	-4.0 – +3.0

a) List the risk factors for cerebral oedema in children with diabetic ketoacidosis. (20% marks)

b) Outline your management of this patient in the first 24 hours, including how you will monitor the child's response to therapy. (30% marks)

After 18 hours, the child's Glasgow Coma Scale remains 10/15. Most recent laboratory results are shown below:

Parameter	Patient Value (24 hours)	Normal Range
Haemoglobin	127 g/L	110 – 145
White cell count	12.9 x 10^9/L	5.0 – 17.0
Platelets	74 x 10^9/L*	150 – 400
Sodium	149 mmol/L*	135 – 145
Potassium	2.9 mmol/L*	3.5 – 5.0
Chloride	127 mmol/L*	98 – 110
Urea	18.9 mmol/L*	2.1 – 6.5
Creatinine	295 µmol/L*	10 – 60
Glucose	13.0 mmol/L*	3.6 – 5.4
Phosphate	0.35 mmol/L*	1.1 – 1.8
Betahydroxybutyrate (ketones)	< 0.15 mmol/L	< 0.30
pH	7.13*	7.35 – 7.45
$PaCO_2$	20 mmHg (2.7 kPa)*	32 – 45 (4.3 – 6.0)
PaO_2	117 mmHg (15.6 kPa)*	80 – 100 (10.7 – 13.3)
Bicarbonate	9 mmol/L*	18 – 25
Base Excess	-20.6 mmol/L*	-4.0 – +3.0

c) Interpret these blood results. (20% marks)

d) Assuming appropriate ongoing management of diabetes, outline your further management of this child. (30% marks)

Comments

8% of candidates passed this question.

The first half of this question asked candidates to show their knowledge of DKA management and the potential for cerebral oedema. The second part demanded interpretation of subsequent blood results (candidates are reminded that this requires more than listing already highlighted abnormalities) and further management based on this interpretation. Quality answers would have discussed appropriate investigation for causes, and ongoing management, of acute kidney injury and thrombocytopaenia in this setting.

Question 14

Octreotide has been proposed as a treatment for chylothorax following cardiac surgery.

a) What is octreotide? (20% marks)

b) List the physiological properties of octreotide. (30% marks)

c) What are the potential side effects of intravenous administration of octreotide? (30% marks)

d) Briefly outline the evidence for octreotide use in this setting. (20% marks)

Comments

25% of candidates passed this question.

A surprising number of candidates knew very little about a drug that is commonly used in PICU to treat persistent chylothorax, with hardly any adequate descriptions of its properties. The last part of the question required only a brief answer indicating the lack of high quality evidence for this practice.

Question 15

a) Describe the definition of Paediatric ARDS in a previously well child, using the 2015 Paediatric Acute Lung Injury Consensus Conference (PALICC) criteria. Include the definitions for both invasive and non-invasive ventilation. (50% marks)

b) How is the oxygenation index (OI) calculated? (10% marks)

c) How is the O_2 saturation index (OSI) calculated? (10% marks)

d) What conditions other than ARDS should be considered in the differential diagnosis of a school-aged child presenting with acute respiratory failure who fails to respond to conventional treatment and management? (30% marks)

Comments

75% of Candidates passed this question.

The first parts of this question were generally well answered, with candidates able to reproduce the PALICC criteria and OI & OSI formulae. The last third of the question required candidates to think more widely and laterally about diseases that might present with respiratory failure. A well organised response would have included examples of infections, cardiac diseases, auto-immune disease, storage diseases, environmental lung disease etc. This was poorly done, with many answers limited to a very few categories and examples.

Reference(s)

Pediatric Crit Care Med 2015; 16:S23–S40.
Intensive Care Med 2015; 41:1099–1102.

Question 16

Critically appraise the evidence for therapeutic hypothermia following cardiac arrest in children.

Comments

58% of candidates passed this question.

There were some quality responses to this question, but many were disappointing, given the topical and prominent subject matter. The expected answer included discussion of context incorporating the adult literature in this field, but the bulk of marks was reserved for detail of design and results of the THAPCA trials, including nuanced interpretation and limitations.

