



# COLLEGE OF INTENSIVE CARE MEDICINE OF AUSTRALIA AND NEW ZEALAND

## SECOND PART PAEDIATRIC EXAMINATION REPORT

**AUGUST / NOVEMBER 2015**

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 four 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 Brisbane at the Lady Cilento Children's Hospital, and the vivas were held at the Brisbane Convention & Exhibition Centre.

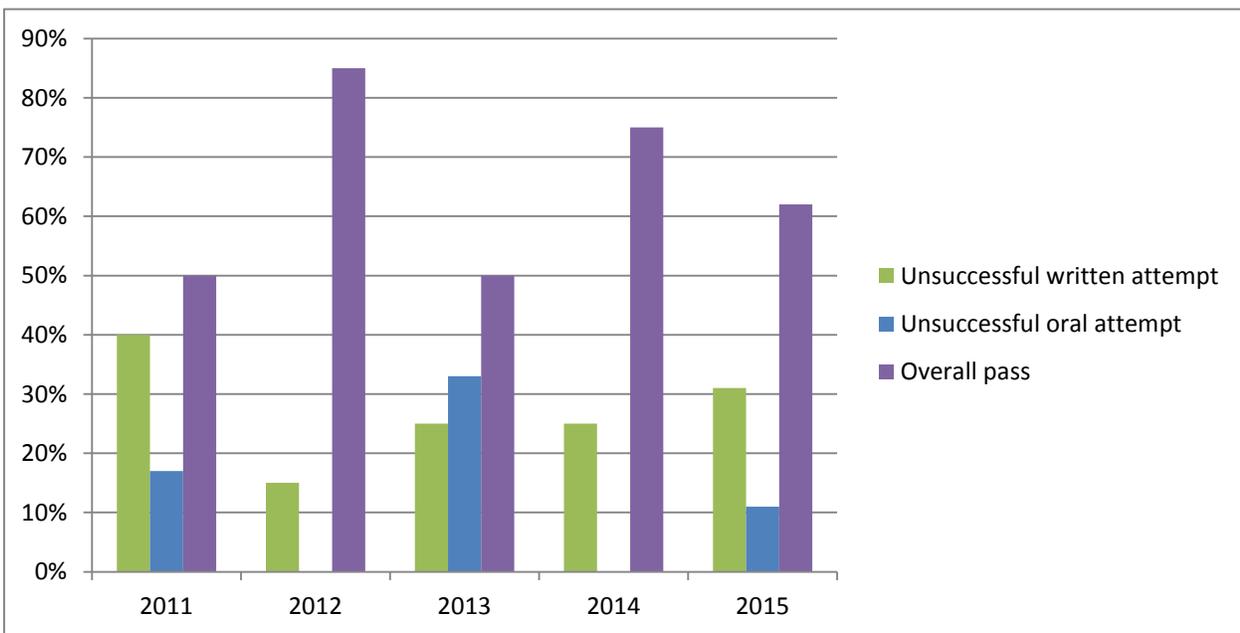
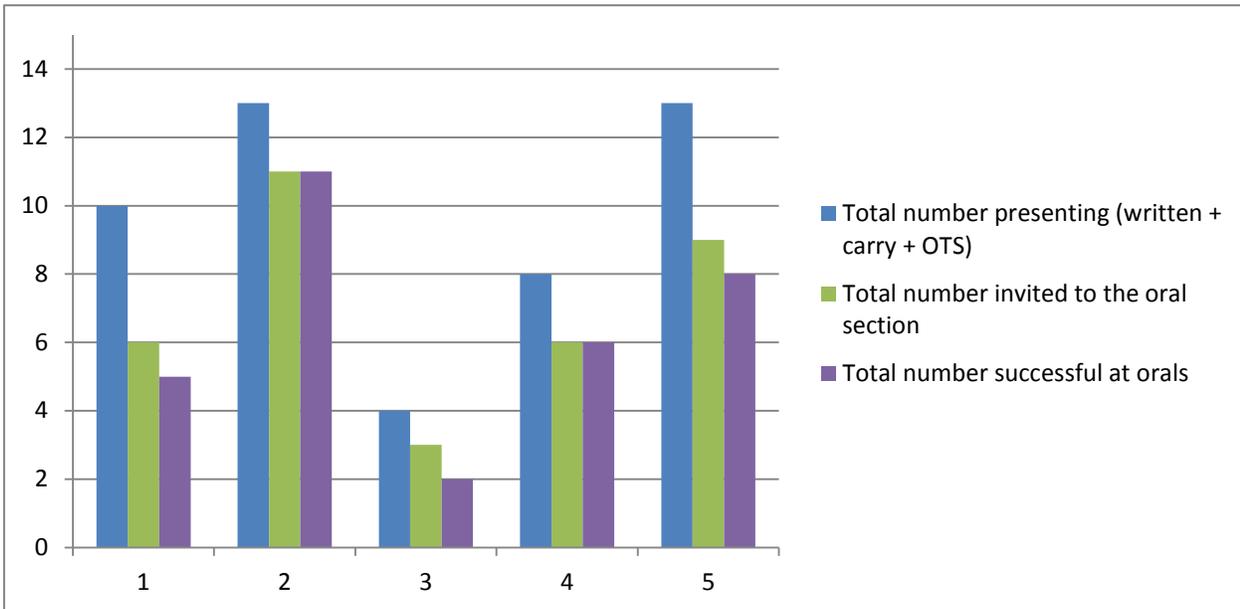
### STATISTICAL REPORT

