COLLEGE OF INTENSIVE CARE MEDICINE
OF AUSTRALIA AND NEW ZEALAND

SECOND PART PAEDIATRIC EXAMINATION

EXAM REPORT

AUGUST / NOVEMBER 2021

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 written section of the Examination was held in Auckland, Brisbane, Melbourne, and Sydney. The Examination included two 2.5 hour written papers, each composed of 15 ten-minute short answer questions. The pass mark for the written section is derived by the Angoff method and for this sitting was set at 50.9%.

The clinical section of the examination was held in Auckland, Brisbane, Melbourne, and Sydney, and the vivas were held at the Cliftons in Auckland, Brisbane, Melbourne, and Sydney. 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.

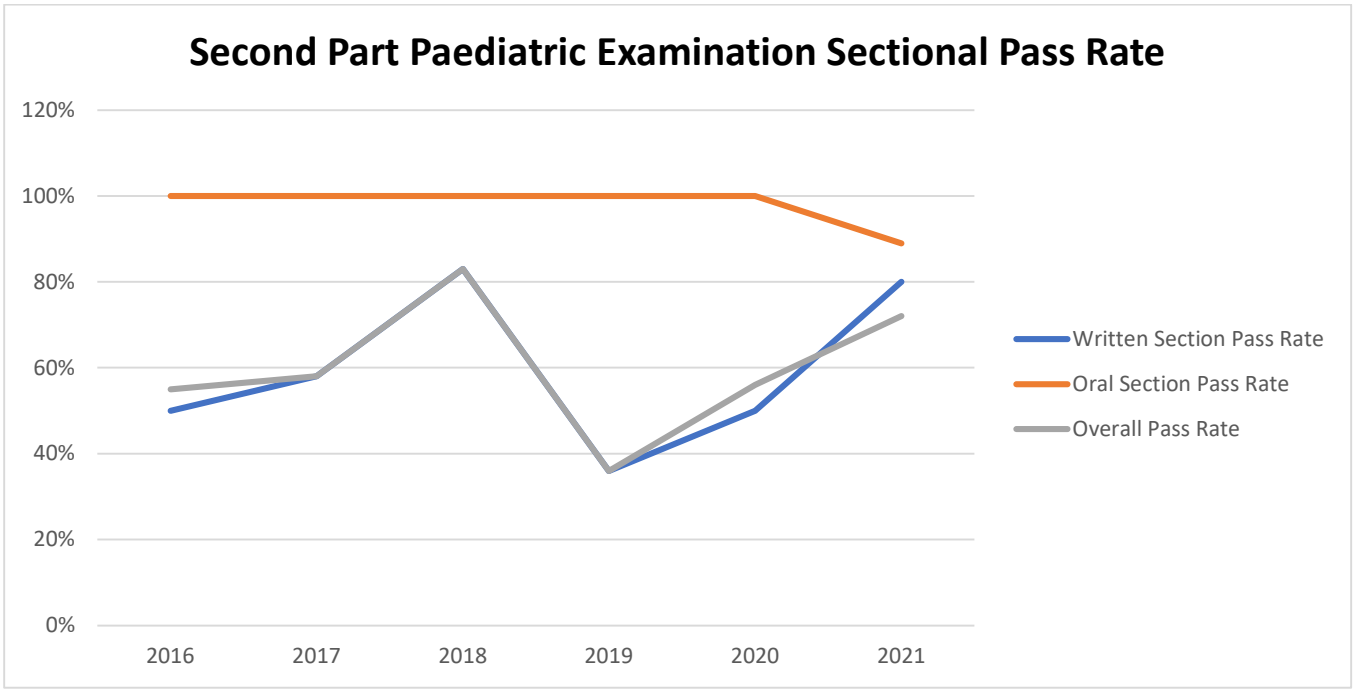
STATISTICAL REPORT

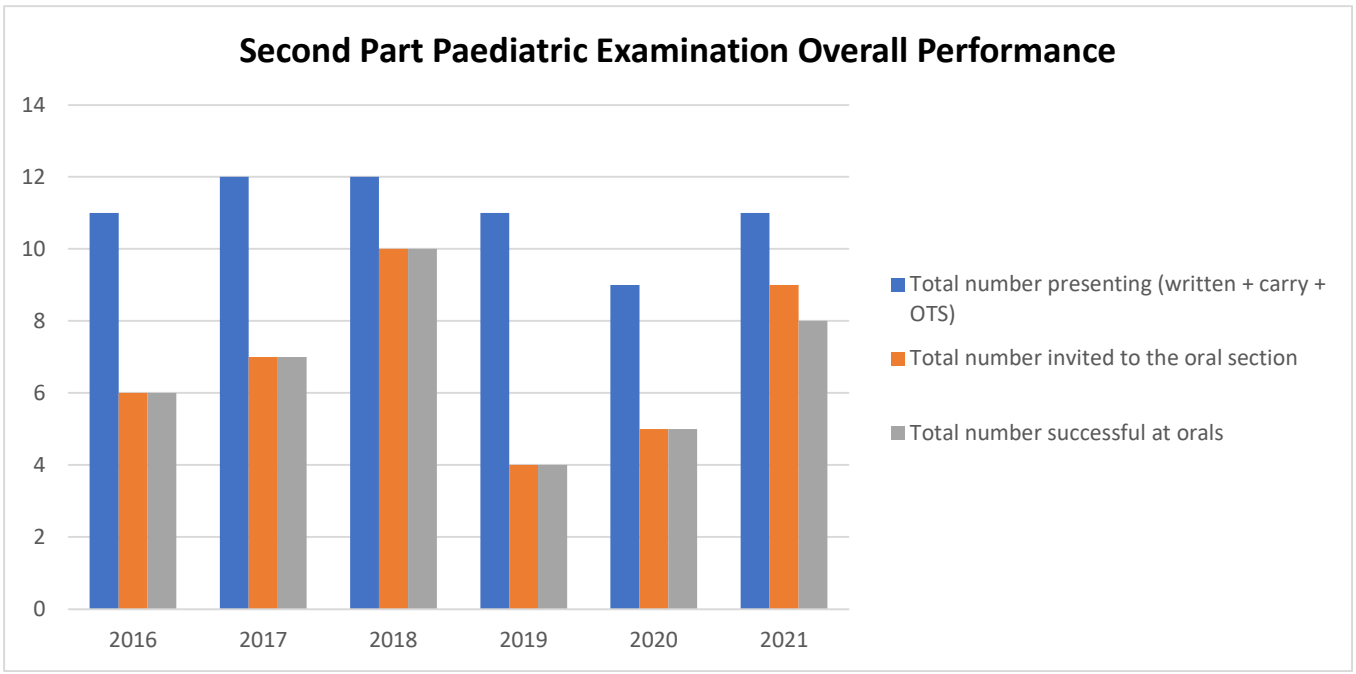
Overall pass rates	**2021**	**2020**	**2019**	**2018**	**2017**	**2016**
Total number presenting (written + carry + OTS)	11	9	11	12	12	11
Total number invited to the oral section	9	5	4	10	7	6
Total number successful at orals	8	5	4	10	7	6
	89%	100%	100%	100%	100%	100%
Overall pass rate	8/11	5/9	4/11	10/12	7/12	6/11
	72%	**56%**	**36%**	**83%**	**58%**	**55%**

Clinical Pass Rates	2021		2020		2019		2018		2017		2016	
	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	89%	78%	60%	70%	75%	78%	50%	73%	71%	75%	100%	80%
Hot Case 2	67%	95%	60%	70%	50%	70%	70%	78%	86%	76%	100%	95%
Total number successful in the Hot Case section	6/9		3/5		3/4		6/10		6/7		6/6	
Overall Hot Case pass rate	67%		60%		75%		60%		86%		100%	