Reference(s)

Moler, N Engl J Med 2015; 372:1898-1908.
Moler N Engl J Med 2017; 376:318-329.
Barnard, N Engl J Med 2002;346:557-563.
Nielsen, N Engl J Med 2013;369:2197-2206.

Question 17

A 5-year-old child presents to the Emergency Department with a 2-week history of fever and nuchal rigidity after returning from India one month ago. He has a temperature of 40ºC, scleral icterus and hepatosplenomegaly, and is drowsy but opens his eyes in response to voice.

Falciparum malaria has been identified on blood smears.

Laboratory results on admission are shown below:

Parameter	Patient Value	Normal Range
pH	7.46*	7.34 – 7.43
pCO_2	27 mmHg (3.55 kPa)*	32 – 45 (7.41 – 6.06)
pO_2 (venous)	35 mmHg (4.60 kPa)	
Base excess	-3.9 mmol/L	-4.0 – +3.0
O_2 saturation (venous)	71.3%	
Bicarbonate	18.6 mmol/L*	22.0 – 26.0
Sodium	127 mmol/L*	135 – 145
Potassium	5.5 mmol/L	3.5 – 5.5
Chloride	102 mmol/L	95 – 110
Ionized calcium	1.05 mmol/L*	1.19 – 1.29
Glucose	4.0 mmol/L	3.5 – 5.5
Lactate	3.1 mmol/L*	0.7 – 2.0
Urea	5.4 mmol/L	2.0 – 6.8
Creatinine	52 µmol/L*	20 – 44
Albumen	30 g/L*	35 – 51
Bilirubin Total	160 µmol/L*	1 – 10
Bilirubin (conjugated)	135 µmol/L*	1 – 10
AST	83 U/L*	10 – 50
ALT	120 U/L*	0 – 45
GGT	76 U/L*	0 – 45
ALP	295 U/L	110 – 370
Haemoglobin	115 g/L	115 – 140
White cell count	10.2 x 10^9/L	5.0 – 14.5
Platelet count	15 x 10^9/L*	150 – 600
INR	1.1	1.0 – 1.2
APTT	37.8 sec*	23.0 – 34.0
Fibrinogen	2.4 g/L	1.5 – 6.0

a) Outline your management over the next 24 hours. (60% marks)

b) List up to <u>eight</u> patient and/or laboratory features of severe malaria that are associated with a poor prognosis. (40% marks)

Comments

33% of candidates passed this question.

There were marks available for general supportive management measures (monitoring, fluids, ventilation, treatment of seizures), but candidates could only score highly if they included monitoring, investigation and treatments aimed specifically at cerebral malaria. Malaria is rarely encountered in our region, but recognition and an understanding of treatment principles and prognosis are all important.

Reference(s)

Arch Dis Child 2016; 101:1004-9.

Question 18

a) List four conditions for which paediatric lung transplant is undertaken. (10% marks)

b) List three absolute and three relative contraindications to lung transplant. (30% marks)

c) List the important management issues in PICU following lung transplantation. (30% marks)

d) What is the expected 5-year survival following paediatric lung transplantation? (10% marks)

e) List the major complications that contribute to morbidity and mortality following paediatric lung transplantation. (20% marks)

Comments

50% of candidates passed this question.

The principles of Paediatric lung transplantation and the management of transplant recipients are core knowledge. Most answers betrayed a lack of familiarity with the subject matter.

Reference(s)

J Thorac Dis 2014;6(8) 1024-31.

Question 19

A 1-month-old baby develops complete heart block overnight following repair of a complete atrioventricular septal defect (AVSD). Five days later the baby is recovering well, but complete heart block persists.

a) What will you tell the parents about the likelihood of needing a permanent pacemaker? (10% marks)

b) Describe the anatomical position of the AV node. (30% marks)

c) List three functional differences between the AV node in newborns and in older children. (15% marks)

d) Why is heart block a recognized complication of AVSD repair? (20% marks)

e) List five non-surgical causes of complete heart block that are encountered in PICU. (25% marks)

Comments

8% of candidates passed this question.