<b>Overall pass rates</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>
Total number presenting (written + carry + OTS)	10	13	4	8	13
Total number invited to the oral section	6	11	3	6	9
Total number successful at orals	5	11	2	6	8
	83%	100%	67%	100%	89%
<b>Overall pass rate</b>	5/10	11/13	2/4	6/8	8/13
	<b>50%</b>	<b>85%</b>	<b>50%</b>	<b>75%</b>	<b>62%</b>

Clinical Pass Rates	2011		2012		2013		2014		2015	
	Pass rate	Highest individual mark								
Hot Case 1	83%	90%	100%	83%	67%	63%	83%	90%	78%	80%
Hot Case 2	50%	67%	100%	87%	67%	67%	83%	80%	56%	85%
Total number successful in the Hot Case section	5/6		11/11		2/3		5/6		8/9	
Overall Hot Case pass rate	83%		100%		67%		83%		89%	

Vivas Pass Rates	2011		2012		2013		2014		2015	
	Pass rate	Highest individual mark								
Viva 1	83%	75%	100%	90%	67%	63%	100%	80%	44%	60%
Viva 2	100%	68%	82%	80%	100%	70%	67%	88%	44%	70%
Viva 3	100%	95%	82%	80%	33%	70%	100%	85%	33%	85%
Viva 4	33%	65%	100%	90%	67%	85%	50%	54%	67%	83%
Viva 5	33%	88%	82%	100%	100%	85%	67%	70%	67%	80%
Viva 6	67%	72%	91%	90%	33%	68%	83%	73%	89%	80%
Viva 7	17%	50%	100%	90%	33%	80%	100%	90%	89%	95%
Viva 8	33%	80%	64%	63%	67%	53%	100%	85%	100%	95%
Total number successful in the Viva section	5/6		11/11		2/3		6/6		8/9	
Overall Viva pass rate	83%		100%		67%		100%		89%	

## 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 alternative ventilation modes, diagnosis and respiratory consequences of neuromuscular disease, biomarkers in cardiac disease and management of prolonged ventilation in Morquio syndrome.

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.

Candidates are reminded to read the questions carefully and thoroughly and to include in their answer only information that is relevant to the question. It is crucially important to write legibly; examiners need to be able to read written answers. 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.

Candidates who failed the written section passed an average of 13/30 questions compared with candidates scoring >50% and gaining an invitation to the oral section, passing an average of 21/30 questions.

### **Hot Cases**

Hot cases run for twenty minutes, with an additional one minute 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 focussed 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

### Notes

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

Images from the SAQ papers are not shown in this 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 your candidate number and each question number on the cover of each book and hand in all books.

### Glossary of Terms

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

## Question 1

A 10-year-old boy is brought to your Children's Emergency Department after being hit by a car travelling at 50 km/hr. On arrival his Glasgow Coma Score is 11 (motor score 4). He is on a spinal board and has a hard collar in place, which is well fitted.

His vital signs are as follows:

Heart rate 134 beats/minute  
Respiratory rate 32 breaths/minute  
Blood pressure 102/61 mmHg  
SpO<sub>2</sub> 99% on 4 L/min O<sub>2</sub> via Hudson mask  
Temperature 35.9°C

He has grazing over the right side of his face and torso. His chest is clear. His abdomen is distended, lacks bowel sounds and seems tender, without obvious rebound.

He is intubated and taken to CT for further imaging. CT of the head and chest are reported as normal.

A single image from his CT scan of the abdomen is shown below: *(image removed)*

- a) Outline your management of this specific injury. (50% marks)

The patient has been stable while sedated and ventilated overnight in a hard collar. The plan is to wake and extubate him.

- b) How will you manage his cervical spine, and what steps will you take to clear this from injury? (50% marks)

## Comments

*38% of candidates passed this question.*

*The first part of this question was about the management of high grade splenic laceration. Candidates who failed this part tended to devote large parts of their answer to a general approach to trauma, rather than the clearly requested focus on splenic trauma. The expected response outlined a conservative approach, with details on how to monitor progress and triggers for transfusion or surgery. The subsequent part, pertaining to cervical spine management, was frequently answered too generically; the patient described is conscious and extubatable, and the answer should have reflected this.*

## Question 2

A 7-month-old girl, weighing 8 kg, with tricuspid atresia is admitted to the Intensive Care Unit following a bidirectional cavopulmonary (Glenn) shunt and take-down of Blalock-Taussig shunt.

On admission she is ventilated (FiO<sub>2</sub> 1.0, PIP 26 cm H<sub>2</sub>O, PEEP 7 cm H<sub>2</sub>O, rate 20 per minute), and has the following observations:

Temperature 36°C  
Heart rate 170 beats/min (sinus)  
Blood pressure 75/50 mmHg  
SVC pressure 22 mmHg  
Atrial Pressure 8 mmHg  
SpO<sub>2</sub> 58%  
End-tidal CO<sub>2</sub> 47 mmHg

- a) Define the transpulmonary gradient and the normal range in this circulation. (10% marks)
- b) List the causes of an elevated transpulmonary gradient. (20% marks)
- c) What would be your target SpO<sub>2</sub> in this child? (10% marks)
- d) List the causes of post-operative hypoxia following a Glenn shunt. (20% marks)
- e) Outline your approach to ventilation in this child. (40% marks)

### **Comments**

*92% of candidates passed this question.*

*This question regarding post-operative management of the cavopulmonary shunt was generally well-answered. The section on approach to ventilation was often disappointingly superficial, however. In particular, few candidates included an appropriately detailed discussion of PaCO<sub>2</sub> management.*

### **Question 3**

- a) Define Airway Pressure Release Ventilation (APRV), and list its fundamental principles. (20% marks)
- b) Outline the initial settings for APRV and the approach to weaning with this mode. (30% marks)
- c) Define High Frequency Oscillation Ventilation (HFOV), and list the advantages it offers over conventional ventilation. (10% marks)
- d) Outline the determinants of CO<sub>2</sub> clearance on HFOV. (40% marks)

### **Comments**

*15% of patients passed this question.*

*Many candidates failed to display even a basic understanding of APRV. The part of the question pertaining to HFOV was disappointing, given that this is relatively common in paediatric intensive care. Most candidates were unable to describe the relationship between CO<sub>2</sub> clearance and tidal volume, and how this was influenced by frequency and delta P. Many supplied a discussion of mechanisms of gas exchange, which was not requested.*

### **Reference**

*Rogers' Textbook of Pediatric Intensive Care, Chp 34: 520-526).  
Pillow, Crit Care Med 2005. 33(3) S135-141.*

#### **Question 4**

Discuss the use of citrate anticoagulation in continuous renal replacement therapy.

