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**University Hospital, Geelong
Emergency Medicine
Trial Fellowship Exam
Short Answer Questions (SAQ)
Week 27**

DIRECTIONS TO CANDIDATE

1. Answer each question in the space provided in this question paper.
2. Do not write your name on this question paper.
3. Enter your examination number in the space below.
4. Cross out any errors completely.
5. Do not begin the exam until instructed to do so.
6. Do not take examination paper or materials from this room.
7. The booklet binder may be removed during the exam.

**QUESTION & ANSWER
BOOKLET**

Question 1 (18 marks)

An 8 year old girl presents with an asthma exacerbation.

- a. State one (1) KEY pro and one (1) KEY con for each of the listed delivery systems for salbutamol, for this patient. (6 marks)

Delivery system	Pro/ con (6 marks)
MDI with spacer	Pro
	Con
Nebulised	Pro
	Con
Intravenous	Pro
	Con

Question 1 (continued)

This 8 year old girl presents with her mother to the emergency department with a 2 hour history of shortness of breath and wheeze. She has a past history of asthma with one ward admission and one previous ICU admission, both 2 years previously.

Her usual medications are Salbutamol (Ventolin) PRN and Fluticasone Propionate (Flixotide) 100 mcg BD.

She has received no prehospital care.

Her initial observations are:

GCS 15
HR 120 /min
RR 40 /min
SpO₂ 93% RA
Temp 37.0 °C
Moderate accessory muscle use
Talking in phrases.

- b. List two (2) medications that you would use in the first 20 minutes of your care. State dose and route. (6 marks)

	Medication (2 marks)	Dose (2 marks)	Route (2 marks)
1.			
2.			

Question 1 (continued)

She rapidly becomes drowsy and exhausted after your initial treatment.

- c. List two (2) medications, other than oxygen and salbutamol, that you would commence on this patient. Provide dose and route for each. (6 marks)

	Medication (2 marks)	Dose (2 marks)	Route (2 marks)
1.			
2.			

Question 2 (12 marks)

A 24 year old man presents by ambulance following a single stab wound to the chest.

Vital signs on arrival are:

BP	165/80	mmHg
HR	125	/ min (sinus rhythm)
RR	26	/ min
O2 sats	97%	RA
GCS	15	

A bedside ECHO confirms cardiac tamponade. Immediately after the ECHO is performed the patient rapidly becomes unconscious.

Repeat BP is BP 60/20 mmHg HR with 140 (sinus rhythm).

- a. List four (4) factors in this presentation that are associated with a good outcome from emergency thoracotomy. (4 marks)

1. _____

2. _____

3. _____

4. _____

- b. List four (4) specific procedures that emergency thoracotomy allows. (4 marks)

1. _____

2. _____

3. _____

4. _____

Question 2 (continued)

You consider performing Emergency thoracotomy in the Emergency Department.

c. List four (4) cons to performing this procedure on this patient. (4 marks)

1. _____

2. _____

3. _____

4. _____

Question 3 (12 marks)

A 21 year old man is brought to the emergency department by ambulance after an Motor Vehicle rollover where he was the unrestrained driver.

His observations are:

BP	80/50	mmHg
HR	50	beats/min
GCS	8	(E2, M4, V2)
O2 Saturation 91 % on 15 L/min O2 via non-rebreather mask		

A Cervical spine is taken- refer to the prop booklet page 2.

a. State five (5) abnormal findings shown in this xray. (5 marks)

1. _____
2. _____
3. _____
4. _____
5. _____

b. Is this injury a stable or unstable injury? (1 mark)

c. State one (1) justification for your answer in "b". (1 mark)

Question 3 (continued)

d. List five (5) LIKELY complications of/ or problems with cervical immobilisation for this patient. (5 marks)

1. _____

2. _____

3. _____

4. _____

5. _____

Question 4 (13 marks)

a. List one (1) clinical feature of each stated Hydrofluoric Acid exposure. (4 marks)

	Exposure	Clinical feature (4 marks)
1.	Dermal	
2.	Inhalational	
3.	Ingestion	
4.	Systemic	

Question 4 (continued)

- b. List three (3) different techniques for the administration of the antidote to Hydrofluoric acid exposure. List one (1) pro and one (1) con for the each technique. (9 marks)

	Technique (3 marks)	Pro (3 marks)	Con (3 marks)
1.			
2.			
3.			

Question 5 (12 marks)

- a. List four (4) medical/surgical conditions that require low altitude in the setting of retrieval. (4 marks)

1. _____

2. _____

3. _____

4. _____

- b. Other than pressurisation issues, list four (4) specific problems with fixed wing as a modality for retrieval. (4 marks)

1. _____

2. _____

3. _____

4. _____

Question 5 (continued)

- c. List four (4) specific problems with rotary wing (helicopter) as a modality for retrieval. (4 marks)

1. _____

2. _____

3. _____

4. _____

Question 6 (11 marks)

- a. List the three (3) criteria that are required in the CDC (Centre for Disease Control and Prevention) definition of an AIDS case. (3 marks)

1. _____

2. _____

3. _____

Question 6 (continued)

- b. Complete the table below with respect to HIV infection, by listing one (1) clinical feature and CD4 count range for each stage of HIV infection. (8 marks)

World Health Organisation clinical stage	Clinical feature (4 marks)	CD4 count range (4 marks)
1		
2		
3		
4		

Question 7 (12 marks)

A 75 year old presents with a painful right eye. You suspect acute angle glaucoma as the most likely diagnosis.

a. Other than age, list three (3) risk factors for the development of acute angle glaucoma. (3 marks)

1. _____

2. _____

3. _____

b. Other than the presence of a risk factor or previous history, list three (3) historical features that would be consistent with a diagnosis of acute angle glaucoma. (3 marks)