This question examined properties of the infant AV node (AVN), and causes and natural history of heart block. The position of the AVN, and variations with specific lesions, explain its propensity to trauma during certain surgeries. Most candidates were unable to describe the position of the AVN, and were therefore unable to discuss its specific vulnerability in AVSD repair. Properties of the newborn AVN (rapid conduction, conduction at rapid rates, capacity for retrograde conduction) were also poorly described.

Question 20

A 2-week-old boy is admitted to PICU from NICU for airway assessment. He was intubated at birth for stridor and upper airway obstruction, and has failed extubation twice due to airway obstruction.

a) List a differential diagnosis for this baby. (30% marks)

b) Compare bronchogram and chest CT scan for the assessment of tracheomalacia. (20% marks)

c) Outline the physiology of airway obstruction in a spontaneously breathing child with tracheomalacia. (20% marks)

d) Draw ventilator flow volume loops for tracheal stenosis and tracheomalacia in a spontaneously breathing child. (30% marks)

Comments

25% of candidates passed this question.

Many of the candidates failed to identify the difference between intra and extra thoracic components of the trachea in their answer and almost all struggled with the flow volume loops. The list of differentials was often incomplete, and many were not well structured.

Reference(s)

Front Pediatric 2017: https://doi.org/10.3389/fped.2017.00060*.*
Arch Dis Child Fetal Neonatal Ed 2005;90:F290–F293.

Question 21

a) Describe a standardised definition and scoring system for acute kidney injury in children. (40% marks)

b) What is contrast-induced nephropathy (CIN)? (20% marks)

c) List the relevant risk factors for CIN in PICU. (20% marks)

d) Which therapies may be useful in preventing CIN? (20% marks)

Comments

67% of candidates passed this question.

Most candidates were able to give a reasonable description of a scoring system (pRIFLE, AKIN or KDIGO). However, knowledge of contrast induced nephropathy was limited, particularly regarding potential strategies to prevent its occurrence.

Reference(s)

Nephrology Dialysis Transplant 2012;27:4263-4272.

Question 22

Describe the anatomy relevant to the insertion of a right-sided internal jugular vein catheter.

Comments

0% of candidates passed this question.

Many of the candidates failed to address the question, which was to describe the anatomy and not the ultrasound appearance. Most focussed on the practicalities of insertion, rather than the anatomy relevant to accessing the vein, with its associated landmarks and other structures.

Reference(s)

Applied Anatomy for Anaesthesia and Intensive Care / Andy Georgiou, Chris Thompson and James Nickells – Cambridge University Press, 2014.

Question 23

In table form, compare and contrast sugammadex and neostigmine for the reversal of neuromuscular blockade. Include dose, onset time, indications, mechanism of action, neuromuscular blocking drugs reversed, adverse effects, mode of elimination and relative cost.

Comments

42% of candidates passed this question.

Although reversal of neuromuscular blockade is more commonly undertaken in theatre, a working knowledge of these drugs is important in ICU. Many candidates had little knowledge of the mechanisms of action and the adverse effects of these drugs.

Reference(s)

Critical care and resuscitation 2013;15:57-62.

Question 24

You suspect smoke inhalation injury in a 5-year-old child admitted after being rescued from a house fire. The child is intubated and ventilated with a FiO_2 of 0.5.

Pulse oximetry reads 98% and central venous saturation is 84% (taken from internal jugular line that is placed at the junction of the right atrium and superior vena cava).

His initial arterial blood gas results are shown below:

Parameter	Patient Value	Normal Range
pH	7.20*	7.34 – 7.45
$PaCO_2$	34 mmHg (4.5 kPa)*	35 – 45 (4.7 – 6.0)
PaO_2	100 mmHg (13.3 kPa)	80 – 100 (10.7 – 13.3)
Bicarbonate	15 mmol/L*	21 – 28
Base excess	-11*	-3 – +3
O_2 saturation	88%*	> 95%
Methaemoglobin	0.2%	0.2 – 1.5
Carboxyhaemoglobin	18.0%*	< 6.0
Lactate	6.9 mmol/L*	< 2.0

Using a table, compare the two major toxidromes suspected in this child, listing the sources of the toxidromes, how they are detected, the mechanism of toxicity, clinical findings, treatment, and how toxicity will manifest at different levels of the toxin.