#### **Comments**

*85% of candidates passed this question.*

*Most candidates gave a reasonable answer to this question and understood the principles involved. To score highly, it was necessary to reveal an in-depth knowledge of the practicalities of citrate administration (how much, where, how to monitor) and the potential side effects.*

#### **Question 5**

You are the consultant on for the Intensive Care Unit. The following information is available to you regarding one of today's elective cardiac surgical admissions:

2-month-old girl with antenatal diagnosis of complete atrioventricular septal defect (AVSD) and Trisomy 21. Presentation and admission with rhinovirus-positive upper respiratory tract infection two weeks ago. She has been an inpatient since then with heart failure, controlled on diuretics, and is taking a combination of oral and nasogastric feeds.

Echo:

Complete AVSD, large primum ASD and large VSD. Preferential AV valve flow towards the RV. Smaller LV, but apex forming. Chordal attachments to the septal crest without outflow tract obstruction. Moderate AV valve regurgitation arising from the cardiac crux: maximum velocity 3.9 m/sec (peak gradient 60 mmHg). Significant D-shaped septal flattening, hypertrophic RV. Aortic valve appears mildly thickened, but no stenosis or regurgitation. Left aortic arch. No coarctation.

She is booked for a complete AVSD repair.

Outline specific complications that you would anticipate following this repair.

#### **Comments**

*38% of candidates passed this question.*

*This question asked candidates to anticipate problems in post-operative care based on pre-operative information (Trisomy 21, recent viral infection, complex AVSD with relatively small LV). Too many candidates addressed general post-op complications (inflammatory response, low cardiac output syndrome, reduced urine output etc.), rather than answering the question about this patient with this background and lesion. Few candidates mentioned AV valve regurgitation, or the consequences of a small left ventricle and abnormal aortic valve in their answer.*

## Question 6

A 7-day-old boy is transferred from a local hospital with fulminant liver failure and shock (blood pressure 77/26 mmHg). He has been intubated & ventilated for control of seizures prior to transfer.

His admission blood results are shown below:

Parameter	Patient Value	Normal Range
pH	7.04*	7.35 – 7.45
PaCO <sub>2</sub>	35 mmHg (4.7 kPa)	35 – 45 (4.7 – 6.0)
PaO <sub>2</sub>	476 mmHg (63.5 kPa)*	80 – 100 (10.7 – 13.3)
HCO <sub>3</sub>	9.0 mmol/L*	17.0 – 30.0
Na	128 mmol/L*	135 – 145
K	6.7 mmol/L*	3.5 – 5.5
Cl	97 μmol/L*	101 – 112
Urea	7.8 mmol/L*	1.0 – 6.0
Creatinine	99 μmol/L*	27 – 78
Ammonia	437 μmol/L*	0 – 80
Glucose	3 mmol/L*	3.5 – 6.1
Bilirubin	133 μmol/L	< 225
Conjugated bilirubin	42 μmol/L*	< 11
Aspartate aminotransferase (AST)	12550 IU/L*	< 50
Alanine aminotransferase (ALT)	2086 IU/L*	< 35
γ-Glutamyl transpeptidase (GGT)	456 IU/L*	< 140
Alkaline phosphatase (ALP)	689 IU/L*	100 – 400
International Normalised Ratio (INR)	13.3*	0.7 – 1.1
Fibrinogen	0.40 g/L*	1.25 – 3.00
Haemoglobin	94 g/L*	168 – 228
White cell count	19.8 x10 <sup>9</sup> /L	> 8.0
Neutrophils	5.56 x10 <sup>9</sup> /L	5.10 – 23.20
Bands	7.52 x10 <sup>9</sup> /L*	0 – 1.70
Platelets	193 x10 <sup>9</sup> /L	140 – 460
C-reactive protein	16*	< 10

- a) List your differential diagnosis. (10% marks)
- b) Tabulate your management plan, including anticipated problems, by organ system. (90% marks)

## Comments

77% of candidates passed this question.

Most candidates passed this question about a newborn with likely HSV infection. Some did not follow the instruction to tabulate by organ system, thereby missing the opportunity to pass or score highly.

## Question 7

A previously well 10-month-old girl presented to a referring centre with rapidly progressive respiratory failure and sepsis. After resuscitation, intubation and ventilation (complicated by tension pneumothoraces) she was transferred to your Paediatric Intensive Care Unit.

Shortly after arrival, she was cannulated onto venovenous (VV)-ECMO using a 14 Fr OriGen double-lumen catheter, which was placed surgically in the right internal jugular vein. She is haemodynamically stable on a low dose adrenaline infusion. Blood cultures have grown methicillin-resistant Staph aureus.

The chest X-ray taken immediately after initiation of VV-ECMO is shown below:

*(Image removed.)*

- a) Outline your approach to the non-ECLS management of this patient. (60% marks)

On day 3 of VV-ECMO, the child's saturations have dropped into the 70's and high 60's. Typically, her saturations on ECMO have been in the mid to high 80's.

