

Illawarra Shoalhaven Local Health District Emergency Medicine Fellowship Program



Topic-Based Quiz: Qs and As

TRAUMA

Candidate Instructions

- Duration = 30min
- Props are included within the examination booklets
- Allocated marks for each question are shown
- Each mark is of equal weight
- There is no negative marking
- Write answers CLEARLY, and cross out any errors
- Answer within space provided
- Do not begin until instructed
- You may take examination book home with you



Good Luck!

Acknowledgement: Thank you to the trainees who have written these SAQs with the hope of making their colleagues sweat, but ultimately gain more exposure to exam practice. Good job.

Question 1

You have just received an 18 year old male in your resuscitation room via ambulance following a high-speed motor cycle accident. He came off his bike and slid into a roadside barrier, impacting his thorax and head.

Excluding pneumothorax/tension pneumothorax, list 4 causes of early respiratory failure in this patient. (4 marks)

Complete the following table with three techniques of managing tension pneumothorax in the resuscitation room, and for each state two early advantages and disadvantages. (9 marks)

	Advantage	Disadvantage
Needle decompression		
Finger thoracostomy		
Tube thoracostomy		

Topic-Based SAQ Quiz: Trauma

List 3 management options for a high-flow bronchopleural fistula with failure of ventilation in an intubated patient. (3 marks)

List 2 negative effects of a high-flow bronchopleural fistula on effective mechanical ventilation. (2 marks)

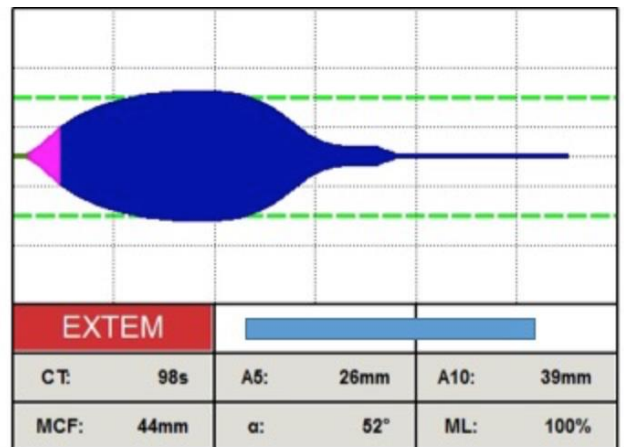
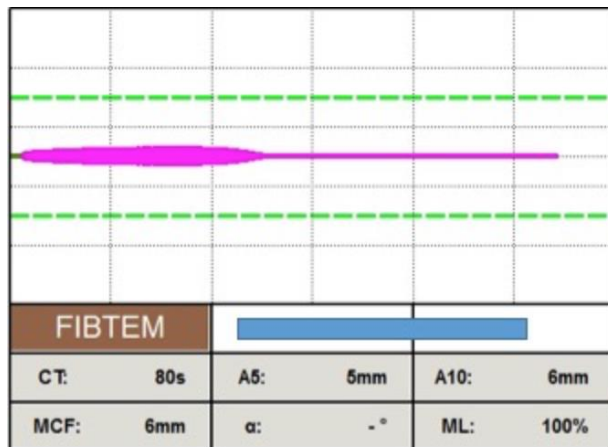
Explain how low cardiac output causes arterial hypoxemia. (2 marks)

Question 2

You have just received a 45 year old male who was involved in a major crush injury at a factory. Both of his lower limbs were crushed between a truck and a concrete barrier, with a prolonged time to his extrication. He has heavy bleeding from multiple sites in his lower limbs.

Your registrar sends a coagulation tube for thromboelastography. The results are below.

Describe the abnormalities in this ROTEM result and list two treatments. (4 marks)



Describe two advantages each for conventional laboratory (INR, aPTT, platelet count) versus viscoelastic (TEG, ROTEM) testing of coagulopathy in trauma. (4 marks)

	Advantages
Conventional testing	
Viscoelastic testing	

Topic-Based SAQ Quiz: Trauma

List three causes of persistent bleeding despite a normal ROTEM result. (3 marks)

d) List two likely causes of cardiac arrest in this patient. (2 marks)

Question 3

You are managing a 22 year old female who has been assaulted with a baseball bat. She has been GCS 3 since arrival of paramedics, with unequal pupils, and has been intubated and transferred to your tertiary hospital by a retrieval team.