Comments

50% of candidates passed this question.

Candidates were expected to recognize the potential for cyanide toxicity and carbon monoxide poisoning. Some candidates ignored half of the question, with answers pertaining only to CO poisoning. Many candidates lost marks because they failed to describe the mechanisms of toxicity adequately. The clinical findings and treatment sections of the question were generally better answered.

Reference(s)

Am J Respir Crit Care Med 2012; 186 (11):1095-101.
N Engl J Med 1991;325(25):1761-6.

Question 25

Critically evaluate the use of beta blockers and androgens to modify the metabolic response to severe burns in children. Do *not* include a discussion of nutrition.

Comments

100% of candidates passed this question.

This was a difficult question, and allowance was made for this during marking. Literature for both of these adjunctive burns therapies is limited, and there is insufficient evidence for routine use of either.

Reference(s)

Hospital Paediatrics 2015; 5:446-451. N Engl J Med 2001; 345: 1223-1229. J Am Coll Surg 2012; 214:489-504. Shock 2016; 45:367-374.

Question 26

The receiver operating characteristic (ROC) curve can be used to represent the accuracy of a diagnostic test.

a) Draw and label a typical ROC curve. (30% marks)

b) What information does the area under the ROC curve convey? (35% marks)

c) How is the optimal cut-off value for a test chosen using the ROC curve? (35% marks)

Comments

42% of candidates passed this question.

There were some excellent answers to this question, but several candidates displayed a lack of familiarity with the ROC curve, which is commonly used in the ICU literature. This material has been examined previously in the written paper.

Reference(s)

Acta Paediatrica 2007;96:644-7.

Question 27

A 6-year-old girl is admitted to PICU with progressive respiratory failure 14 days following a haematopoietic stem cell transplant (HSCT) from a matched unrelated donor. She is placed on non-invasive ventilation. The chest X-ray reveals widespread airspace opacification.

She is receiving non-invasive ventilation with an inspiratory pressure of 22 cmH_2O and expiratory pressure of 12 cmH_2O through a full-face mask at a rate of 15 breaths/min. The fractional inspired oxygen concentration is 80%. The SpO_2 is 88%.

Based on the deteriorating clinical situation, you decide she requires intubation and invasive mechanical ventilation.

a) Briefly outline your approach to minimising the risks of induction and intubation. (30% marks)

b) Briefly outline your initial approach to mechanical ventilation, including arterial blood gas targets. (30% marks)

c) List the likely causes of her respiratory disease. (30% marks)

d) What is the survival to discharge from PICU rate of children who are intubated and ventilated for hypoxic respiratory failure following HSCT (to within 10%)? (10% marks)

Comments

100% of candidates passed this question.

This was a straightforward question where candidates were expected to describe their approach to a high-risk intubation, with subsequent ventilation for ALI/ARDS. The latter parts of the question depended

on knowledge of likely causes of respiratory failure and prognosis in HSCT. There were some excellent answers.

Reference(s)

Pediatric Critical Care Medicine 2016; 17(3):e109-e116.

Question 28

a) Discuss the timing of parenteral nutrition in critically ill children. (50% marks)

b) List the problems and complications associated with parenteral nutrition. (50% marks)

Comments

58% of candidates passed this question.

An understanding of the NEJM paper referenced below was expected in the first part of the question, and candidates were expected to interpret this study for day-to-day practice. The second part of the question was relatively simple, and was generally better answered.

Reference(s)

N Engl J Med 2016; 374:1111.
Journal of Paediatric Gastroenterology and Nutrition. 2005; 41:S1-S53.

Question 29

A 14-year-old girl, two weeks following a renal transplant has severe pain from generalised Stephens-Johnson syndrome involving her eyes, pharynx, vagina and 50% of her skin. Tacrolimus was thought to be the trigger and has been stopped.