Vivas Pass Rates	2021		2020		2019		2018		2017		2016	
	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	88%	80%	100%	74%	25%	54%	70%	75%	100%	70%	67%	80%
Viva 2	45%	70%	100%	90%	50%	60%	70%	85%	86%	78%	100%	85%
Viva 3	45%	75%	100%	80%	75%	70%	60%	83%	86%	85%	0%	49%
Viva 4	100%	74%	60%	80%	100%	88%	80%	59%	86%	78%	67%	90%
Viva 5	88%	94%	80%	86%	75%	69%	80%	73%	43%	76%	100%	88%
Procedure Viva	67%	60%	100%	71%	100%	65%	100%	90%	100%	70%	100%	83%
Radiology Viva	34%	56%	80%	73%	25%	58%	70%	75%	86%	85%	83%	80%
Communication Viva	78%	70%	40%	60%	75%	88%	80%	83%	57%	90%	83%	95%
Total number successful in the Viva section	8/9		5/5		4/4		10/10		6/7		6/6	
Overall Viva pass rate	89%		100%		100%		100%		86%		100%	

Overall Performance





EXAMINERS' COMMENTS

Written Paper

Eight of the thirty short answer questions had a pass rate of less than 50%. Topics covered by questions with a pass rate of 30% or less related to fluid removal post cardiac surgery, vitamin C in sepsis and cardiac pacing.

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
- Illegibility making answers unreadable

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.
- Time management- asking questions delaying examination
- Incomplete or poor technique for examination of a system.
- Failure to request appropriate investigations

- Poor interpretation of imaging and data.
- Poor synthesis of findings with limited differential diagnosis.
- 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.
- Lack of ability to see bigger picture

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 Second Part Paediatric 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

You are looking after a 5-year-old girl with widespread burns 24 hours after being rescued from a house fire. She has developed respiratory failure. She was intubated and ventilated at the scene. She has burns to the face, chest, back and abdomen, with a total burnt body surface area estimated to be 30%.

Her ventilator settings are:

Mode:	SIMV
Tidal volume:	6 ml/kg
FiO_2:	0.9
Rate:	40 breaths/minute
Inspiratory time:	0.7 seconds
PEEP:	10 cmH_20

The measured peak inspiratory pressure is 27 cmH_20.

Chest X-ray shows the endotracheal tube in good position and bilateral pulmonary infiltrates. Her arterial blood gas analysis is shown below:

Parameter	Patient Value	Normal Range
pH	7.14*	7.35 – 7.45
PaO_2	50 mmHg (6.66 kPa)*	80 – 105 (10.7 – 14.0)
$PaCO_2$	55 mmHg (7.33 kPa)*	35.0 – 45.0 (4.6 – 6.0)
SaO_2	80%	
Bicarbonate	18.0 mmol/L*	22.0 – 26.0
Base excess	-7.2 mmol/L*	-2.0 to 2.0
Lactate	5 mmol/L*	< 2

In table form, list your approach to managing this patient's respiratory failure, using the following headings: potential cause, investigation, and treatment.

Maximum Score	7.0
Percentage Passed	70%

Examiners' comments:

This question required understanding of specific issues relating to inhalational burns and gas poisoning with ability to maintain a global overview. Most candidates had a good approach and understanding. A good answer required a structured answer relating causes to investigation and management. Some candidates omitted common complications such as ARDS or lacked detail in their responses.

Reference(s):

AN SEN PEDIATRIC INHALATION INJURY, BURNS &TRAUMA VOLUME 5, ARTICLE NUMBER: 31 (2017) Up to date: Cyanide poisoning; Authors: Shoma Desai, MD, Mark K Su, MD, MPH

Question 2

A 14-year-old boy weighing 72 kg has been in your PICU for 4 hours with acute severe asthma secondary to a viral illness. Despite maximal appropriate medical management, he has deteriorated and requires intubation.

SpO_2 is 85% on BiPAP in 100% oxygen. He is grey, agitated, and has severe work of breathing with minimal air entry. There is no pneumothorax on chest X-ray.

a) Outline how your approach to intubation of this child differs from your standard intubation. (40% marks)

b) Outline your approach to ventilation. (30% marks)

c) Your PICU does not offer ECMO. What are your indications for referral to an ECMO centre? (30% marks)

Maximum Score	7.75
Percentage Passed	60%

Examiners' comments:

Management of acute severe asthma is a common and important issue in PICU. Many candidates have a good approach and recognise this is a precarious situation needing a high level of vigilance, which needed to be stated. Good answers were structured, clearly outlining what was different for this intubation from a standard intubation, possible complications, and measures to mitigate those complications. Details that were often missed included role of cuffed/size of ETT and informed assent/consent of parents with some answers lacking detail and structure. Referral criteria for ECMO were very generic rather than giving the necessary specific clinical criteria and candidates needed to show broad understanding of principles.

Reference(s):

Rogers Textbook of PICU (4th edition) p690-695

Rehder, KJ (2017) Adjunct therapies for Refractory Status Asthmaticus in children. Resp Care Vol.62, no.6, pp.849-864.

Brenner, B Corbridge, T Kazzi, A (2009) Intubation and mechanical ventilation of the asthmatic patient in respiratory failure. Proc Am Thor Soc Vol 6, pp. 371-379.

Stather DR & Stewart TE (2005) Clinical review: Mechanical ventilation in severe asthma. Crit care Vol.9, no.6, pp. 581-587

Medar SS et al (2020) Extracorporeal and advanced therapies for progressive refractory near-fatal acute severe asthma in children Pediatric Pulmon Vol.55, no.6, pp.1311-1319

Demoule A et al, (2020) How to ventilate obstructive and asthmatic patients. Intensive Care Med vol.46, pp.2436-2449

Question 3

A 14-year-old old boy with a Fontan circulation complicated by atrioventricular (AV) valve regurgitation, elevated systemic venous pressures and protein–losing enteropathy has been in your ICU for 14 days following AV valve repair.

Major complications have included:

- Staphylococcal deep sternal wound infection. The chest was reopened, and the wound debrided 7 days ago. Flucloxacillin and gentamicin were given for 2 days, flucloxacillin alone for last 7 days.
- Gastric ulceration and bleeding 5 days ago. Aspirin was stopped and there is currently no anticoagulation. Continues on pantoprazole.

His haemodynamics have improved and blood pressure is now stable off pressors. He was restarted on enalapril 2 days ago and extubated to high flow nasal cannula oxygen yesterday.

The urine output has fallen over the last 3 days to 0.3 ml/kg/hour, despite frusemide 20mg 6 hourly, and serum creatinine has risen steadily. Dipstick analysis of urine reveals moderate amounts of white blood cells, red blood cells and glucose, and trace amounts of protein.