- b) Outline your approach to this clinical problem. (40% marks)

### **Comments**

*85% of candidates passed this question.*

*Good responses detailed the non-ECLS care by system, extending the answer to include aspects such as wound and skin care and communication with family. Responses to the part of the question regarding desaturation on VV ECMO were mostly limited, with few candidates revealing a comprehensive knowledge of potential causes of such a problem and approaches to diagnosis and treatment.*

### **Question 8**

You are caring for a 4-year-old boy who has suffered significant brain injury, following a near-drowning episode three weeks ago. He is currently ventilator-dependent despite two attempts to wean and extubate. He is unresponsive to stimuli and has fixed pupils. He demonstrates adequate respiratory drive, but has no cough or gag response.

Although you feel that his likely quality of life is very poor, his parents have been unwilling to discuss any palliative plan due to their religious beliefs.

Outline your approach to this dilemma.

### **Comments**

*46% of candidates passed this question.*

*It was surprising that many candidates were unable to structure their answer to this question in a useful way. Clinical aspects to answers did not gain marks, which were reserved for description of an open and transparent approach, with communication and consultation paramount. Expected responses also included offering of an external second opinion and discussion with local clinical ethics committee.*

### **Question 9**

In a table, compare and contrast the features of Diabetic Ketoacidosis and Hyperosmolar Hyperglycaemic State (hyperosmolar non-ketotic coma).

### **Comments**

*38% of candidates passed this question.*

*This was a straightforward question, which was disappointingly poorly answered. Answers should have included not only the biochemical similarities and distinctions, but should also have addressed clinical features of presentation, complications and an approach to management.*

### **Question 10**

- a) Outline the proposed mechanism of action of heated humidified high flow nasal cannulae (HHFNC). (50% marks)
- b) List four situations where there is some evidence of benefit of HHFNC. (30% marks)
- c) List potential adverse effects of HHFNC. (20% marks)

### **Comments**

*77% of candidates passed this question.*

*This was generally well-answered. However, some candidates were surprisingly vague and did not supply sufficient detail in their answers regarding proposed mechanisms and potential adverse effects. Detail of how this mode of respiratory support exerts its effect, rather than just a description of the clinical effect was expected.*

### **Question 11**

A 3-year-old immunised boy is admitted with a 3 week history of weight loss, fever, night sweats, cough and increasing work of breathing. He has been treated with antibiotics and prednisolone by his GP. He lives with his grandfather, who has also been unwell, and tuberculosis is suspected. He is febrile, obtunded and has a heart rate of 180 beats/min and a respiratory rate of 90 breaths/min, with saturations in air of 70%.

His chest X-ray is shown below:

*(Image removed.)*

- a) List radiographic features you see on this chest X-ray consistent with pulmonary tuberculosis. (5% marks)
- b) What other radiographic features might you see with pulmonary tuberculosis? (5% marks)
- c) How would you confirm the diagnosis? (20% marks)
- d) List four extrapulmonary presentations of tuberculosis in children. (20% marks)
- e) Outline your management plan for this child, including any specific precautions you will take. (50% marks)

### **Comments**

*92% of candidates passed this question.*

*Sufficient detail to diagnose and treat tuberculosis safely was required to pass this question and the majority of candidates scored well.*

## Question 12

A 4-month-old male infant has been ventilated in the Intensive Care Unit for 10 days for parainfluenza 4 pneumonitis. He has made a good respiratory recovery, and has minimal residual changes on chest X-ray. On CPAP/pressure support with an  $\text{FiO}_2$  of 0.25, he does not have increased work of breathing,  $\text{SpO}_2$  is 98% and end-tidal  $\text{CO}_2$  is 40 mmHg.

Immediately following extubation, the  $\text{SpO}_2$  decreases and non-invasive ventilation is started. After four hours of mask BiPAP with an  $\text{FiO}_2$  of 0.65,  $\text{SpO}_2$  is 90% and arterial  $\text{PaCO}_2$  is 73 mmHg. On examination he appears to have thoraco-abdominal asynchrony and generalised hypotonia.

A chest X-ray is performed, which is shown below:

*(Image removed.)*

- a) List your differential diagnosis. (30% marks)
- b) An electromyogram (EMG) and nerve conduction studies are obtained. Tabulate the expected results for each of your diagnosis given in part a). (70% marks)

## Comments

23% of candidates passed this question.

To pass this question, the candidate needed to formulate a reasonable differential diagnosis based on the clinical information provided. Clearly the focus was on neuromuscular disease, based on the question and the investigations listed in the second part. Detailed, disease-specific knowledge of EMG and nerve conduction tests was not required, but candidates were expected to have sufficient knowledge of pathophysiological processes to anticipate when tests would be normal or abnormal, and to deduce how they might be abnormal. Many candidates did not even attempt to do this.