1. _____

2. _____

3. _____

Question 7 (continued)

c. List three (3) examination features that would be consistent with a diagnosis of acute angle glaucoma. (3 marks)

1. _____

2. _____

3. _____

d. Other than analgesics, list three (3) drugs that you may commence for this patient. (3 marks)

1. _____

2. _____

3. _____

Question 8 (12 marks)

- a. List three (3) pros to the practice of assigning Australasian Triage Scale 2 to all adult patients who present with chest pain. (3 marks)

1. _____

2. _____

3. _____

- b. List three (3) cons to the practice of assigning Australasian Triage Scale 2 to all adult patients who present with chest pain. (3 marks)

1. _____

2. _____

3. _____

Question 8 (Continued)

As duty consultant in a tertiary ED, you have just arrived for handover to a late shift on Monday evening. The department is full. There are no monitored or general cubicles available and the waiting room is full. Your medical staff are currently occupied with several high-acuity cases. 3 ambulance cases have just arrived, and are waiting to be triaged in the corridor. Of these, one patient looks to be in severe pain, the other two appear short of breath.

- c. State three (3) options for the care of these 3 ambulance patients. Provide one (1) pro or con for each of these options (state whether a pro or a con). (6 marks)

	Option for care (3 marks)	Pro or con (State whether pro or con) (3 marks)
1.		
2.		
3.		

Question 9 (17 marks)

A 64 year-old man presents to your Emergency Department with dyspnoea and palpitations. His past history includes COPD, chronic renal failure, obesity, IHD and hypertension.

Vital signs on presentation are:

BP	88/60	mmHg
RR	20	bpm
O ₂ sats	88%	RA
GCS	15	
Temperature	36	°C

An ECG is taken- refer to the prop booklet page 3.

a. State six (6) abnormal ECG findings. (6 marks)

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

Question 9 (continued)

A venous blood gas is performed- see props booklet page 4.

- b. List three (3) KEY abnormalities in this blood gas. State one (1) point to demonstrate the significance of each abnormality for this patient. (6 marks)

	Abnormality (3 marks)	Significance (3 marks)
1.		
2.		
3.		

Question 9 (continued)

c. List five (5) medications that you may prescribe for this patient. (5 marks)

1. _____
2. _____
3. _____
4. _____
5. _____

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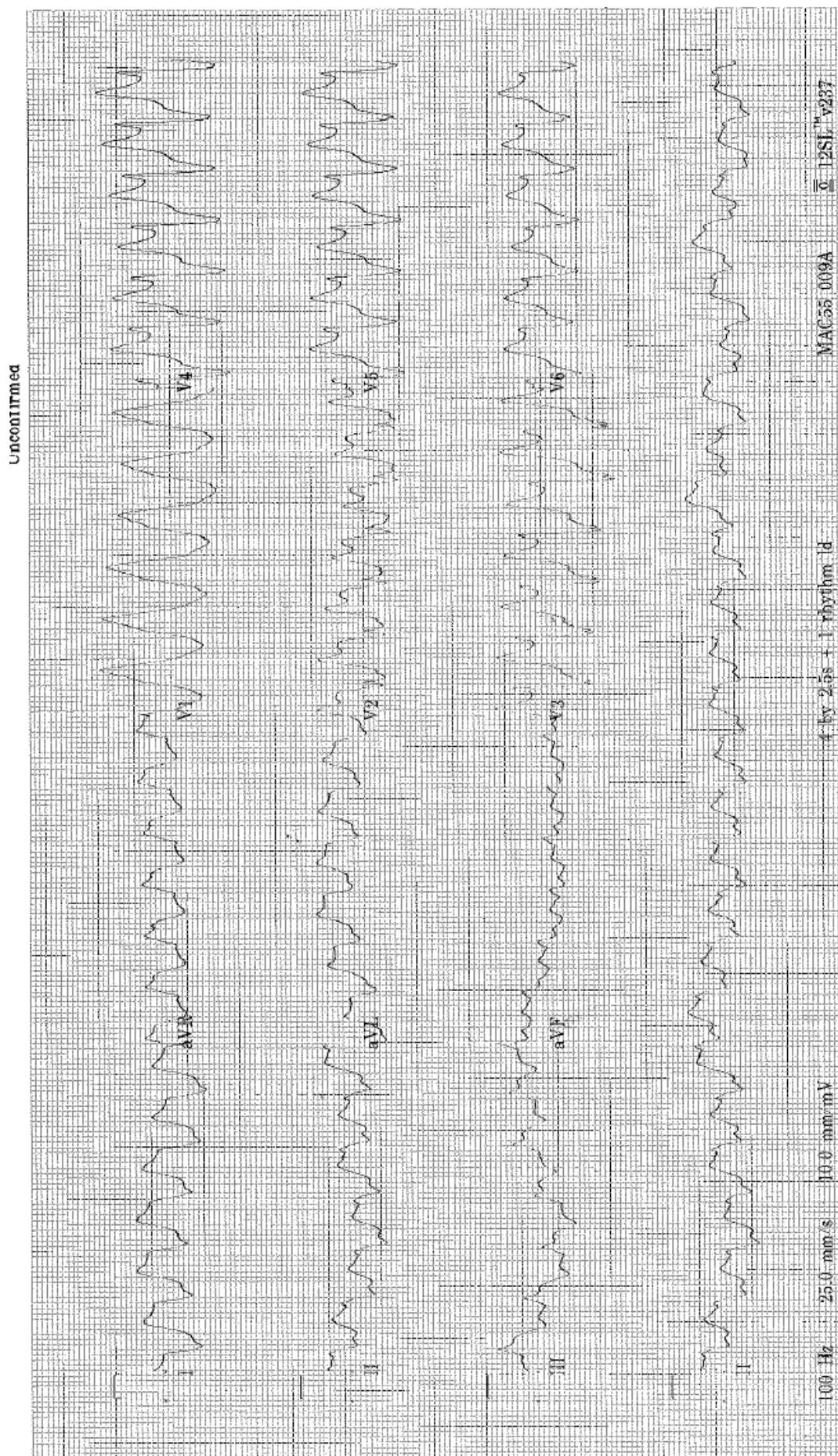
Week 27