Selected laboratory tests are shown below:

Parameter	Patient Value	Normal Range
Sodium	131 mmol/L*	135 – 145
Potassium	5.2 mmol/L*	3.5 – 5.0
Urea	21.0 mmol/L*	2.1 – 6.5
Creatinine	230 µmol/L*	30 – 80
Albumin	29 g/L*	33 – 47
Haemoglobin	109 g/L*	115 – 155
Platelets	246 x 10^9/L	150 – 400
WCC	12.8 x 10^9/L	4.5 – 13.5
Neutrophils	9.1 x 10^9/L*	1.5 – 8.0
Lymphocytes	2.1 x 10^9/L	1.5 – 6.5
Eosinophils	1.2 x 10^9/L*	0.0 – 0.5

a) Briefly outline the risk factors for acute kidney injury in this patient. (50% marks)

b) Outline your approach to investigation and management of the acute kidney injury. (50% marks)

Maximum Score	6.0
Percentage Passed	40%

Examiners' comments:

This question required candidates to have knowledge and understanding of risk factors for kidney injury tailored to a specific complex cardiac patient. Many candidates gave causes for general renal failure, though this question also required discussion about the multifactorial causes of AKI relating to Fontan specific issues and circulation. Many answers did not mention specific detail regarding the Fontan circulation/ residual lesions and its role in AKI eg protein losing enteropathy and AV regurgitation. Well-structured answers had a multi-prong approach to management, including aspects such as examination of fluid status, review of fluid balance and echocardiogram to assess AV valve competence and function. Some candidates listed only a few aspects of management. Management answers need to give specific information, tailored to the specific patient showing depth of understanding. Legibility is necessary to ensure all possible marks are obtained.

Question 4

a) Outline the physiological and metabolic derangements that occur following brain death. (40% marks)

b) Outline your approach to support of the brain-dead potential organ donor in ICU before donation surgery. Do not include details regarding donation suitability, organisation, and consent in your answer. (60% marks)

Maximum Score	7.5
Percentage Passed	80%

Examiners' comments:

This question required an understanding of the physiological and metabolic derangements following brain death. Most candidates gave superficial answers without necessary detail.
A good answer discussed autonomic storm and outlined the physiology relating to this.
The management section was consistently done well. Better answers had a structured approach with explanation of treatment in detail and also provided a more comprehensive approach to overall management as well as specific organ donation considerations such as temperature control and fluid status.

Reference(s):

The Australian and New Zealand Intensive Care Society Statement on Death and Organ Donation. Melbourne. Edition 4.1 2021. ISBN 4978-1-876980-39-9.

Gupta R, Dhanani S. Endocrine Considerations of the Pediatric Organ Donor. J Pediatr Intensive Care 2016;5:205–212

Question 5

As part as your newly appointed PICU specialist portfolio, you are asked to establish a Rapid Response Team service within your institution.

Outline the important aspects to consider in successfully creating such a service.

Maximum Score	6.5
Percentage Passed	50%

Examiners' comments:

Most candidates understand the concepts of a rapid response team providing a superficial overview of the Rapid response team focusing just on impact in PICU rather than the hospital wide implications. A good answer required a broad overview displaying understanding of reasons for doing this and clarity about who would be involved, how this should be progressed and potential challenges. Better answers had a structured approach to understanding the current system in place, gathering key stakeholders, and thinking about integration hospital wide including involvement of administration/executive support and trigger tools. Many answers did not consider aspects such as equipment, governance, and documentation for RRT and why it is important in terms of patient safety or reduced mortality or potential disadvantages of the system.

Reference(s):

Chalwin, BMC 2020

Cheng, Paediatric and Child Health, 2018

Rapid Response Team UpToDate

Grimes, Clin Nurse Specialist, 2007

Rapid Response System, PSNet

Question 6

A 3-month-old baby presents with cardiomegaly and the echocardiogram shows an ejection fraction of 15% with dilated poorly functioning ventricles. There is a family history of cardiomyopathy.

a) Define ejection fraction and explain how it is measured. (10% marks)

b) The baby deteriorates with increasing heart rate, respiratory rate and a rising lactate. You decide to intubate. List the precautions that you will take when preparing for and performing intubation in this specific situation. (40% marks)

c) In table form, briefly compare and contrast cardiomyopathy and myocarditis in terms of aetiology, diagnostic features and tests, and prognosis in a child of this age. (30% marks)

d) The team is discussing whether the child is an ECMO candidate. Outline your opinion on this matter. (20% marks)

Maximum Score	9.05
Percentage Passed	90%

Examiners' comments:

This question related to a very high-risk child with poor cardiac function. Many candidates were not able to define ejection fraction or describe how it is measured. Candidates needed to recognise that this child would be at high risk during intubation and most candidates displayed a safe approach to undertaking this. Cardiomyopathy and myocarditis were well understood with candidates able to set out tabulated answers, though some answers lacked sufficient detail.
Consideration of ECMO was less well done, with answers lacking detail. Better answers provided a reasoned approach to ECMO, including giving limited options for longer term support, transplant, and consideration of palliation.

Reference(s):

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4641179/

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6352488/

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3903430/

Question 7

In table form, outline the mode of action, indications, dose and potential side effects of the following medications: methylene blue, vasopressin and metaraminol.

Maximum Score	6.0
Percentage Passed	70%

Examiners' comments:

Knowledge of a variety of vasopressor therapy is expected. Experimental agents can also be examined. Vasopressin mode of action and methylene blue were the main areas of knowledge deficit**.** Better responses were able to identify the specific mechanism of action, indications, and side effects. Less common indications for methylene blue such as cyanide toxicity and its use in treating and causing methemaglobinemia were provided in better responses.

Question 8

a) What is a therapeutic monoclonal antibody? (10% marks)

b) Outline three mechanisms of action of therapeutic monoclonal antibodies. (30% marks)

c) List three therapeutic monoclonal antibodies used in PICU, their target molecule and the disease or condition for which they are used. (60% marks)

Maximum Score	7.25
Percentage Passed	40%

Examiners' comments:

Most candidates were unable to explain what a monoclonal antibody is or describe the mechanism of action. Few were able to give three examples of monoclonal antibodies, the target molecule and disease it is used in. Better responses were able to identify the chimeric cell formation leading to specific antibody production. The receptor, pathway, cellular/disease specific outcome was provided in the better answers. Some candidates confused biologic agents such anakinra and etanercept with specific "mabs". Many candidates made errors in the names, spelling or targets. In general, long answers lacking specific detail do not score highly.

Reference(s):

Lu, Hwang, Liu et al. Development of therapeutic antibodies for the treatment of disease. Journal of Biomedical Science 2020; J

Question 9

A 6-month-old female weighing 8 kg was admitted 18 hours ago following uncomplicated repair of tetralogy of Fallot. Overnight she has received 60 ml/kg of fluid boluses for "capillary leak", which has settled. The patient is now grossly oedematous. She remains intubated and ventilated.

The chest X-ray shows congested lung fields and small bilateral pleural effusions.

Current vasoactive infusions are milrinone 0.5 mcg/kg/min and noradrenaline 0.02 mcg/kg/min.

Echocardiogram this morning demonstrates mildly depressed biventricular function and no residual lesions.

Urine output has been 0.2 ml/kg/hour for the last 2 hours, despite 8 mg of intravenous frusemide 4 hours ago. There is no peritoneal dialysis catheter.

Observations:

Temperature:	36.6°C
Heart rate:	155 beats/minute, sinus rhythm
Blood pressure:	76/40, mean 51 mmHg
CVP:	14 cmH_2O

Parameter	Patient Value	Normal Range
Sodium	130 mmol/L*	135 – 145
Potassium	4.7 mmol/L	3.5 – 5.1
Urea	10.0 mmol/L*	1.3 – 6.6
Creatinine	60 µmol/L*	10 – 30
pH	7.33*	7.35 – 7.45

Outline your plan for fluid removal in this infant over the next 48 hours, including a plan for stepwise escalation if required.