## Question 13

A 6-month-old girl with chronic liver failure undergoes a cadaveric liver transplant and is admitted to the Paediatric Intensive Care Unit. Her blood results over the first post-operative day are shown below:

Parameter	Normal Range	Patient Value		
		6 Hours	12 Hours	18 Hours
Sodium	135 – 145 mmol/L	136	135	133*
Potassium	3.5 – 5.2 mmol/L	4.5	4.3	5.2
Urea	1.4 – 5.4 mmol/L	2.7	4.2	2.7
Creatinine	20 – 50 $\mu\text{mol/L}$	< 20	< 20	< 20
Glucose	3.5 – 5.4 mmol/L	5.6*	4.7	2.3*
Lactate	0.5 – 2.2 mmol/L	1.8	4.6*	6.2*
Albumin	32 – 45 g/L	35	30*	27*
Bilirubin	0 – 24 $\mu\text{mol/L}$	31*	101*	240*
Alkaline Phosphatase (ALP)	80 – 350 IU/L	223	88	223
Aspartate aminotransferase (AST)	0 – 80 IU/L	419*	419*	2050*
Alanine aminotransferase (ALT)	< 45 IU/L	784*	530*	784*
$\gamma$ -Glutamyl transpeptidase (GGT)	0 – 50 IU/L	29	38	29
Haematocrit	0.31 – 0.40		0.31	0.20*
Haemoglobin	105 – 136 g/L	112	101*	70*
International Normalised Ratio (INR)	0.8 – 1.2	0.8	5.5*	6.4*
Fibrinogen	1.5 – 4.0 g/L	2.0	1.4*	0.7*
pH	7.36 – 7.44	7.40	7.20*	7.10*

- a) List four possible causes for these laboratory findings in this setting. (20% marks)
- b) Outline your priorities over the next few hours. (40% marks)
- c) Discuss your approach to the use of anticoagulation and blood products post-liver transplant. (40% marks)

### **Comments**

*62% of candidates passed this question.*

*Candidates who scored poorly in this question failed to impart the urgency with which investigations and communication with transplant teams needed to take place. Several candidates answered this question with a general 'ABC' style approach, which did not convey that they understood the priorities and practicalities of this specific situation.*

### **Question 14**

Outline the pathophysiological basis and clinical application of the following biomarkers in children with cardiac disease:

- a) Serum lactate
- b) Serum B-type natriuretic peptide
- c) Serum cardiac troponin
- d) Central venous oxygen saturation

### **Comments**

*23% of candidates passed this question.*

*This question was almost universally poorly answered, despite the fact that two of the biomarkers are both simple and ubiquitously used. Answers were narrow in focus, lacked detail and revealed a lack of knowledge. Candidates were expected to know the source, nature and longevity of these markers, circumstances under which they may be useful (or not), clinical applications and practical restrictions to use.*

### **Question 15**

Critically evaluate the use of early goal directed therapy in septic shock.

### **Comments**

*85% of candidates passed this question.*

*There were some excellent answers to this question, where candidates were highly conversant with the recent literature in this area. Poor answers failed to give context to recent publications, ignoring previous studies, or did not mention paediatric literature or application.*

## Question 16

A 19-year-old girl is admitted to your unit following cervical decompression and upper cervical spinal fusion. She has type IV mucopolysaccharidosis (Morquio syndrome), is confined to a wheelchair and has severe lung disease, requiring mask CPAP support for 12 – 15 hours per day.

She had a lumbar/thoracic spinal fusion seven years ago for kyphoscoliosis.

As part of the current procedure she has had a tracheostomy tube inserted, in anticipation of the need for prolonged post-operative respiratory support. The plan is to remove the tracheostomy tube when it is no longer needed.

Her chest X-ray and initial ventilator settings are shown below, (*image removed*) and her arterial blood gas results are shown on page 3.

### Ventilator Settings:

Mode	SIMV Volume Control
FiO <sub>2</sub>	0.6
Tidal Volume	8 mL/kg (160 mL)
PEEP	5 cmH <sub>2</sub> O
Pressure Support	10 cmH <sub>2</sub> O
Rate	16 breaths/min
Inspiratory time	1 second
Ventilator is alarming: peak inspiratory pressure > 35 cmH <sub>2</sub> O	

Arterial Blood Gas		
Parameter	Patient Value	Normal Range
pH	7.21*	7.36 – 7.44
PaCO <sub>2</sub>	43.5 mmHg (5.8 kPa)	35.0 – 45.0 (4.6 – 6.0)
PaO <sub>2</sub>	150 mmHg (20.0 kPa)*	80 – 100 (10.6 – 13.3)
SaO <sub>2</sub>	0.99	0.95 – 1.00
Bicarbonate	16 mmol/L*	21 – 27
Chloride	110 mmol/L	95 – 110
Base Excess	-11 mmol/L*	-2 to +2
Lactate	0.7	0.5 – 2.2
Haemoglobin	125 g/L	105 – 136
Sodium	140 mmol/L	135 – 145
Potassium	3.6 mmol/L	3.5 – 5.2
Glucose	5.0 mmol/L	3.5 – 5.4
Calcium (ionised)	1.02 mmol/L*	1.15 – 1.30

- What features of this chest X-ray will you need to consider in your management? (10% marks)
- Outline your airway and ventilation strategy for this patient. (30% marks)
- The patient remains dependent on invasive ventilation after three weeks. Make a table of potential causes and your approach to each. (60% marks)

### Comments

15% of candidates passed this question.

*This question was very poorly answered. Again, many candidates did not manage a consultant-level overview of this complex patient, and answered from a very narrow perspective. The airway and ventilation*

strategy needed to pertain to this patient, and general statements about ventilation and extubation did not accrue marks. The answers to the section on prolonged ventilator dependency lacked practical approaches and suggestions, and very few candidates mentioned palliative care as an option.

### Question 17

- a) Nominate a study that has changed Paediatric Intensive Care Unit practice. Briefly describe its design and major findings. (25% marks)
- b) Describe the important limitations of the study and caveats in its application to your clinical practice. (25% marks)
- c) List four broad reasons for a positive clinical trial result. (30% marks)
- d) List the four key factors to consider in clinical trial design. (20% marks)

### Comments

46% of candidates passed this question.

This question allowed candidates to reflect on how clinical research is used in practice and to display their understanding of the limitations and difficulties in design, interpretation and application of clinical research. Studies cited included PRIMACORP, TRIPICU, SAFE and others, and most candidates were able to give a limited description of design and limitations. The second half of the question was less well answered, requiring more abstract, broader thinking about research design and interpretation.