PROP BOOKLET

Question 3



Question 9



Question 9 (continued)

Venous blood gases		Reference range
pH	6.9	(7.35 – 7.45)
pCO ₂	60 mmHg	(35 – 45)
pO ₂	28 mmHg	
HCO ₃	10 mmol/L	(22 – 33)
Base Excess	-10	(-3 – +3)
K ⁺	8.6 mmol/L	(3.5 – 5.5)

"List" = 1-3 words

"State" = short statement/ phrase/ clause

UNIVERSITY HOSPITAL, GEELONG
FELLOWSHIP WRITTEN EXAMINATION

WEEK 27- TRIAL SHORT ANSWER QUESTIONS Suggested answers

PLEASE LET TOM KNOW OF ANY ERRORS/ OTHER OPTIONS FOR ANSWERS

Please do not simply change this document - it is not the master copy !

Question 1 (18 marks)

An 8 year old girl presents with an asthma exacerbation.

- d. State one (1) key pro and one (2) key con for each of the listed delivery systems for salbutamol, for this patient. (6 marks)

NB: Pt is 8 yrs old

Avoid repeating the same point as a pro for one technique and a con for an alternative technique

You only get 1- so make it a clinically relevant pro/con

Avoid generic- eg IV access cf specific for IV salbutamol

Delivery system	Pro/ cons (6 marks)
MDI with spacer	Pro: <ul style="list-style-type: none"> • Able to be delivered/controlled by child & parents • Allows observation of correct technique and education while in ED • Continue care that has been efficacious on D/c • In mild → as efficacious as nebs (level 1 evidence) • Less confronting than neb • Lower dose of ventolin delivered- more likely to avoid salbutamol toxicity
	Cons: <ul style="list-style-type: none"> • Cooperation required • Likely to be ineffective in severe/critical due to inadequate tidal volumes • Poor acceptance if unfamiliar
Nebulised	Pro: <ul style="list-style-type: none"> • Efficacious in severe asthma- high dose with flow promotes inhalation • Less cooperation needed by patient • Less effort required by patient • Less effort required by staff • Delivers supplemental oxygen
	Cons: <ul style="list-style-type: none"> • More confronting than spacer • Infectious disease transmission via aerosol spread • Higher dose salbutamol- ↑ likelihood salbutamol toxicity
Intravenous	Pro: <ul style="list-style-type: none"> • Rapid effect of bronchodilation • Able to access entire lung- especially important if poor tidal volumes or segmental collapse • Does not require consistent respiratory effort • Dose titration
	Cons: <ul style="list-style-type: none"> • Salbutamol toxicity- lactic acidosis, tachycardia, ↓K, • Effect and therefore risk toxicity amplified by concomitant theophylline use • Greater nursing vigilance required

This 8 year old girl presents with her mother to the emergency department with a 1 day history of shortness of breath and wheeze. She has a past history of asthma with one ward admission and one previous ICU admission, both 2 years previously.

Her usual medications are Salbutamol (Ventolin) PRN and Fluticasone Propionate (Flixotide) 100 mcg BD.

Her initial observations are: GCS15 HR120/min RR 40/min SpO₂ 91% RA Temp37.0°C Moderate accessory muscle use Talking in phrases.

- e. List two (2) medications that you would use in the first 20 minutes of your care. State dose and route. Provide a justification for each choice. (6 marks)

Medication (2 marks)	Dose (2 marks)	Route (2 marks)
Salbutamol	12 puffs	MDI spacer
Prednisolone	2mg/kg (max 60mg)	Oral
Atrovent	6 puffs	MDI spacer
Dexamethasone	0.15 mg/kg	Oral

The patient rapidly becomes drowsy and exhausted after your initial treatment.

- f. List two (2) medications, other than oxygen and salbutamol, that you would commence on this patient. Provide dose and route for each. (6 marks)

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Medication (2 marks)	Dose (2 marks)	Route (2 marks)
Aminophylline	Load 10mg/kg over 60 min	IV
Magnesium sulphate	50mg/kg over 20 min	IV
ipratropium	250 mcg 20 min x3	Nebulised
Methylpred	1mg/kg	IV