Maximum Score	6.25
Percentage Passed	30%

Examiners' comments:

This question required an understanding of AKI and a methodical approach to management. Good responses identified the nature of the issues requiring graded intervention. Candidates needed to discuss excluding reversible factors and fluid restriction. A graded response needed to discuss specific diuretic therapies, description of peritoneal dialysis (including placement of a catheter), and the potential role of CVVH. Better responses outlined all three therapies.
Very few candidates discussed how they would assess the degree of AKI (eg. pRIFLE criteria) or review for reversible AKI causes. Many candidates included use of diuretics but not what would consider effective or ineffective diuresis. Many candidates discussed only a single renal replacement therapy of PD or CVVH and did not consider a staged approach to these two therapies. Some candidates did not answer the question as asked and gave prescriptions for PD and CVVH which was not requested.
n.

Reference(s):

Donald H. Shaffner and David G. Nichols (2015). Rogers' Textbook of Pediatric Intensive Care (5th ed.). LWW. Chapter 79, 110

Ross M. Ungerleider and Jeffrey Jacobs et al (2018). Critical Heart Disease in Infants and Children (3rd ed.). Elsevier. Chapter 16 Organ system response to cardiac function - renal

Bradley P. Furhman .P. and Jerry J. Zimmerman(2016). Pediatric Critical Care (5th ed.). Elsevier. Chapter 38, 75, 78

Andrew D Bersten (2018) Oh's Intensive Care Manual, (8th ed). Elsevier. Chapter 47, 48

Question 10

Regarding thromboelastography (TEG):

a) Briefly explain how the TEG assay is performed. (10% marks)

b) List three clinical situations in which TEG is used in critically ill children. (10% marks)

c) List four differences between TEG and standard coagulation tests. (20% marks)

d) List the haemostatic components that determine R, alpha-angle and MA on the TEG trace shown below (Figure 10.1). (30% marks)

e) List the haemostatic abnormalities indicated by the three following TEG traces (A, B and C). (30% marks)

Maximum Score	9.0
Percentage Passed	70%

Examiners' comments:

Overall most of the candidates understood TEG and majority managed to describe components and traces. A good answer displayed knowledge, understanding of the appropriate clinical use of TEG and how to interpret the results.

Reference(s):

Moynihan, Coll Am Path, 2021

MacDonald, Seminars Thrombosis 2010

Question 11

This question relates to the inter-hospital transport of the critically ill child.

a) What physical properties of gases require special consideration during aeromedical transport? (20% marks)

b) You are asked to retrieve a five-year-old girl who has suffered traumatic head and chest injuries with orbital and rib fractures, pulmonary contusion, and a liver laceration. Outline potential complications and specific precautions you will take to maintain stability during transport to your hospital 300 km away. (80% marks)

Maximum Score	7.25
Percentage Passed	50%

Examiners' comments:

This question required knowledge of aeromedical gas laws and implications for transport. Many candidates were aware of gas expansion with altitude but did not discuss oxygen tension or other gas laws. The clinical scenario required a structured, comprehensive approach to transporting a sick child

with good answers keeping a global overview in anticipating and mitigating potential complications. This question required specific detail relating to transport issues of this particular injured patient, rather than generic ABC approach. Candidates needed to discuss the impact of gas expansion in the patient and equipment, potential ventilation issues and hypoxia, and cardiovascular instability in addition to other aspects relevant to long distance transport.

Reference(s):

Gas Laws and Clinical Application

https://www.ncbi.nlm.nih.gov/books/NBK546592/

https://wellingtonicu.com/Data/Flight/2017%20Flight%20course%20manual.pdf

Question 12

A 12-year-old male presents to the emergency department with nausea, headache, and a depressed conscious state. You suspect carbon monoxide poisoning from overnight use of a propane gas heater.

His observations are:

Heart rate:	125 beats/minute
Respiratory rate:	40 breaths/minute
Blood pressure:	105/65 mmHg
SpO_2:	99%

An arterial blood gas is shown below:

Parameter	Patient Value	Normal Range
pH	7.29*	7.34 – 7.43
$PaCO_2$	32 mmHg (4.3 kPa)	31 – 42 (4.1 – 5.6)
PaO_2	85 mmHg (11.3 kPa)	80 – 105 (10.7 – 14.0)
SaO_2	58%	
Carboxyhaemoglobin	41%*	
Bicarbonate	15 mmol/L*	20 – 26
Base excess	-6.7*	-5.0 to 5.0
Lactate	6.5 mmol/L*	1.0 – 1.8

a) Outline the pathophysiology of carbon monoxide poisoning. (30% marks)

b) Explain the disparity between the SpO_2 on pulse oximetry and the SaO_2 on arterial blood gas. (10% marks)

c) Comment on the PaO_2 (10% marks)

d) Outline the specific treatment of carbon monoxide poisoning and the pathophysiologic rationale. (50% marks)

Maximum Score	7.25
Percentage Passed	60%

Examiners' comments:

This question required candidates to display understanding of the pathophysiology of carbon monoxide poisoning and how to manage this. A good answer required description of how carbon monoxide causes toxicity with the mechanism explaining the difference between saturations on oximetry and arterial gas. The specific treatment is important knowledge. Most answers displayed a lack of knowledge, of insufficient in detail and descriptions. In particular, candidates lacked knowledge of why the PO2 is unaffected.

Reference(s):

Oh's Intensive Care Manual, Eighth edition. Chs 90 & 28.

Ilano AL Raffin TA. Management of carbon monoxide poisoning. Chest 1990; 97: 165-9.

Weaver LK et al. Hyperbaric oxygen for acute carbon monoxide poisoning. New Engl J Med 2002; 347: 1057-67.

Question 13

A two-year-old boy with respiratory syncytial virus pneumonitis has severe acute respiratory distress syndrome, with an oxygenation index of 37.

He has Trisomy 21 and had an atrioventricular septal defect repair as an infant with no residual lesions and normal cardiac function.

He was diagnosed with acute myeloid leukaemia five months ago and his oncological prognosis is believed to be good. He is currently neutropaenic.

The medical consensus is that V-V ECMO should be initiated to give him the best chance of a good outcome.

Outline your approach to:

a) The initial ECMO consent conversation. (60% marks)

b) Ongoing communication with this family during the ECMO run. (40% marks)

Maximum Score	6.25
Percentage Passed	80%

Examiners' comments:

This question required an understanding of paediatric consent, and communication issues relating to ECMO. Most candidates approached this by outlining how to conduct a family meeting, omitting the critical analysis of the conversation with a family about obtaining consent and what aspects were important. Better answers considered important aspect relating to consent for this specific patient, in addition to communication aspects.

Reference(s):

Moynihan, K. M. et al. Decision-Making, Ethics, and End-of-Life Care in Pediatric Extracorporeal Membrane Oxygenation: A Comprehensive Narrative Review. Pediatr Crit Care Me Publish Ahead of Print, (2021).

Question 14

An 18-month-old child admitted to PICU 8 hours ago following resection of a craniopharyngioma has been passing 5 ml/kg/hour of urine for the past 3 hours.

a) Outline the diagnostic criteria for diabetes insipidus. (20% marks)

b) Apart from central diabetes insipidus, what is your differential diagnosis for this child's polyuria? (20% marks)

c) Outline your approach to fluid and electrolyte management in this child. (40% marks)

On post-operative day 5, the patient becomes oliguric and the serum sodium is 125 mmol/L (normal range 135 – 145 mmol/L).

d) Describe two likely explanations for this scenario. (20% marks)

Maximum Score	7.0
Percentage Passed	80%

Examiners' comments:

Diabetes insipidus is a common PICU condition which is part of core knowledge. Candidates are expected to display good understanding relating to diagnosis, differentials, causes and management. Most candidates diagnosed diabetes insipidus though gave generic answers to management which do not score high marks. A good answer required specific detail and a structured management plan discussing fluid management, electrolytes and vasopressin.