### Reference

Oh's Intensive Care Manual, Chapter 10.

### Question 18

A 9-year-old girl with a history of acute lymphoblastic leukaemia has congestive cardiac failure and poor cardiac function. She completed chemotherapy treatment six weeks ago and is in remission. She requires Paediatric Intensive Care Unit admission and management. The chest X-ray on admission to the Paediatric Intensive Care Unit is shown on page 5 (*image removed*).

She is commenced on diuretics, intravenous dobutamine via a peripheral line, and non-invasive ventilation. A nasopharyngeal aspirate is positive for enterovirus. Left ventricular fractional shortening is 10% on echocardiogram. Four months ago the echocardiogram showed a structurally normal heart, with a fractional shortening of 31%.

- a) List the important features on the X-ray. (10% marks)
- b) List your differential diagnosis. (20% marks)
- c) Outline your approach to vascular access in this patient. (40% marks)

One week later she is still in the Paediatric Intensive Care Unit, with increasing ventilation and inotrope requirements. The nasopharyngeal aspirate is now negative.

- d) Discuss the role of mechanical cardiac support in this patient. (30% marks)

## Comments

69% of candidates passed this question.

Patients who did poorly on this question did not articulate the vulnerability of the patient and did not recognise the dangers inherent in line insertion. Consequently, such answers did not discuss the practicalities of vascular access appropriately.

## Question 19

- a) Define antibiotic stewardship. (10% marks)
- b) Outline the principles of good antibiotic stewardship in the Paediatric Intensive Care Unit. (90% marks)

## Comments

100% of candidates passed this question.

This question was answered very well, with candidates displaying a good understanding of the principles involved and giving practical examples of application.

## Question 20

A 3.2 kg term infant had a neonatal repair of a ventricular septal defect, atrial septal defect and coarctation of the aorta. He has been in the Paediatric Intensive Care Unit since his repair, three weeks ago. His post-operative course was complicated by an initial low cardiac output state, followed by bilateral chylothoraces, requiring prolonged drainage, thoracic duct ligation, total parenteral nutrition then monogen feeds. He was weaned to CPAP/pressure support, with a  $\text{FiO}_2$  of 0.25, but subsequently failed extubation to nasal CPAP.

He is currently ventilated on pressure-limited SIMV, with a 3.5 mm cuffed nasotracheal tube.

Ventilator settings are as follows:

Pressures 17/5 cm  $\text{H}_2\text{O}$

Rate 30/minute

$\text{FiO}_2$  0.23

$\text{SpO}_2$  is 95% and capillary  $\text{pCO}_2$  is 40 mmHg (5.3 kPa), normal range 35 – 45 mmHg (4.7 – 6.0 kPa)

List potential causes of his extubation failure, and outline how you would investigate each.

## Comments

92% of candidates passed this question.

A relatively easy question, addressing a commonly encountered clinical problem. The best answers were comprehensive, incorporating all of the information imparted in the stem.

## Question 21

*(Images removed.)*

- a) A 5-month-old baby is recovering from repair of anomalous origin of the left coronary artery from the pulmonary artery (ALCAPA). The nurse notes an abnormal rhythm on the monitor and performs an ECG (ECG 1) shown on page 8.
- What rhythm is shown?
  - List the reasons for your answer. (25% marks)
- b) An 8-month-old baby is admitted to the Intensive Care Unit following repair of Tetralogy of Fallot and is haemodynamically stable. A routine post-operative ECG (ECG 2) is performed and shown on page 9.
- What is the rhythm?
  - What treatment is required? (25% marks)
- c) A 5-year-old with acute myeloid leukaemia is being treated for fungal sepsis and is having haemofiltration for renal failure. His ECG (ECG 3) is shown on page 10.
- Describe the abnormalities seen on the ECG.
  - What is the diagnosis? (25% marks)
- d) A newborn infant is admitted with supraventricular tachycardia, successfully treated with adenosine. His ECG (ECG 4) is shown on page 11.
- What is the diagnosis?
  - Explain the electrophysiological basis of the ECG abnormality. (25% marks)

## Comments

*54% of candidates passed this question.*

*Candidates were asked to identify the following abnormalities on ECG: multiple atrial ectopic beats, junctional rhythm, hypokalaemia and WPW syndrome. Some candidates were unable to describe changes evident on ECG and failed to recognise simple rhythm disturbances.*

## Question 22

Discuss the impact of viral respiratory tract infections in children undergoing cardiac surgery with cardiopulmonary bypass.

## Comments

*69% of candidates passed this question.*

*Candidates who scored highly addressed more than just the direct effects of CPB, discussing which lesions and patients might be most affected by repair following preceding viral infection, and the broader impact of delayed surgery or recovery on PICU and cardiac surgical services.*

### Question 23

In table form, compare and contrast the following characteristics of midazolam and dexmedetomidine:

- a) Mechanism of action
- b) Uses in the Intensive Care Unit
- c) Elimination half-life
- d) Metabolism
- e) Adverse effects
- f) Cost
- g) Role in the Intensive Care Unit delirium

### Comments

*100% of candidates passed this question.*

*A straightforward question that was answered well by the majority of candidates.*

### Question 24

A 6-week-old child is admitted with bronchiolitis and is stable on high flow nasal cannula oxygen. The nurse records a blood pressure of 180/120 mmHg, using an appropriately sized cuff. This blood pressure is confirmed by several repeat measurements.