RCH asthma Mx guideline

Severity	Signs of Severity	Management
Mild	Normal mental state Subtle or no increased work of breathing accessory muscle use/recession. Able to talk normally	Salbutamol by MDI/ spacer (dose below table) - give once and review after 20 mins. Ensure device / technique appropriate. Good response - discharge on B2-agonist as needed. Poor response - treat as moderate. Oral prednisolone for acute episodes which do not respond to bronchodilator alone - 2 mg/kg (max 60 mg) initially, only continuing with 1 mg/kg daily for further 1-2 days if there is ongoing need for regular salbutamol. Provide written advice on what to do if symptoms worsen. Consider overall control and family's knowledge. Arrange follow-up as appropriate.
Moderate	Normal mental state Some ↑WOB accessory muscle use/recession Tachycardia Some limit of ability to talk	Oxygen if O ₂ saturation is < 92%. Need for Oxygen should be reassessed. Salbutamol by MDI/ spacer - 1 dose (dose below) every 20 minutes for 1 hour ; review 10-20 min after 3rd dose to decide on timing of next dose. Oral prednisolone - 2 mg/kg (max 60 mg) initially, only continuing with 1 mg/kg daily for further 1-2 days if there is ongoing need for regular salbutamol.
Severe	Agitated/distressed Moderate-marked increased work of breathing accessory muscle use/recession. Tachycardia Marked limitation of ability to talk Note: wheeze is a poor predictor of severity.	Oxygen as above Salbutamol by MDI/ spacer - 1 dose (dose below) every 20 minutes for 1 hour; review ongoing requirements 10-20 min after 3rd dose. If improving, reduce frequency. If no change, continue 20 minutely. If deteriorating at any stage, treat as critical. Ipratropium by MDI/ spacer - 1 dose (dose below) every 20 minutes for 1 hour only. Aminophylline If deteriorating or child is very sick. Loading dose: 10 mg/kg i.v. (maximum dose 500 mg) over 60 min. Unless markedly improved following loading dose, give continuous infusion (usually in ICU), or 6 hourly dosing (usually in ward). Drug doses Magnesium sulphate 50% (500 mg/mL) Dilute to 200 mg/mL (by adding 1.5mls of sodium chloride 0.9% to each 1ml of Mg Sulphate) for intravenous administration <ul style="list-style-type: none"> • 50 mg/kg over 20 mins • If going to ICU, this may be continued with 30 mg/kg/hour by infusion Oral prednisolone (2 mg/kg); if vomiting give i.v. methylprednisolone (1 mg/kg) Arrange admission after initial assessment.
Critical	Confused/drowsy Maximal work of breathing accessory muscle use/recession Exhaustion Marked tachycardia Unable to talk	Oxygen Continuous nebulised salbutamol (use 2 x 5mg/2.5L nebulisers undiluted) - see below re toxicity. Nebulised ipratropium 250 mcg 3 times in 1st hr only, (20 minutely, added to salbutamol). Methylprednisolone 1 mg/kg i.v. 6-hourly. Aminophylline as above Magnesium sulphate as above. In ICU patients on Mg infusion, aim to keep serum Mg between 1.5 and 2.5mmol/L. May also consider i.v. salbutamol . Limited evidence for benefit. 5 mcg/kg/min for one hour as a load, followed by 1-2 mcg/kg/min. Beware salbutamol toxicity: tachycardia, tachypnoea, metabolic acidosis. Can occur with

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	<p>SILENT CHEST, wheeze may be absent if there is poor air entry.</p>	<p>both IV and inhaled therapy. Lactate commonly high. Consider stopping/reducing salbutamol as a trial if you think this may be the problem. Aminophylline, magnesium and salbutamol must be given via separate IV lines. Intensive care admission for respiratory support (facemask CPAP, BiPAP, or intubation/IPPV) may be needed.</p>
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Question 2 (12 marks)

A 24 year old man presents by ambulance following a single stab wound to the chest.
Vital signs on arrival are: BP 165/80 mmHg HR 125 / min (sinus rhythm) RR 26 / min O2 sats 97% RA
GCS 15

A bedside ECHO confirms cardiac tamponade. Immediately after the ECHO is performed the patient rapidly becomes unconscious.
Repeat BP is BP 60/20 mmHg HR with 140 (sinus rhythm).

- a. List four (4) factors in this presentation that are associated with a good outcome from emergency thoracotomy. (4 marks)
 - **Isolated chest injury**
 - **Single injury**
 - **Penetrating wound**
 - **Stab (*better than GSW*)**
 - **Normal vital signs on presentation**
 - **Presence of tamponade**

- b. List four (4) specific procedures that emergency thoracotomy allows. (4 marks)
 - **Preicardotomy for tamponade**
 - **Control cardiac bleeding**
 - **Compress/clamp pulmonary trunk**
 - **Compress/clamp descending aorta**
 - **Open cardiac massage**
 - **RA access for IV (!)**

You consider performing Emergency thoracotomy in the Emergency Department.

- c. List four (4) cons to performing this procedure on this patient. (4 marks)
 - **Operator skill**
 - **Risk needlestick / splash/ blood everywhere**
 - **lack of back up thoracic/ surgery to definitively Mx injuries**
 - **lack of appropriate equipment**

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TRAUMA



Emergency physician credentialing for resuscitative thoracotomy for trauma

Mark Fitzgerald,^{1,2} Gim Tan,³ Russell Gruen,^{1,2} De Villiers Smit,^{2,3} Kate Martin,^{1,2} Emma Newton-Brown,³ Carl Luckhoff¹ and Amit Maini¹

¹Trauma Service and ²Emergency & Trauma Centre, The Alfred Hospital, and ³National Trauma Research Institute, Melbourne, Victoria, Australia

Abstract

Objective: A low case incidence and variable skill level prompted the development of a credentialing programme and specific surgical training in resuscitative thoracotomy for emergency physicians at The Alfred, a Level 1 Adult Victorian Major Trauma Service.

Methods: A review of the incidence of traumatic pericardial tamponade and the objectives of resuscitative thoracotomy were undertaken.

Results: A training programme involving pre-reading of a 17 page teaching manual, a 40 min didactic lecture and a 2 h surgical skills station using anaesthetized pigs were developed. The specific indication for resuscitative thoracotomy for this programme is ultrasound demonstrated cardiac tamponade secondary to blunt or penetrating truncal trauma in a haemodynamically unstable patient with a systolic blood pressure of less than 70 mmHg despite pleural decompression and intravenous volume replacement. Cardiac electrical activity must be present. The primary aims of resuscitative thoracotomy taught are release of cardiac tamponade, control of haemorrhage and access for internal cardiac massage.

Conclusion: Emergency physicians working in high-volume Trauma Centres are expected to diagnose cardiac tamponade and on occasion decompress the pericardium. Specific training in the procedure should be undertaken.

Key words: cardiac tamponade, credentialing, focused assessment with sonography in trauma, resuscitative thoracotomy.