Reference(s):

Patti, G., Ibba, A., Morana, G., Napoli, F., Fava, D., di Iorgi, N. and Maghnie, M., 2020. Central diabetes insipidus in children: Diagnosis and management. Best Practice & Research Clinical Endocrinology & Metabolism, p.101440.

Lamas, C., del Pozo, C. and Villabona, C., 2014. Clinical guidelines for management of diabetes insipidus and syndrome of inappropriate antidiuretic hormone secretion after pituitary surgery. Endocrinología y Nutrición (English Edition), 61(4), pp.e15-e24.

de Vries, F., Lobatto, D.J., Verstegen, M.J., van Furth, W.R., Pereira, A.M. and Biermasz, N.R., 2021. Postoperative diabetes insipidus: how to define and grade this complication?. Pituitary, 24(2), pp.284-291.

Question 15

A 3-month-old boy is admitted to PICU following a respiratory arrest on the ward requiring endotracheal intubation.

Having been previously well, he is being investigated for several days of poor feeding, constipation, and listlessness. On the ward he was afebrile, but tachycardic, and was noted to have a weak cry. He has received penicillin and gentamicin for presumed sepsis.

Following intubation without induction agents or neuromuscular blockade, he is profoundly hypotonic and has sluggishly reactive pupils.

a) Give the likely diagnosis and five other possible diagnoses. (20% marks)

b) Outline the pathophysiology of the likely diagnosis. (20% marks)

c) Outline your approach to management, including how you would confirm the diagnosis. (60% marks)

Maximum Score	7.75
Percentage Passed	40%

Examiners' comments:

This boy has botulism. Although this is not common in PICU, it is an important diagnosis that candidates should be aware of. Although the majority of candidates did not recognise botulism as the likely diagnosis, candidates were able to score marks if they had a good knowledge of their proposed diagnosis. Candidates needed to propose botulism or a similar diagnosis in their differentials and give a detailed account of pathophysiology/investigations/management of their proposed alternative. Many candidates who gave SMA or GBS as possible diagnosis did not provide full specific answers for these alternatives.

Reference(s):

Furhman & Zimmerman's Pediatric Critical Care, 5th Edition. Ch 71

Campbell et al. Journal of Paediatrics and Child Health 2017. Volume 53, Issue 4 p. 416-418

Question 16

Discuss the following aspects of dexmedetomidine use in the PICU:

a) Pharmacology. (10% marks)

b) Indications. (20% marks)

c) Benefits and disadvantages. (30% marks)

d) Evidence for use relevant to PICU. (40% marks)

Maximum Score	9.0
Percentage Passed	60%

Examiners' comments:

Dexmedetomidine is now widely used in PICU. Most candidates answered this well. Candidates who scored highly recognised that some parts of the question required 3-4 answers to score full marks and knew the literature well. Candidates who failed did so by not providing a complete answer and had limited or no knowledge of the evidence for use. Many claimed it was an alpha-2 antagonist rather than agonist.

Reference(s):

Dexmedetomidine Sedation in Mechanically Ventilated Critically Ill Children: A Pilot Randomized Controlled Trial Simon J Erickson et al Pediatr Crit Care Med. 2020 Sep;21(9):e731-e739

Efficacy and Safety of Dexmedetomidine for Prolonged Sedation in the PICU: A Prospective Multicenter Study (PROSDEX). Sperotto F et al Pediatr Crit Care Med. 2020 Jul;21(7):625-636

Question 17

A 3-week-old girl had a hypoplastic arch repair and pulmonary artery banding for multiple ventricular septal defects five days ago. She does not have any additional congenital or chromosomal abnormalities.

An echocardiogram performed on the second day post-op demonstrated:

- Unobstructed arch repair
- Mildly impaired ventricular function (improved compared to the previous echo)
- Band in good position, Vmax 2.5 m/s

This morning she was extubated onto nasal CPAP of 6 cmH_2O. A milrinone infusion continues at 0.5 mcg/kg/min. Routine arterial blood gas one-hour post-extubation was unremarkable, and vital signs were stable.

Five hours post-extubation, she has increased work of breathing, her heart rate has increased from 140 to 175 beats/minute, and mean blood pressure has dropped to below 40 mmHg.

An arterial blood gas is shown below:

Parameter	Patient Value	Normal Range
pH	7.06*	7.32 – 7.46
$PaCO_2$	84 mmHg (11.2 kPa)*	31 – 42 (4.1 – 5.6)
PaO_2	28 mmHg (3.7 kPa)*	80 – 105 (10.7 – 14.0)
Base excess	-8.5*	-5 to +5
Bicarbonate	23 mmol/L	20 - 26
Lactate	10.9 mmol/L*	1.0 – 1.8

Outline your approach to re-intubation.

Maximum Score	8.25
Percentage Passed	100%

Examiners' comments:

This was a straightforward question concerning 'high-risk intubation' that nearly all candidates answered well. A good answer required a comprehensive safe and anticipatory approach, giving specific details of an organised approach, teamwork, medications, and concerns. Many candidates did not give the detail expected of a scenario common in PICU and did not achieve the high marks possible.

Reference(s):

Esangbedo, I. D. et al. Risk Factors for Peri-Intubation Cardiac Arrest in Pediatric Cardiac Intensive Care Patients: A Multicenter Study. Pediatr Crit Care Me 21, e1126–e1133 (2020).*

Miura, S., Jardim, P. V., Butt, W. & Namachivayam, S. P. Extubation Failure and Major Adverse Events Secondary to Extubation Failure Following Neonatal Cardiac Surgery. Pediatr Crit Care Me 21, e1119–e1125 (2020).*

Dean, P. N. et al. Identification of the Physiologically Difficult Airway in the Pediatric Emergency Department. Acad Emerg Med 27, 1241–1248 (2020).

Question 18

Randomised controlled trials in critical care often fail to meet a specified statistical threshold to demonstrate benefit of a therapy or intervention (commonly referred to as 'negative' trials).

Outline ten potential reasons for this.

Maximum Score	7.0
Percentage Passed	50%

Examiners' comments:
Candidates who approached this question in a structured and systematic way encompassing all areas of trial design did well. Most candidates answered this well and were able to provide several reasonable points.

Reference(s):

Vincent JL, Marini JJ, Pesenti A. Do trials that report a neutral or negative treatment effect improve the care of critically ill patients? No. Intensive Care Med 2018; 44: 1989-1991

Question 19

a) Briefly outline your approach to diagnosis of chylothorax after surgery for congenital heart disease. (25% marks)

b) In table form, list i) the complications of chylothorax, ii) how you would diagnose, and iii) how you would manage each of these. (75% marks)

Maximum Score	8.0
Percentage Passed	90%

Examiners' comments:

This was a simple question which most candidates answered well. Better candidates gave a full range of complications of chylothorax and a logical stepwise approach to management. Discussion needed to include immunocompromise and sepsis in addition to fluid balance and other issues.

Reference(s):

Tutor, James D. (2014). Chylothorax in infants and children. Pediatrics (Evanston), 133(4), 722–733.

Uptodate: Etiology, clinical presentation, and diagnosis of chylothorax Author: John E Heffner, MD; Section Editor: V Courtney Broaddus, MD; Aug 17, 2020.