She has developed renal dysfunction but is not currently dialysed:

Parameter	Patient Value	Normal Range
Urea	28.0 mmol/L*	2.1 – 6.5
Creatinine	196 µmol/L*	20 – 60

a) Outline how you will approach her pain management. (50% marks)

b) Outline how her renal impairment will affect your prescribing. Your answer must include drugs from five different categories. (50% marks)

Comments

92% of candidates passed this question.

Candidates approached the first part of this question in a variety of ways. Those that were most structured scored best, particularly if a tiered approach, responding to the patient's clinical state, was described. Many candidates did not mention non-pharmacological aspects of pain management. The second part of the question was often interpreted more broadly than the intended changes to analgesic prescription. This approach was not penalised.

Question 30

A 9-year-old, previously well aboriginal boy from the tropical Northern Territory, presented to his local community hospital with a 5-day history of fever, lethargy, vomiting, headache and difficulty walking and has been transferred to your ICU.

On presentation, he is febrile (38.5˚C), however his other vital signs are normal. He has cerebellar signs (truncal ataxia, nystagmus, past pointing, intention tremor, staggering gait) and a left cranial nerve six palsy. He has no meningism. His Glasgow Coma Scale is 15.

His electrolytes creatinine and urea are normal. Other laboratory investigations are shown below. A non-contrast head CT scan is normal.

Parameter	Patient Value	Normal Range
White blood cell count	13.2 x 10^9/L *	4 – 11
Neutrophils	9.8 x 10^9/L	1.8 – 7.5
Lymphocytes	2.1 x 10^9/L	1.5 – 3.5
C reactive protein	5 mg/L	< 8
Erythrocyte sedimentation rate	70 mm/hr*	3 – 13
Cerebrospinal fluid protein	0.97 g/L*	< 0.40
Cerebrospinal fluid cell count	12 polymorphs, 6 lymphocytes, 0 red blood cells. No bacteria seen.	

Four T2-weighted axial brain MRI scans *(*Figures 1 – 4) are shown below:

(Images removed from report.)

a) List the distribution of the enhancing lesions seen on the MRI scan. (20% marks)

b) List your differential diagnosis. (45% marks)

c) Briefly outline the role of corticosteroids in treatment of each of your differential diagnoses. (35% marks)

Comments

50% of candidates passed this question.

There were simple marks here for describing the distribution of MRI abnormalities. Some candidates struggled with the second part of the question, providing a very limited differential diagnosis (which was worth 45% of the marks). The expected answer covered a wide variety of CNS infections and causative agents, including melioidosis, and some non-infective causes (ADEM, tumour, inhalant abuse). Marks available for the third part depended on a good answer to part b).

ORAL SECTION

The Clinical Section

The Clinical Section (2 clinical cases – 20 minutes per case) was conducted in the Paediatric Intensive Care Unit at the Children's Hospital at Westmead, Sydney.

Candidates who approach the clinical examination of the patient and presentation of findings in an organized manner will impress the examiners. 30% of the overall marks are allocated to the two clinical cases. Candidates should bear this in mind when preparing for the examination.

Candidates were given a written introduction to the hot cases which they studied for 2 minutes prior to commencement. This allowed candidates time to think about how best to approach the case, what information to seek and how to structure the examination. These two minutes are in addition to the 20 minutes taken to perform the hot case.

Cases are usually presented as problem solving exercises. For maximum marks, candidates should demonstrate a systematic approach to examination, clinical signs should be demonstrated, and a reasonable discussion regarding their findings should follow.

Some candidates waste valuable time at the start of the case by spending more than a couple of minutes around the bedside before actually examining the patient. Exposing the patient should be limited to those areas that are necessary for that component of the examination. Candidates must show appropriate courtesy and respect to patients and their families if present during the examination.

The twenty minutes available for each case provides ample opportunity to discuss investigations and plans of management. Candidates are reminded that a large proportion of the marks are allocated to coherent presentation and synthesis, discussion and reasoning. Candidates should approach the case discussion in a consultant-like manner.