Introduction

Most fatalities from blunt or penetrating cardiac injuries occur prior to hospital arrival. The main physiological determinant for survival to hospital is acute cardiac

tamponade – which might be present without external signs of injury, abnormal clinical signs or ECG abnormalities. The cause of the tamponade is usually a laceration to a low pressure cavity. In recent years the widespread availability and use of ultrasound for the

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EDITORIAL

Emergency room thoracotomy: Has availability triumphed over advisability in the care of trauma patients in Australasia?

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Should emergency physicians be trained to perform emergency resuscitative thoracotomy (ERT)? In this issue, Fitzgerald *et al.* describe a programme of surgical training that allows credentialing of emergency physicians in this procedure.¹ But, does it make sense and does this training actually provide the necessary expertise?

Emergency resuscitative thoracotomy is a procedure with a limited place in the spectrum of emergency procedures in Australasia. Our low incidence of penetrating trauma leads to few patients with injuries for which this procedure might sensibly be employed.² As with any circumstance where emergency action is required with low frequency, there needs to be a practised response to ensure that the intervention can be delivered rapidly when necessary.

Two key issues then are relevant. One is the technical nature of the procedure, and the other is the availability of staff to perform it.

Emergency resuscitative thoracotomy is a surgical procedure, and the complexity of the intervention and its consequences mean that significant training is required to perform it. Surgeons in general, and general and thoracic surgeons in particular, are well placed by the nature of their day-to-day activities to perform this sort of surgery. They need only to be trained in regards the indications for the procedure and about undertaking it in ED environment. The former is taught during both the surgical education and training programme, and through specific surgical trauma courses such as the Definitive Surgical Trauma Care course.³

Teaching non-surgeons to perform ERT and specifically teaching emergency physicians requires a completely different approach. Although any interventional specialist can be expected to be familiar with the basic tools of a minor surgical procedure, the bar is considerably higher with ERT. An unfamiliar approach with a range of instruments not normally used in day-to-day practice creates the potential for both ineffective intervention, and dangerous complications for the patient, the surgeon and his/her assistants. Whether a 40 min didactic lecture and a 2 h surgical skill programme really provides the requisite opportunity for effective and durable learning is a moot point that is not addressed by Fitzgerald *et al.* In fact, it is not even clear that general surgeons or their trainees have the full range of technical competencies necessary for the optimal employment of ERT.

A recent paper from Oslo, Norway by Pahlke⁴ reported on the outcomes of 109 consecutive ERT for trauma between 2001 and 2007 (27 penetrating and 82 blunt trauma) and showed very respectable survivals of 37% (10/27) for penetrating trauma and 12% (10/82) for blunt trauma, to give an overall survival rate of 18%. These results are strikingly better than the 25-year published survival data reported by Rhee *et al.*⁵ of 3.8% for penetrating trauma and 1.4% for blunt trauma. The key difference between Pahlke's report⁴ and an earlier one from Scandinavia that reported 0/10 survival following ERT⁶ was that the ERT were done by a resident in cardiothoracic surgery, who was a member of the trauma team. This expertise not only reflects on the satisfactory outcome, but also the fact

Ian Civil, FRACS, Director of Trauma Services, Senior Specialist.

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Question 3 (11 marks)

A 21 year old man is brought to the emergency department by ambulance after an MVA rollover where he was the unrestrained driver.

His observations are: GCS 8 (E2, M4, V2) BP 80/50 mmHg HR 50 beats/min O2 Saturation 91 % on 15 L/min O2 via non-rebreather mask



- a. State five (5) abnormal findings shown in this xray. (5 marks)

NB: This prop was used previously as a VAQ- The examiners agreed that the major abnormalities on the film were easily identifiable and the serious nature of the injuries and their consequences demanded a high level response from candidates.

- **Posterior shift of C5 on C6 ~ 25% vertebral body width**
- **Displaced, anterior flexion teardrop fracture of C5**
- **# C5 + C6 spinous process**
- **Disruption of anterior spinal line at C5/6**
- **Disruption of posterior spinal line at C5/6**
- **Disruption spino-lamina line**
- **Soft tissue swelling 2.5 cm at C4**

Better answers included quantification of the findings (e.g. amount of soft tissue swelling; amount of displacement), either by direct measurement (e.g. in millimetres) or by comparison with vertebral body width. The most common features of unsuccessful answers were failure to identify at least one of the listed criteria. Indeed, most unsuccessful answers actually failed to mention two or more of these criteria. The most common were poor terminology used in describing the abnormalities. Even more surprisingly, some candidates got the level of injury wrong! This was considered such a basic essential skill that it was viewed very poorly in this, a consultant level exam.

- b. Is this injury a stable or unstable injury? (1 mark)
- **Unstable**
- c. State one (1) justification for your answer in "b". (1 mark)
- **Anterior and posterior longitudinal ligament disrupted/ "3 pillar/ column" injury**
- d. List five (5) **LIKELY** complications of/ or problems with cervical immobilisation for this patient. (5 marks)
- Cx Collar:
 - **Patient discomfort- HA, mandibular pain**
 - **Worsening neurological function- immobilisation may not be in neutral position**
 - **↓ access to neck/occiput- ↓ visualisation, access to EJV & IJV**
 - **Cutaneous pressure ulceration**

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- **↑ intracranial pressure**- *from Cx collars- average of 2-5 mmHg- may be up to 15 mmHg*
- **↑ difficulty of intubation**
- **Aspiration risk**
- **DVT risk**

Question 4 (12 marks)

c. List one (1) clinical feature of each stated Hydrofluoric Acid exposure. (4 marks)

	Clinical feature
Dermal	<ul style="list-style-type: none"> Severe unremitting pain Blistering/tissue loss May take several hours for skin signs to develop (initially no obvious erythema or blistering)
Inhalational	<ul style="list-style-type: none"> Oropharyngeal discomfort Non cardiogenic APO Immediate onset of mucosal irritation Delayed onset of SOB, cough, wheeze
Ingestion	<ul style="list-style-type: none"> Mild throat pain Low concentrations (< 20%) are minimally corrosive to GIT Dysphagia Vomiting Abdo pain Cardiac arrest- Arrest from systemic fluorosis without warning from 30 min- 6/24
Systemic	<ul style="list-style-type: none"> Systemic fluorosis Ventricular arrhythmias ↓Ca/ ↓Mg → tetany/ QT prolongation Cardiac arrest

d. List three (3) different techniques for the administration of the antidote to Hydrofluoric acid exposure and give details. Provide one (1) pro for each technique. (9 marks)

NB: again, try to avoid repeating the same point as a pro for one technique and a con for an alternative technique.