Question 20

A 5-year-old boy with sickle cell disease awoke this morning with right sided weakness and difficulty speaking.

a) List five differential diagnoses in order of likelihood. (30% marks)

b) Outline your approach to diagnostic workup and acute management in this child. (70% marks)

Maximum Score	8.0
Percentage Passed	100%

Examiners' comments:

This question was answered well. Some candidates omitted major parts of investigation or management, particularly relating to SCD. Good answers prioritised likely diagnoses and displayed a structured approach to management.

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Reference(s):

Furhman & Zimmerman's Pediatric Critical Care, 5th Edition. Chapters 69, 90.

Management of Stroke in Neonates and Children. A Scientific Statement From the American Heart Association/American Stroke Association

Stroke. 2019;50:e51–e96. Central nervous system complications and management in sickle cell disease. Blood. 2016;127(7):829-838

Question 21

Critically evaluate the role of Vitamin C administration in sepsis.

Maximum Score	7.5
Percentage Passed	20%

Examiners' comments:

Vitamin C is not used outside clinical trials in PICU. However, it is topical, and candidates should have knowledge of this. Most candidates lacked knowledge and answered very poorly. Critically evaluate questions such as this require knowledge of the topic and literature, critical thinking and a clearly set out discussion and conclusion.

Reference(s):

Marik P et al 2017, Hydrocortisone, Vitamin C, and Thiamine for the Treatment of Severe Sepsis and Septic Shock CHEST vol.151, no.6, pp.1229-1238.

Kuhn SO et al 2018, Vitamin C and sepsis, Curr Opin Anaesthesiol vol.31, no.1, pp. 55-60. (Review)

Fowle, AA et al 2019, Effect of Vitamin C Infusion on Organ Failure and Biomarkers of Inflammation and Vascular Injury in Patients with Sepsis and Severe Acute Respiratory Failure (CITRIS-ALI) JAMA vol 322, no.13, pp.1261-1270.

Hager, DN et al 2019, Effect of Vitamin C, Thiamine, and Hydrocortisone on Ventilator- and Vasopressor-Free Days in Patients with Sepsis (VICTAS). JAMA vol.325, no.8, pp.742-750.

Fujii T et al 2020, Effect of Vitamin C, Hydrocortisone, and Thiamine vs Hydrocortisone alone on time alive and free of vasopressor support among patients with septic shock (VITAMINS). JAMA vol.323, no.5, pp.423-431.

Kalil A 2020 Editorial Lack of Benefit of High-Dose Vitamin C, Thiamine, and Hydrocortisone, JAMA vol.323, no.5, pp. 419-420.

Fujii et a 2020 Review Vitamin C and thiamine for sepsis: time to go back to fundamental principles, Int Care Med Vol.46, pp.2061-2063

Hwang SY et al 2020, Combination therapy of vitamin C and thiamine for septic shock: a multicentre, double-blind, randomized Controlled Study. Intensive Care Med vol.2, pp.167–345.

Moskowitz A et al 2020, ACTS clinical trial investigators effect of ascorbic acid, corticosteroids, and thiamine on organ injury in septic shock: the acts randomized clinical trial. JAMA vol.324, no.7, pp.642–650.

Wald EL et al 2020 Letter to the Editor, Hydrocortisone–Ascorbic Acid–Thiamine Use Associated with Lower Mortality in Pediatric Septic Shock. Vol. 201, no.7

Schlapbach LJ et al 2021, Resuscitation in Paediatric Sepsis Using Metabolic Resuscitation–A Randomized Controlled Pilot Study in the Paediatric Intensive Care Unit (RESPOND PICU) Frontiers in Pediatrics

Question 22

a) Define the following terms used in DDD mode cardiac pacing:

   i. Ventricular sensitivity
   ii. Post-ventricular atrial refractory period (PVARP)
   iii. AV delay (30% marks)

b) The following ECGs (pages 6, 7 and 8) have all been taken in patients on temporary cardiac pacing because the heart rate has been noted to be irregular. In each case, briefly describe:

   i. The pacemaker-related problem
   ii. The solution (70% marks)

Maximum Score	8.0
Percentage Passed	30%

Examiners' comments:

This question was straightforward with most candidates able to define pacing terms. Analysis of paced ECGs required understanding and clear descriptions and candidates should have a well-practiced approach to ECG interpretation. Some candidates gave inaccurate answers. Although a few of the ECGs were difficult, but even differentiating when a pacing spike captured the atrium or ventricle was done poorly by many.

Question 23

For each of the three (23.1, 23.2 and 23.3) new admissions to PICU described below, provide:

a) Your fluid, electrolyte, and nutrition management.

b) Justification for your recommendation.

23.1

A 3.2 kg ex preterm (34 weeks) male infant aged 5 weeks, previously well:

- RSV bronchiolitis day 4 symptoms has been nil by mouth in regional hospital for 2 days.
- "Maintenance iv fluids" running, no information about urine output.
- Humidified, high flow nasal cannula oxygen therapy (FiO_2 0.3).
- Respiratory rate 80 breaths/minute, SpO_2 94%, heart rate 155 beats/minute, well perfused, normal tissue turgor, no oedema, alert.

Admission lab results (venous blood gas):

Parameter	Patient Value	Normal Range
pH	7.24*	7.32 – 7.43
pCO_2	61 mmHg (8.1 kPa)*	38 – 48 (5.1 – 6.4)
Na^+	130 mmol/L*	135 – 145
K^+	3.9 mmol/L	3.5 – 4.8
Urea	5.4 mmol/L	2.5 – 7.5

(30% marks)

23.2

A 28 kg male age 11 years:

- Post-op thoracolumbar spinal instrumentation for syndromic kyphoscoliosis.
- "Maintenance IV fluids" running, catheter draining good volume urine.
- Respiratory rate 24 breaths/minute, mask oxygen, SpO_2 97%, heart rate 125 beats/minute, well perfused, normal tissue turgor, no oedema, thoracic and lumbar epidurals, responds to voice / drowsy post anaesthesia.

Admission lab results (arterial blood gas):

Parameter	Patient Value	Normal Range
pH	7.44	7.35 – 7.45
$PaCO_2$	37 mmHg (4.9 kPa)	35 – 45 (4.7 – 6.0)
Na^+	132 mmol/L*	135 – 145
K^+	3.9 mmol/L	3.5 – 4.8
Urea	5.4 mmol/L	2.5 – 7.5

(30% marks)

23.3

A 24 kg female age 14 years:

- Relapse of anorexia nervosa
- Nasogastric tube and intravenous cannula in situ, no fluids running, no information available about urine output.
- Respiratory rate 12 breaths/minute, SpO_2 97% in room air, heart rate 44 breaths/minute, cool poorly perfused hands feet, central capillary refill <2 seconds, blood pressure 88/52 mmHg, reduced tissue turgor, no oedema, drowsy - responds to name.

Admission lab results (venous blood gas):

Parameter	Patient Value	Normal Range
pH	7.42	7.32 – 7.43
pCO_2	28 mmHg (3.7 kPa)*	38 – 48 (5.1 – 6.4)
Na^+	134 mmol/L*	135 – 145
K^+	1.9 mmol/L*	3.5 – 4.8
Urea	12.4 mmol/L*	2.5 – 7.5

(40% marks)

Maximum Score	6.25
Percentage Passed	90%

Examiners' comments:

Fluid and nutrition management is core information which candidates are expected to know well and have a good clinical approach for. Generally, this question was answered well. Multiple different approaches were acceptable for this question. However, several candidates didn't write about "management" of feeds but rather what type and rate. "Management" should also include items such as dietician review, gastro involvement where needed, and nutritional assessment.
Candidates appeared to find the case of the postoperative spine most difficult, and knowledge of refeeding syndrome was less well known.