- a) List six important potential causes for hypertension in this child. (30% marks)
- b) List your approach to examination and investigation of this child's hypertension. (30% marks)
- c) Outline your immediate management of this child's hypertension. (40% marks)

### Comments

*100% of candidates passed this question.*

### Question 25

- a) Outline the physiology of the normal cough reflex. (30% marks)
- b) Outline how this can be affected by neuromuscular disease in children. (30% marks)
- c) List approaches and methods to assist with secretion management in non-intubated patients with neuromuscular disease in the Intensive Care Unit. (40% marks)

## Comments

*8% of candidates passed this question.*

*All parts of this question were answered poorly. Most candidates were unable to even outline the basic physiology aspects of the question and therefore could not build on this to answer the second part. The ultimate part of the question addressed a common clinical problem and an organised answer including an approach to prevention of atelectasis, physiotherapy, viscosity management, coughing and mechanical insufflation/exsufflation was expected.*

## Question 26

A 17-year-old boy was admitted to the Paediatric Intensive Care Unit following resection of a cerebellar cavernoma. A non-contrast CT scan was performed on the first post-operative day. Two images (Image 1 and Image 2) from that scan are shown below.

*(Images removed.)*

On the first two post-operative days he was nauseated, requiring multiple anti-emetics, but otherwise he appeared to be recovering well. On the third post-operative day he has become difficult to rouse, speaking single words, and has symmetrical upper limb tremors and flexion dystonia. His pupils are equal and reactive. His Glasgow Coma Score fluctuates; at best his eyes open to voice, he localises to pain, does not speak, but cries intermittently.

His observations are as follows:

Heart rate 120 beats/minute  
Respiratory rate 20 breaths/minute  
Blood pressure 165/100 mmHg  
SpO<sub>2</sub> 95% in air

List five potential differential diagnoses for the current clinical situation, and appropriate management (investigations and/or treatment) for each.

## Comments

*69% of candidates passed this question.*

*Most candidates answered this well, coming up with a plausible differential diagnosis and appropriate investigations. Some expected responses included hydrocephalus, hyponatraemia, dystonic reaction, posterior fossa syndrome and seizures.*

## Question 27

You are undertaking a retrieval from a regional centre, where a 10-year-old boy has been injured riding a quad-bike. He has anterior neck lacerations from a barbed wire fence. He presents with soft stridor but no respiratory distress.

Glasgow Coma Score is 15  
No focal neurological signs  
Pulse 90 beats/minute  
Blood pressure 110/70 mmHg  
Respiratory rate 26 breaths/minute

- a) What will you focus on in your assessment (by phone) of this patient and what equipment/resources will you require for transfer? (50% marks)

On arrival, the patient has deteriorated with hypoxia and moderate-severe respiratory distress.

- b) How will you manage this patient's airway? (50% marks)

### **Comments**

*92% of candidates passed this question.*

*Although the pass rate was high, the second part of the question revealed that many candidates had a limited understanding of management of an unstable airway, and discussion of the appropriate equipment for such an undertaking was sparse.*

### **Question 28**

A 10-year-old boy has been in the Paediatric Intensive Care Unit for 13 days following severe burns involving 55% of his body surface area. He has been to the operating theatre four times to have his burns debrided and grafted.

Throughout his admission he has been receiving a combination of midazolam, fentanyl, and ketamine as infusions for analgesia, sedation and anxiolysis. He was extubated 36 hours ago and now appears to be agitated and confused.

Outline your approach to the assessment and management of his confusion and agitation, including your usual approach to delirium management.

### **Comments**

*62% of candidates passed this question.*

*Candidates were expected to address possible reasons for the child's clinical state (drug withdrawal, metabolic abnormalities, sepsis etc.) as well as delirium. Some candidates answered only about delirium. Several candidates displayed very poor knowledge of delirium assessment and treatment.*

### **Question 29**

A 9-year-old girl is admitted to Paediatric Intensive Care from theatre following removal of a large suprasellar tumour. Her pre-operative weight was 30 kg. In the first three hours she passes 130, 120, and then 150 mls of urine.

Observations show the following:

Heart rate 90 beats/minute  
Blood pressure 115/60 mmHg  
Central venous pressure 4 mmHg  
Temperature 36.7°C  
SpO<sub>2</sub> 98%

Laboratory investigations are shown below:

Parameter	Patient Value	Normal Range
Sodium	152 mmol/L*	135 – 145
Potassium	3.5 mmol/L	3.4 – 4.5
Chloride	116 mmol/L*	95 – 110
Bicarbonate	22 mmol/L	21 – 27
Urea	3.8 mmol/L	1.5 – 5.4
Glucose	6.0 mmol/L*	3.5 – 5.5
Urine Sodium	90 mmol/L	
Urine osmolality	305 mOsmol/L	

- a) What is the most likely cause of the hypernatraemia? (10% marks)

Twelve hours later, her observations are as follows:

Heart rate is 125 beats/min  
Blood pressure 110/60 mmHg  
Central venous pressure 3 mmHg  
The serum sodium is 159 mmol/L, and her urine output is averaging 6 mL/kg/hr

- b) Outline your approach to fluid management in this patient. (40% marks)

After four days in the Intensive Care Unit, the patient is discharged to the neurosurgical ward on regular desmopressin (DDAVP), ward diet and free fluids. Two days later she has a generalised convulsion. Her serum sodium is 115 mmol/L.

- c) List differential diagnosis for the hyponatraemic seizure, and briefly outline acute management. (50% marks)

### Comments

*77% of candidates passed this question.*

*The first 2 parts of this question were generally answered well, although a calculation of water deficit was missing from most answers. In the third part of the question, few candidates described investigation of the cause of the hyponatraemic seizure; candidates are reminded that the term 'management' includes investigation (see Glossary).*

### Question 30

Discuss aetiology, prevention, diagnosis, and management of ventilator associated pneumonia in children.