Technique	Pro	Con
Topical	<ul style="list-style-type: none"> Less invasive cf other techniques 	<ul style="list-style-type: none"> Topical Rx is limited as skin is relatively impermeable to Ca Tissue necrosis (<i>Ca Gluconate is preferred to CaCl as the higher concentration of Ca is very irritant to skin</i>)
S/c infiltration (5% via fine needle)	<ul style="list-style-type: none"> Rapid relief of pain (1st line Rx if small effected area) 	<ul style="list-style-type: none"> Amount of Ca delivery is limited (max dose 1 ml/ cm² of affected tissue) Initial pain from free Ca ions ↑ tissue damage if Ca > FI and ∴ free/unbound Ca Excessive digit injection may compromise circulation
IV	<ul style="list-style-type: none"> ↑ penetration of Ca ions to affected tissue Technically easier than I/A (requires IV and BP cuff only) 	<ul style="list-style-type: none"> Ischaemic pain results ∴ difficult to assess if Rx effective (<i>resolution of pain is the most important marker of successful Rx</i>) Poor pt acceptance Rx time limited by limb ischaemia time Risk systemic ↑Ca if cuff deflates
IA (<i>Ca gluc diluted in 5%D</i>) Rx over 2-4 /24)	<ul style="list-style-type: none"> Most effective Rx for systemic fluorosis 	<ul style="list-style-type: none"> Deep tissue infiltration of Ca ions may exacerbate tissue damage Risk arterial spasm/ thrombosis→limb ischaemia Resource intensive Requires ICU admission post

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TOXICOLOGY



Hydrofluoric acid poisoning: Data from the Victorian Poisons Information Centre

Anselm Wong, Shaun Greene and Jeff Robinson
Victorian Poisons Information Centre, Austin Hospital, Melbourne, Victoria, Australia

Abstract

Objective: To determine the epidemiology of hydrofluoric acid (HF) exposures, over an extended time period, in Victoria, Australia.

Methods: Retrospective case review of all HF exposures from calls to the Victorian Poisons Information Centre (VPIC) from June 2005 to February 2011.

Results: The VPIC received calls regarding 75 separate HF exposures (approximately 12 per year). The majority 68 (91%) of calls related to male patients. Sixty-nine (92%) calls related to adults, six (8%) to children (<12 years) and none to the elderly (>65 years age). Fifty-three per cent of exposures occurred at the workplace. Dermal exposures comprised 54 (72%). Forty-six (85%) of these resulted from hand contact, six (11%) arm and two (4%) legs. The second most common exposure was ocular 11 (15%). More than half of exposures involved HF concentrations of 10% or less. Of the dermal exposures treated in EDs, 16% required calcium treatment in a form other than gel. Overall poisoning severity was mild (79% of cases Poisoning Severity Score of 0 or 1). Health professionals were the most frequent callers (53% of all cases).

Conclusions: Calls to the VPIC regarding HF are relatively rare, but almost all calls regarding HF taken by the VPIC required hospital evaluation. The majority of exposures were accidental occupational dermal exposures in male adults and most of these were minor, requiring topical calcium gel only. Small exposures with higher concentrated HF can be fatal; however, there were no cases of severe toxicity in the present study.

Key words: *epidemiology, hydrofluoric acid, poison control centre.*

Introduction

Hydrofluoric acid (HF) is used in the manufacture of glass, electronics, pesticides and high-octane fuels. It is used in electroplating, and it is also the active ingredient in some household products, such as rust removers, wheel cleaners and aluminium brighteners.

Following tissue exposure to HF, fluoride ions bind with calcium and magnesium, forming insoluble salts and depleting body stores of these cations. Fluoride also

inhibits intracellular enzymes, including those of the Krebs cycle and the Na/K⁺ ATPase pump, which contributes to cell death and cellular energy failure. In addition, fluoride stimulates adenylate cyclase, which increases adenosine monophosphate, subsequently increasing the possibility of arrhythmias.¹

The degree of toxicity related to HF exposure depends on the route of exposure, surface area of skin or tissue exposed and concentration of HF. Even small dermal exposures to HF can cause severe pain resistant

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Question 5 (12 marks)