Question 24

A 12-year-old girl is transferred to your PICU with a 4-day history of fever and abdominal pain, during which time she was receiving regular paracetamol.

She is drowsy, confused and not obeying commands. On an adrenaline infusion at 0.3 mcg/kg/min, she is warm peripherally and has a mean blood pressure of 58 mmHg with a wide pulse pressure.

Echocardiogram shows good, hyperdynamic biventricular function.

Blood test results just prior to leaving the referral hospital include:

Parameter	Patient Value	Normal Range
Urea	5.1 mmol/L	2.0 – 6.8
Creatinine	150 µmol/L*	35 – 74
Bilirubin (total)	150 µmol/L*	0 – 10
AST	17,000 U/L*	0 – 41
ALT	8000 U/L*	0 – 36
GGT	120 U/L*	0 – 45
Ammonia	170 µmol/L*	10 – 50
Amylase	236 U/L*	20 – 90
Lipase	2800 U/L*	0 – 180
Prothrombin time	73.8 seconds*	10.0 – 14.1
INR	6.4*	1.0 – 1.2
APPT	31.9 seconds	24.6 – 38.4
Fibrinogen	1.60 g/L*	1.68 – 5.29
Paracetamol level	38 mg/L*	'Critically high' > 20
Lactate	23.0 mmol/L*	0.7 – 1.9

a) List <u>five</u> differential diagnoses for this patient's liver failure. (10% marks)

b) Outline your approach to organ/systems-based management over the next 12 hours.
(90% marks)

Maximum Score	6.75
Percentage Passed	90%

Examiners' comments:

Candidates needed to have a broad approach to diagnosis and management of acute hepatic failure. Differential diagnoses needed to include a range of options, with a structured approach to investigation and management. Some candidates displayed paucity of knowledge or clinical experience relating to this condition. Better answers discussed that some of the therapies.
Are interesting without evidence base, such as high clearance CRRT.

Reference(s):

Lutfi R, Abulebda K, Nitu, Mara E, Molleston JP, Bozic M, Subbarao G Intensive Care Management of Pediatric Acute Liver Failure, Journal of Pediatric Gastroenterology and Nutrition 2017;64(5):660-670

Management of Acute Liver Failure: A Pediatric Perspective. Current Pediatric Reports. 2018; 6(3): 246–257.

Squires RH, Acute Liver Failure in Children: Managhement, complications and outcomes. Up-to-Date (online)

Question 25

It is 8am, and you are the intensivist on duty in your 12 bed PICU for the next 3 days. Today you have 10 patients in PICU.

The PICU has been very busy for the past 3 days, with acute admissions, discharge bed block, and cancelled booked admissions post elective surgery. The nursing staffing number for the next PICU night shift is marginal, there is only 1 bed available in the hospital for the planned PICU discharges. Neurosurgical theatre is on standby awaiting confirmation of an afternoon PICU bed for a patient cancelled yesterday, and the retrieval team is on its way to a regional centre to retrieve a child with pneumonia.

Tensions are high and there have already been angry exchanges between teams.

Outline your priority actions and the leadership principles which underpin these actions.

Maximum Score	7.25
Percentage Passed	100%

Examiners' comments:

This was a practical managerial question which candidates answered well overall. Those with clinical experience of leading this common PICU situation were able to discuss the prioritisation, conflict management and other leadership and human factors skills required.

Reference(s):

https://www.cicm.org.au/CICM_Media/CICMSite/Files/Training/T-36-The-Competencies,-Teaching,-Learning-Opportunities-and-Assessments-for-Training-in-Paediatric-Intensive-Care-Medicine.pdf

Question 26

Discuss the following aspects of Humidified High Flow Nasal Cannula oxygen therapy in the PICU:

a) Proposed mechanism of benefits. (30% marks)

b) Risks and contraindications. (20% marks)

c) Evidence for use. (30% marks)

d) How you use it in your practice in the PICU. (20% marks)

Maximum Score	7.5
Percentage Passed	70%

Examiners' comments:

This is one of the most commonly used treatments in PICU. Some candidates displayed very detailed knowledge about the scientific data behind this treatment whereas others had limited knowledge about mechanisms, risks and complication. Several candidates overstated the PEEP numbers HFNPO2 delivers. Remembering study acronyms should not detract from an overall understanding of the applications of a therapy.

Reference(s):

High-flow nasal cannula oxygen therapy in children: a clinical review. Kwon JW.Clin Exp Pediatr. 2020 Jan;63(1):3-7.

A multicenter randomized controlled trial of a 3-L/kg/min versus 2-L/kg/min high-flow nasal cannula flow rate in young infants with severe viral bronchiolitis (TRAMONTANE 2). Milési C et al Intensive Care Med. 2018 Nov;44(11):1870-1878.

A Randomized Trial of High-Flow Oxygen Therapy in Infants with Bronchiolitis.

Franklin D, Babl FE, Schlapbach LJ, Oakley E, Craig S, Neutze J, Furyk J, Fraser JF, Jones M, Whitty JA, Dalziel SR, Schibler A.N Engl J Med. 2018 Mar 22;378(12):1121-1131.

Question 27

Standardised mortality rate (SMR) is widely used as a quality indicator in PICU.

a) Define the SMR. (20% marks)

b) Outline <u>three</u> limitations of using SMR as a quality benchmark. (30% marks)

c) Compare the <u>two</u> most widely used scoring systems used in standardising paediatric mortality. (50% marks)

Maximum Score	7.0
Percentage Passed	40%

Examiners' comments:

Many candidates struggled to define SMR despite being partially given to them in part c). Many also struggled with naming PIM & PRISM. Limitations of SMR was poorly answered beyond describing data entry errors. Some candidates were able to define SMR was and knew expected mortality relied on validated severity scoring. Some lacked knowledge about the latest version of PRSIM possibly reflecting

ANZ use of PIM only. Oddly more than one mentioned an explosion as an explanation for variation in SMR. Unfortunately, some candidates left complete sections blank so were unable to score marks. There was confusion for some candidates with SOFA & APACHE scores which were not relevant to this question.

Reference(s):

Straney L et al. PIM 3: An updated model for predicting mortality in pediatric intensive care. Pediatr Crit Care Med 2013; 14: 673-81.

Pollack MM et al. PRISM III: An updated pediatric risk of mortality score. Crit Care Med 1996; 24(5): 743-52.

Pollack MM et al. The pediatric risk of mortality score: Update 2015. Pediatr Crit Care Med 2016; 17(1): 2-9.

Question 28

Discuss the following aspects of procalcitonin:

a) Biological function.

b) Synthesis.

c) Kinetics.

d) Sensitivity & specificity in diagnosis of sepsis.

e) Use in your practice.

Maximum Score	7.5
Percentage Passed	40%

Examiners' comments:

This question required detailed knowledge, such as the source of PCT in disease. Most trainees described it as a sensitive but poorly specific marker for bacterial sepsis. Several lacked detailed knowledge e.g., source of PCT in disease. Candidates were expected to give greater detail than general statements without level of specifics around pros & cons of PCT. Illegibility was an issue for some candidates.