### Comments

*62% of candidates passed this question.*

*This question was poorly answered, especially as it was quite prescriptive in how to organise the answer. Few candidates wrote about aetiology, and discussion of prevention was unsophisticated and uncritical.*

## **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 Lady Cilento Children's Hospital in Brisbane.

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.

This year candidates were given a written introduction to the hot cases for the first time. This allowed candidates one minute to think about how best to approach the case, what information to seek and how to structure examination. This minute is 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 4 week old infant with Pertussis who had been intubated after an apneic episode requiring CPR.
- A 2 year old girl with a chromosomal abnormality and global developmental delay who was intubated with respiratory failure.
- A 5 month old girl with multiple cardiac and non-cardiac complications following a VSD repair 8 weeks ago.

### **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 – Procedure station**

You are called to the Emergency Department where a six year old boy (20Kg) with undifferentiated syndrome has presented with generalised tonic-clonic seizures. He has been given midazolam 5mg intranasally and then 5mg IM pre-hospital, followed by 2.5mg IV in ED. He has been loaded with keppra 50mg/Kg and phenytoin 18mg/kg.

He appears to have stopped fitting but he has become hypopnoeic and it is difficult to maintain his airway as he has trismus. He desaturates to mid-80s, despite 15LPM facemask oxygen with a reservoir.

He has not improved with ventilation using a self-inflating bag. An attempt is made to intubate by a senior ED consultant, but this is unsuccessful.

You will have the ED consultant, another doctor and a nurse to assist.

### **Viva 2 – Radiology Station**

A series of plain X-rays, CT scans and MRIs were shown for candidates to comment on, including cervical spine trauma, cerebral AV malformation with bleed and a Chiari malformation.

### **Viva 3 – Communication Station**

You are about to meet Jo, a PICU registrar. You have been allocated as Jo's mentor. Jo is an adult ACEM trainee, has just started her advanced training and is doing a 6-month PICU rotation.

It is now 4 months into the term. You have been asked to talk to Jo because of a complaint from several nurses, who report that recently Jo has been making repeated errors in medication prescribing, does not review patients when asked, has been dismissive and sarcastic and is difficult to find on night duty (often asleep). These complaints have been escalated to the Nurse Manager and the Director. Now a ward consultant has also complained about her behavior.

Previously in this term you have had to speak to Jo because of her dismissive manner with nursing staff.

### **Viva 4**

A 2 month old ex-28 week premature infant with chronic lung disease presents with respiratory distress after a three day history of coryza and cough. His respiratory rate is 50/minute, heart rate 150/minute and pulse oximetry 89% in oxygen at 2 Litres/ minute. A nasopharyngeal aspirate is positive for respiratory syncytial virus (RSV). He is admitted to PICU with a diagnosis of RSV bronchiolitis.

Outline your approach to respiratory support in this infant.

### **Viva 5**

You are called to assist at a MET call in the outpatient clinic area. A 14 year old boy with severe cerebral palsy, complicated by epilepsy and a recent increase in his severe muscle spasms, has become unresponsive following a bolus via his intrathecal baclofen pump. The PICU fellow is providing assisted ventilation via bag and mask. The patient appears to be breathing.

What is your differential diagnosis for the cause of his unresponsive state?

### **Viva 6**

A 4 day old baby with an antenatal diagnosis of hypoplastic left heart syndrome (mitral atresia, aortic atresia) with a moderately restrictive atrial septum is admitted to the PICU following surgery. The baby has had a Norwood procedure with a 5mm Sano shunt.

The baby was transferred from theatre to PICU on dopamine 3 mcg/kg/min, haemodynamically stable, intubated with an open sternum, 2 chest drains and 4 pacing wires.

At handover, the surgeon describes no residual lesions – no arch gradient by comparison of right arm and umbilical artery invasive blood pressures.

Initial arterial blood gas in FiO<sub>2</sub> 0.6:

pH 7.38  
PaO<sub>2</sub> 40mmHg  
PaCO<sub>2</sub> 38mmHg  
lactate <2mmol/L

Describe the components of the Norwood procedure.

### Viva 7

You are called to the surgical ward as an emergency to see an 8 year old boy who underwent an uncomplicated appendectomy 2 days ago. He has had increasing abdominal pain, fever and tachycardia for 6 hours and has received 20 mL/kg normal saline fluid bolus during that time.

A full blood count performed 1 hour ago:

Hb 110  
Plts 104  
WCC 2.2 (33% neutrophils, 35% bands)

On examination he looks flushed and is difficult to rouse:

Temperature of 39°C  
Heart rate 186 beats per minute  
Blood pressure 68/29  
Respiratory rate 30 breaths per minute  
Abdo distended with no bowel sounds.  
Extremely tender around wound

Briefly describe your initial approach and treatment.

### Viva 8

It is 8:30pm and you are in the Emergency Department of your hospital as the acting Trauma Team leader. A 13 year old male pedestrian was struck by a car travelling at 50 km/hr approximately one hour ago. The impact was predominantly right-sided and the boy was thrown 12 metres along the road.

Upon arrival of the paramedics his GCS was 4 and he was intubated and ventilated with cervical spine precautions. An intravenous cannula was sited and he received 40 mL/kg 0.9% NaCl during transfer to hospital.

A primary survey reveals

- Intubated orally with 6.0 cuffed endotracheal tube
- Hard cervical collar in situ
- Adequately ventilated with equal chest movement; decreased air entry to the right base
- HR 135 beats per minute
- BP 80/40 mmHg
- Tem 34.8 °C
- Abdominal distension, with marked bruising over right lateral abdomen/lower chest

What are your major concerns about this patient's clinical condition?