- a. List four (4) medical/surgical conditions that require low altitude in the setting of retrieval. (4 marks)
- **# skull/ penetrating head injuries**
 - **Aerocele (CI)**
 - **Recent GIT sutures**
 - **Bowel obstruction**
 - **Mediastinal emphysema**
 - **PTX not Rx with ICC**
 - **Penetrating eye injury**
 - **DCI**
 - **Anaemia Hb < 7.0**
 - **Acute coronary syndrome**
 - **(spinal injuries- lower G forces for helicopter cf fixed)**
- b. Other than pressurisation issues, state four (4) specific problems with fixed wing as a modality for retrieval. (4 marks)
- **Space, Access**
 - Limited space, lighting, facilities for interventions
 - Equipment → space, weight, secure in flight
 - **Infusions with drip chambers** → dysfunctional in turbulence, often fail during acceleration/ deceleration
 - **Defibrillation**
 - if high risk for arrhythmias → apply self adherent pads prior to departure, preinform pilot
 - problem with residual current leak → may disable electronic equipment
 - ∴ pilot must be consulted prior to any attempt, may need to turn off some equipment → final decision is pilots
 - **Motion sickness** → antiemetics early
 - **“Sopite syndrome”** → yawning, drowsiness, disinclination for physical/ mental work
 - not directly related to degree of turbulence
 - unresponsive to anti- motion meds
 - little adaption with time
 - **Danger from agitated patients**
 - **Noise, vibration**
 - communication, missing alarms
 - fine procedures difficult
 - need constant vigilance → use of visual signs (eg chest wall mvt)
 - **Communication**
 - Patient, pilot, receiving hospital
 - **Acceleration, deceleration and turbulence**
 - **Extremes of temperature, humidity**
 - **Electromagnetic interference** between avionics and monitoring devices
 - **Danger from loose, mobile equipment**
 - **Positioning** → severe CHI → place head forwards at take off and towards tail at landing
 - **Delays in landing** Eg from weather conditions, must be prepared for prolonged Mx
 - **Not as easily mobilised**
 - **Needs airstrip**
 - **Road transport required at each end**
- c. List four (4) specific problems with rotary wing (helicopter) as a modality for retrieval. (4 marks)
- **Limited flying time 2/24 or 200km**
 - **High noise levels** → communication only via headset
 - **Size limitation- space limited for equipment**
 - **Weight restrictions critical**

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- Usually not pressurized
- Temperature → difficult to maintain cabin pressure
- Weather/ night flying restrictions
- Slower flying speed cf fixed wing
- Expense
- Rotor clearance → IV poles etc

Question 6 (11 marks)

a. List the criteria that are required in the CDC (Centre for Disease Control and Prevention) definition of an AIDS case. (3 marks)

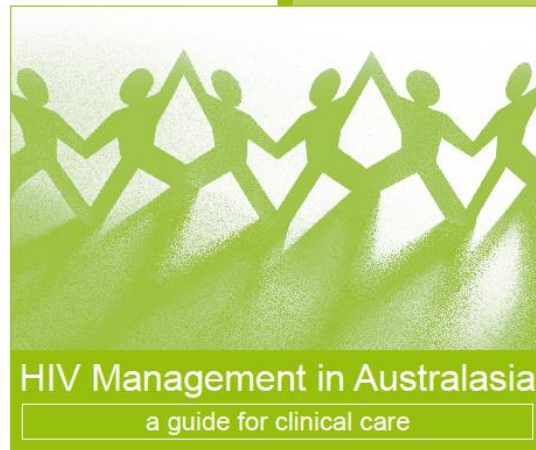
- **HIV infected**
- **With either :**
 - **CD4 T lymphocyte count < 200**
 - Or**
 - **Defined- opportunistic infection**

b. Complete the table below with respect to HIV infection, by listing one (1) clinical feature and CD4 count range for each stage of HIV infection. (8 marks)

World Health Organisation clinical stage	Clinical feature (4 marks)	CD4 count (4 marks)
1	<ul style="list-style-type: none"> • Asymptomatic • Persistent generalised LN 	> 500
2	<ul style="list-style-type: none"> • Mild symptoms • Moderate wt loss • Recurrent RTI • HZ • Angular cheilitis • Recurrent oral ulceration • Seborrhoeic dermatitis • Fungal nail 	350-499
3	<ul style="list-style-type: none"> • Severe wt loss • Chronic Ds > 1/12 • Persistent fever • Oral candidiasis • Pulmonary Tb • Severe bacterial infection • Ulcerative stomatitis/gingivitis • Anaemia • thrombocytopenia 	200-349
4	<ul style="list-style-type: none"> • Severe symptoms • AIDS defining: <ul style="list-style-type: none"> ○ PCP pneumonia ○ Cerebral Toxo ○ Encephalopathy ○ CMV retinopathy ○ Kaposi sarcoma ○ Tb ○ Cryptococcal meningitis • HIV wasting syndrome 	< 200

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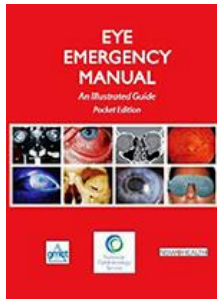
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Question 7 (12 marks)

A 75 year old presents with a painful right eye. You suspect acute angle glaucoma as the most likely diagnosis.

- a. Other than age, list three (3) risk factors for the development of acute angle glaucoma. (3 marks)
- **Shallow anterior chamber (!)**
 - **Anticholinergic drugs- atropine, Atrovent**
 - **Beta agonists**
 - **Mydriatics**
 - **↑ lens thickness**
 - **FHx**
 - **Ethnic predisposition- SE Asia**
 - **Female 3x > male**
- b. Other than the presence of a risk factor or previous history, list three (3) historical features that would be consistent with a diagnosis of acute angle glaucoma. (3 marks)
- **Severe unilateral pain**
 - **Onset post watching TV, lying face down**
 - **Visual disturbance- classically “visual halo”**
 - **+/- N/V**
- c. List three (3) examination features that would be consistent with a diagnosis of acute angle glaucoma. (3 marks)
- **IOP > 30 mmHg**
 - **Semi dilated, non reactive pupil**
 - **Corneal haze**
 - **Perilimbal conjunctival injection**
 - **Shallow anterior chamber**
- d. Other than analgesics, list three (3) drugs that you may commence for this patient. (3 marks)
- NB: doses not requested ∴ not required*
- **Acetazolamide (500mg IV)**
 - **Mannitol (1g/kg)**
 - **Pilocarpine (2% every 5 min for 1/24)**
 - **Timoptol (0.5% 1 drop every 30 min)**
 - **Antiemetic (not maxolon)**

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Question 8 (12 marks)

- a. List three (3) pros to the practice of assigning ATS 2 to all adult patients who present with chest pain. (3 marks)