Reference(s):

Eisenhardt SU et al (2019) C-reactive protein: How conformational changes influence inflammatory properties. Cell cycle vol.8, no.23, pp.3885-3892

Duke T (2012) Procalcitonin in the paediatric intensive care unit. RCH Guidelines viewed 4th July 2021

Nickson C (2020) Procalcitonin. Life in the Fast Lane viewed 4th July 2021 NICE Guidelines (2014) Diagnosis and monitoring of sepsis: procalcitonin testing

Question 29

a) Define diastolic dysfunction. (10% marks)

b) Name one echocardiography method and the parameters measured to assess diastolic dysfunction. (20% marks)

c) List eight conditions which result in left and/or right ventricular diastolic dysfunction. (20% marks)

d) List four clinical consequences of left and/or right ventricular diastolic dysfunction relevant to PICU. (10% marks)

e) Outline your approach to management of diastolic dysfunction in PICU. (40% marks)

Maximum Score	6.8
Percentage Passed	70%

Examiners' comments:

Overall answers suggested diastolic dysfunction was not an aspect of cardiac dysfunction that was considered in any detail in clinical work. Very few candidates were aware of the ECHO parameters interrogated to support the diagnosis. Lack of structure & general nature of statements included in answers in part c) - e), suggested superficial understanding of this topic.
Candidates had better understanding of causes and clinical consequences, though some focused on the RV only.

Reference:

Furhman and Zimmerman 8th Edition, Ch 38

Recher, M., Botte, A., Soquet, J. et al. Assessment of left-ventricular diastolic function in pediatric intensive-care patients: a review of parameters and indications compared with those for adults. World J Pediatr 17, 21–30 (2021). https://doi.org/10.1007/s12519-020-00369-x

Question 30

The infant daughter of a friend has been admitted to your PICU. You are not on clinical service and not involved in her care.

The child has a metabolic disorder and is in a high-dependency bed following a relatively minor ENT procedure. Her parents describe her as listless and febrile with a very fast heart rate, and they are worried by plans to discharge her to the ward this evening. The parents contact you via social media concerned about her condition and the care being provided by the ICU team.

How will you respond to this situation?

Maximum Score	8.0
Percentage Passed	90%

Examiners' comments:

This question on professionalism and boundaries required a candidate to listen to parents, ask permission to escalate to team and then escalate, making sure the child is safe. Poor candidates failed to recognise that the child may be sick. Reassurance is inappropriate given the available report from the parents. Most candidates knew that management should be left to the on-duty team. Some erred with too little involvement ie. leaving it all to the family while some had too much personal involvement. Some candidates became distracted by details around how to support a family raising concerns (such as MET calls, discussion with patient liaison officer; writing down concerns) rather than what was asked for.

ORAL SECTION

The Clinical Section

The Clinical Section (2 clinical cases – 20 minutes per case) was conducted in the Paediatric Intensive Care Units in different centres due to COVID pandemic precluding a single site.

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:

- 15-year-old multitrauma patient with high spinal injury ventilated two weeks post MVA
- 7-day old post BT shunt for DORV with open chest two days post operatively
- 11-week child with persistent desaturation post shunt surgery with complex CHD
- 4 day old child ventilated after presenting with shock and low Apgars at birth
- 12 year old boy in PICU for 6 weeks with MRSA necrotising pneumonia and ECMO
- 2-year-old with hyperammonaemia from metabolic disease post liver transplant
- 5-year-old boy with rupture of cerebral artery aneurysm post coiling and craniectomy
- 8 month old in PICU for 3 days with Trisomy 21, parainfluenza pneumonia and hypoxia

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

Previously well 12-year-old boy (45 kg) presents with shortness of breath and has a working diagnosis of myocarditis. ECHO shows that he has severe biventricular dysfunction with a rising lactate despite supportive measures. A decision is made to commence VA ECMO and he is taken to the operating theatre. He is surgically cannulated via the right groin in the setting of eCPR. ECLS is commenced with a 21 Fr access cannula in the right femoral vein and a 17 Fr return cannula in the right femoral artery. He returns to PICU for ongoing care.

At handover the team identifies that the right lower limb is cold and mottled.

How will you approach this situation?

(*Image removed from report.)*

Viva 2

You work in a 12 Bed PICU which is a mix of single rooms and 4 bedded rooms.

Your infection control team reports that your unit has three patients with the same ESBL (extended spectrum beta-lactamase) infections.

You have been asked by the director of PICU to address this problem.

Describe your approach and management of this situation.

Viva 3

A 14-year-old male is being airlifted from a rural accident scene. He was riding a motorcycle (wearing a helmet) and was hit on the right side by a 4-wheel drive vehicle at 80 km/hour. His initial GCS was 15, but fell to 7 over 15 minutes.

Ambulance at the scene noted right sided abdominal bruising and distension, right sided open forearm and ankle fractures, and deformation of the right thigh. His heart rate was 140 beats/minute, with only a carotid pulse palpable. They intubated him, inserted an intraosseous needle in the left humerus and an 18-gauge intravenous cannula, and have placed him in a cervical collar, pelvic binder, and right leg splint. He has received 9 units of O negative blood en route.

You have been called to the Emergency Department (ED) prior to the patient's arrival and you will lead the resuscitation.

On his arrival in ED he is hand ventilated in 100% FiO_2 via an oral 7.0 ETT; SpO_2 is 100% and heart rate is 150 beats/minute. A single blood pressure measurement reads a mean of 70 mmHg. Fast scan shows no effusion or air leak and a large amount of abdominal fluid.

Outline your initial management plan.

(*Image removed from report.*)

Viva 4

A 3-year-old boy presents to the Emergency Department with tachypnoea (respiratory rate 60 breaths/minute), increased work of breathing, fever (39°C) and tachycardia (heart rate 140 beats/minute). SpO_2 is 85% in 4 litres oxygen per minute via Hudson mask, and he has an expiratory grunt.

Nasopharyngeal aspirate is positive for influenza A (negative for all other respiratory viruses, including COVID-19).

Discuss your initial approach to investigation and management.

(*Image removed from report.*)

Viva 5

A one-week-old girl presents shocked with a history of lethargy, irritability, grunting and poor feeding after a normal vaginal delivery at term. She has been intubated and has received adequate fluid resuscitation. A sepsis screen has been performed and the baby has been started on broad spectrum antibiotics.

Initial laboratory tests show her serum ammonia level is 500 µmol/L (normal 0 – 80 µmol/L).

What is your differential diagnosis?

Viva 6 – Procedure Viva

A 6-week-old baby is admitted to PICU following a 3.5 uncuffed tracheostomy insertion for subglottic stenosis.
She has a past history of VACTERL syndrome and a tracheoesophageal fistula (repaired Day 1 of life).

The day following surgery she is ventilating well on CPAP/pressure support and comfortable on low dose morphine.
Her saturations drop (78 – 82%) and do not recover despite increasing the FiO_2 from 0.25 to 0.5.
On examination she has increased work of breathing and prolonged expiration with a 'tight sounding' fixed expiratory noise.

What is your differential diagnosis?

What will you do?

Viva 7 – Radiology Viva

Candidates were shown a series of radiological investigations and asked to describe the important findings in each.

Viva 8 – Communication Viva

You are the Consultant on-call for the PICU and have been called in to the unit to assist with managing a brief hyperkalaemic arrest in a baby Day 1 post-op arterial switch operation for transposition of the great arteries.

The patient has now been successfully resuscitated with return of normal sinus rhythm and a satisfactory cardiac output. The serum potassium is now normal.

From information obtained after speaking to several staff members, it appears that the arrest may have been precipitated by potassium administration prescribed by a relatively new Registrar (Julie) based on a serum potassium result which was probably spurious (all previous results were on the high side, and this specimen looks as if it may have been a diluted sample).

The Registrar (Julie) is extremely upset by what has happened and has gone home. You are now going to meet Julie online via Zoom at her request for 10 minutes, before meeting with the parents to explain to them what happened.