Cases encountered in the clinical component of the examination included:

- A 5-month-old girl, 4 days after a Ross-Konno procedure.
- A 17-year-old girl with sepsis following a second liver transplant.
- A 2-day-old boy, 2 days following an open atrial septectomy for hypoplastic left heart syndrome.
- A 9-year-old girl, 1 month after a traumatic brain injury.

Viva Section

There are 8 stations of ten minutes each for structured vivas. Two minutes are provided to read an introductory scenario (which includes the initial question) outside each viva room. This same information is also provided inside the viva room.

The following are the introductory scenarios and questions provided to the candidates:

Viva 1

A 7-year-old girl weighing 20 kg is brought in by ambulance after she was struck by a car doing 60 km/hr.

She had a Glasgow Coma Score of 9 at the scene and was intubated uneventfully by paramedics prior to transport.

She arrives in ED and is being hand-ventilated in 100% oxygen.

Initial observations:

SpO_2 92%
Pulse 140 beats per minute
Blood Pressure 80/40 mmHg

What are your immediate clinical concerns with this patient?

Viva 2

A 5-month-old baby weighing 7 kg is admitted to PICU following a complete repair of Tetralogy of Fallot. He has been previously well, with no previous surgery. His preoperative saturations were in the low 80's.

The operative procedure was uneventful with 150 minutes of cardiopulmonary bypass, and 70 minutes cross-clamp time. The repair involved patch VSD closure, muscle bundle resection from a very thick right ventricle and a transannular patch repair of the right ventricular outflow tract. A small inter-atrial communication has been made. There was a brief period of junctional rhythm during rewarming. Transoesophageal echo post repair showed no important residual lesions.

He is receiving dobutamine at 5 micrograms/kg/minute, along with morphine and midazolam infusions.

Ventilator settings:

Pressures 22/5 cmH_2O, rate 30 breaths per minute, FiO_2 0.5
Tidal volume 9 mls/kg

Initial observations:

Temperature 35.5°C
Heart rate 160 beats per minute (sinus rhythm)
Blood pressure 80/50 mmHg
Central venous pressure 12 mmHg
SpO_2 95%
Cerebral NIRS 65%
Arterial lactate 1.5 mmol/l

What are your concerns during the first postoperative evening for this patient?

Viva 3

A 4-year-old girl with a history of Acute Myelogenous Leukaemia (AML) and a bone marrow transplant 2 weeks ago has been transferred to PICU with significant and ongoing haematemesis and melaena.

An endoscopy is scheduled in 4 hours' time.

Heart rate 160 beats per minute
Blood pressure 74/30 mmHg
Weight 15 kg

Parameter	Patient Value	Normal Range
Haemoglobin	40*	105 – 135 g/L
Platelets	16*	150 – 400 x 10^9/L
White Cell Count	0.7*	6.0 – 18.0 x 10^9/L
Neutrophils	0.1*	1.0 – 8.5 x 10^9/L
Lymphocytes	0.2*	4.0 – 10.0 x 10^9/L
Monocytes	0.1*	0.1 – 1.0 x 10^9/L
Bands	0.2*	0.0 – 0.5 x 10^9/L
INR	3.1*	0.8 – 1.2
APTT	78*	27 – 53 Sec
Fibrinogen	0.6*	0.8 – 3.8 g/L

Discuss your immediate transfusion strategy.

Viva 4

A previously well, 70 kg 16-year-old boy is being transferred from a small hospital in tropical (northern) Australia to your PICU.

He has a 2-week history of sore throat, headache and myalgia, 5 days of fevers and night sweats, vomiting and loose stools. He is a student and lives in town with no recent bush, farm, overseas travel or creek/dam water exposure. There are no known TB contacts. He was given 2 litres of fluid resuscitation at the time of presentation 24 hours ago and developed increasing work of breathing and hypoxia. He was subsequently intubated and ventilated and has become increasingly difficult to ventilate.