NB: Triage is covered well in both Dunn & Cameron

- **Clinical safety- Worst-case scenario typically assumed**
- **↑ sensitivity- low false -ve rate for serious illness**
- **High pick-up rate for serious conditions like STEMI**
- **Optimal use of limited resources**
- **Standardisation of care**
- **Validity**
- **Reliability**
- **Acceptability**
- **Ample scope for research: automatically categorised data**
- **Ability to measure and benchmark** - Permits measurement of healthcare access and efficiency: ATS is integral to several ED performance measures

- b. List three (3) cons to the practice of assigning ATS 2 to all adult patients who present with chest pain. (3 marks)

- **↓ specificity- high “false positive” rate**
- **High resource consumption- directs resources from other, equally deserving cases**
- **No evidence on validity & reliability of triage for chest pain**
- **Statistical analysis issues:**
 - **ATS too simplistic a measure of healthcare – leads to inaccurate assessments**
 - **May affect funding**
 - **Assumes all healthcare sites are equal, in casemix & resources**

As duty consultant in a tertiary ED, you have just arrived for handover to a late shift on Monday evening. The department is full. There are no monitored or general cubicles available and the waiting room is full. Your medical staff are currently occupied with several high-acuity cases. 3 ambulance cases have just arrived, and are waiting to be triaged in the corridor. Of these, one patient looks to be in pain; another appears short of breath.

- c. State three (3) options for the care of these patients. Provide one (1) pro or con for each of these options (state whether a pro or a con). (6 marks)

Option for care	Justification
Defer all intervention until cubicles available	Pro: <ul style="list-style-type: none"> • Leaves responsibility with ambulance Con: <ul style="list-style-type: none"> • delays emergency treatment • keeps ambulance resource off road • negative effects on relationship with ambulance
Initiate nursing triage and registration on trolleys	Pro: <ul style="list-style-type: none"> • allows detailed risk assessment and prioritisation • allows simple interventions such as analgesia and fast track Ix Con: <ul style="list-style-type: none"> • Limited in value • Blurs delineation between ambulance and ED responsibilities
Medical triage and	Pros:

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treatment on trolleys	<ul style="list-style-type: none"> Should improve process times downstream Cons: <ul style="list-style-type: none"> Delays departmental handover May lead to inappropriate bed moves (ie not aware of situation of other pts) Marginal value added Consumes additional resources Potential confusion between nursing and medical roles.
Clear a cubicle and use as rapid (in-out) assessment area	Pro: <ul style="list-style-type: none"> Permits more detailed assessment Privacy Con: <ul style="list-style-type: none"> Consumption of precious resource Corridor only temporarily relieved
Clear 3 cubicles to offload patients, per normal processes	Pro: <ul style="list-style-type: none"> Ideal option All 3 cases are likely to need cubicle! Con: <ul style="list-style-type: none"> Least feasible, given current circumstances Case(s) may need monitoring that is being provided, but may not be readily available

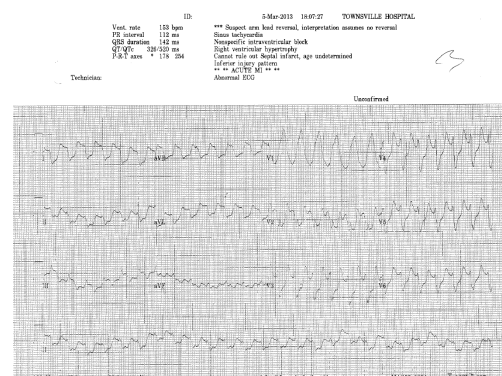
Question 9 (17 marks)

A 64 year-old man presents to your Emergency Department with dyspnoea and palpitations. His past history includes COPD, chronic renal failure, obesity, IHD and hypertension.

Vital signs on presentation are: GCS 15 BP 88/60 mmHg RR 20 bpm O₂ sats 88% RA Temperature 36°C

a. State six (6) abnormal ECG findings. (6 marks)

- Rate ~ 155
- Broad QRS ~ 160
- AVR grossly +ve
- NW/ extreme right axis
- Peaked T waves
- ST changes- interpretation difficult



A venous blood gas is performed:

pH 6.9 (7.35 – 7.45) **pCO₂ 60** mmHg (35 – 45) **pO₂ 28** mmHg **HCO₃ 10** mmol/L (22 – 33) **BE-10** (-3 – +3) **K⁺ 8.6** mmol/L (3.5 – 5.5)

b. List three (3) key abnormalities in this blood gas. State one (1) point to demonstrate the significance of each abnormality for this patient. (6 marks)

Abnormality (3 marks)	Significance (3 marks)
pH 6.9/ HCO₃ 10	<ul style="list-style-type: none"> Profound acidaemia Mixed metabolic & respiratory acidosis Metabolic likely to be related to renal failure High morbidity/ mortality
CO₂ 60	<ul style="list-style-type: none"> Indicates type II respiratory failure Potential cause (likely combination- CRF, IHD, sedative meds (eg narcotics, Pickwickian syndrome from morbid obesity)
K⁺ 8.6	<ul style="list-style-type: none"> Severe/ life threatening May account for VT Calculated K⁺ elevated by low pH (predicted 6.1 if normalised to 7.4) Requires urgent correction

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- c. List five (5) medications that you may prescribe for this patient. (5 marks)
- **Ca Gluconate/ CaCl** (*unless dig toxicity possible*)
 - **Digibind if Dig toxicity**
 - **NaHCO₃** (*8.4% 100 ml*)
 - **Insulin** (*10 IU + 50 mls 50% D*)
 - **Salbutamol** (*neb 5 mg*)
 - **Resonium** (*rectal*)

This resource is produced for the use of University Hospital, Geelong Emergency staff for preparation for the Emergency Medicine Fellowship written exam. All care has been taken to ensure accurate and up to date content. Please contact me with any suggestions, concerns or questions.

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