Initial laboratory tests at the local hospital are shown below:

Parameter	Patient Value	Normal Range
Sodium	126 mmol/L*	135 – 145 mmol/L
Potassium	3.6 mmol/L*	3.5 – 5.2 mmol/L
Chloride	94 mmol/L*	95 – 110 mmol/L
Urea	5.0 mmol/L	2.1 – 7.1 mmol/L
Creatinine	111 mmol/L*	60 – 110 mmol/L
Albumin	28 g/L*	35 – 50 g/L
Haemoglobin	114 g/L*	135 – 180 g/L
Platelets	44 x 10^9/L*	140 – 400 x 10^9/L
White Cell Count	3.4 x 10^9/L* Neutrophils 2.48 x 10^9/L* Lymphocytes 0.48 x 10^9/L*	4 – 11 x 10^9/L 2 – 8 x 10^9/L 1 – 4 x 10^9/L
C Reactive Protein	169 mg/L*	< 5.0 mg/L

Outline your differential diagnosis and your initial approach to investigation.

Viva 5

A 10-year-old 40 kg patient with severe sepsis and pneumonia that was refractory to conventional treatment has been placed on VA ECMO via femoral vessels 5 hours ago. A 19 F arterial and 22 F venous ECMO cannula have been placed in the right femoral artery and vein respectively.

The patient is receiving a cardiac index of 2.4 l/min/m^2 via the VA ECMO circuit. You notice purpura on fingers and toes. The heart rate is 110 beats per minute and the blood pressure is 80/40 mmHg, with a mean of 60 mmHg.

Ventilator settings are:

PEEP 10 cmH_20
PIP 20 cmH_2O (10 above PEEP)
Rate 10 breaths per minute
FiO_2 0.4
Inspiratory time 1.5 seconds

Arterial blood gas:

Parameter	Patient Value	Normal Range
pH	7.35	7.34 – 7.43
pCO_2	36 mmHg (4.80 kPa)	35 – 45 mmHg (4.67 – 6.00 kPa)
pO_2	44 mmHg (5.87 kPa)*	80 – 105 mmHg (10.67 – 14.00 kPa)
SaO_2	77%*	
Lactate	5.8 mmol/l*	1.0 – 1.8 mmol/l

The lactate is unchanged since cannulation.

What is your differential diagnosis for this blood gas?

Viva 6 – Procedure viva

A 4-month-old 6 kg infant with SVT and poor cardiac function has been accepted into PICU from cardiology clinic.

They are being admitted for semi-elective cardio version - you are senior clinician co-ordinating the child's care.

They have been feeding poorly off and on for 3 months. The heart rate has ranged between 150-280 beats per minute and the cardiac performance is poor on echocardiogram, there is no pericardial effusion. Adenosine resulted in only brief sinus pauses in clinic.

On examination the infant has a heart rate of 240 beats per minute, systolic blood pressure 65 mmHg, prolonged capillary refill and cool peripheries. The respiratory rate is 72 breaths per minute, with subcostal recession evident. There are scattered crackles but no wheeze on auscultation. The liver is 4 cm below the costal margin. Oxygen saturation recordings – when available – are in the low 90's.

The venous gas is shown below. The child has been placed in high-flow nasal cannulae gas at 8 litres per minute. The infant last fed 6 hours ago.

Outline your approach to stabilising the child for cardioversion.

Viva 7 – Radiology Viva

Candidates were shown and asked to comment on a series of plain X-ray, CT and MR images from unrelated cases, including a diaphragmatic hernia, necrotizing enterocolitis, traumatic spinal cord injury, intracranial haemorrhage and empyema with massive air leak.

Viva 8 – Communication Viva

A 3-month-old infant is admitted to your intensive care unit following a cardiorespiratory arrest on the ward. The patient was discharged from PICU 36 hours ago after a 10-day admission with pertussis. The patient was transferred to the ward on room air having had no episodes in the previous 48 hours that required nursing or medical intervention. You were not on when the decision to discharge was made.

The patient was found by the ward nurse apnoeic and pulseless. His recordings from 10 minutes before were heart rate 167, SpO_2 96%, temperature 38.6ºC.

He underwent 6 minutes of CPR with 1 dose of adrenaline before return of circulation. He has been transferred back to PICU intubated and ventilated on a low dose adrenaline infusion.

The mother arrives and demands to speak with the “doctor in charge”. She seems very upset and angry.