List four causes of mydriasis in patients with head injury (4 marks)

List two causes of miosis in patients with head injury.

List 3 signs of foraminal/tonsillar herniation.

Describe the difference in pupillary responses between the following pathologies in head injury. (6 marks)

	Direct response	Consensual response
Ipsilateral occipital cortical injury		
Ipsilateral oculomotor nerve injury		
Ipsilateral vitreous haemorrhage		

Topic-Based SAQ Quiz: Trauma

e) A venous blood gas reveals a sodium of 154mM. List two causes for this finding in this patient.

Question 4

You have just received an 11 year old male with isolated neck injuries after riding a trailbike into a wire fence. On the ambulance stretcher he is sitting upright with visible agitation, stridor and spitting out blood. His vital signs are:

GCS 14 E4V4M6

HR 130

NIBP 140/90

RR 36

SpO2 88% on room air, not tolerating oxygen

List 4 techniques that could be used to secure the airway in this case, and for each, list two advantages and two disadvantages. (12 marks)

Technique	Advantages	Disadvantages

Topic-Based SAQ Quiz: Trauma

List 4 difficulties or complications during or after emergency cricothyroidotomy specifically in a patient with possible laryngotracheal injury. (4 marks)

Question 5

A 56 year old male has just arrived in your department via aeromedical retrieval team following an explosion approximately 5 hours ago. The patient was working in a shipping container when a nearby cylinder exploded. He was intubated by the retrieval team for severe burns, estimated at 60% TBSA, with a GCS of 4 and is on an inotrope infusion.

During the transfer off the retrieval stretcher, the ventilator alarms for high airway pressure. List 5 potential causes in this patient. (5 marks)

An arterial blood gas shows a hemoglobin of 188g/L. List 2 causes of this finding in this patient. (2 marks)

List 4 causes for an elevated lactate in this patient. (4 marks)

ANSWERS

Question 1

Excluding pneumothorax/tension pneumothorax, list 4 causes of early respiratory failure in this patient. (4 marks)

- Airway obstruction due to direct trauma
- Airway obstruction due to traumatic brain injury
- Hypoventilation secondary to traumatic brain injury
- Hypoventilation secondary to cervical spine injury
- Hemothorax
- Pulmonary contusion
- Flail chest
- Aspiration
- Pulmonary hemorrhage
- Pulmonary edema from fluid resuscitation
- Pulmonary edema from acute aortic regurgitation
- Pulmonary edema from myocardial contusion
- Neurogenic pulmonary edema
- Anaphylaxis from administered medication
- Hypoventilation from administered analgesia

Complete the following table with three techniques of managing tension pneumothorax in the resuscitation room, and for each state two early advantages and disadvantages. (9 marks)

	Advantage	Disadvantage
Needle decompression	<ul style="list-style-type: none"> • Fast • Only requires access to anterior chest 	<ul style="list-style-type: none"> • Needle may not reach pleural space • Easily kinked, obstructed or dislodged • Difficult to confirm if pneumothorax was present • May cause pulmonary injury
Finger thoracostomy	<ul style="list-style-type: none"> • Allows assessment of pleural space (lung up/down) • Definite access to pleural space confirmed • Allows 're-fingering' • Does not require tube attachment 	<ul style="list-style-type: none"> • Requires anaesthesia, analgesia and positive pressure ventilation • Usually requires access to axilla • Does not record or contain air leak or blood drainage • Thoracostomy may clot off with subsequent ineffective drainage

Topic-Based SAQ Quiz: Trauma

	Advantage	Disadvantage
Tube thoracostomy	<ul style="list-style-type: none">• Tube assists in maintaining patency of thoracostomy• Does not require positive pressure ventilation• Records and contains air leak and blood drainage• Definite access to pleural space confirmed• Allows assessment of pleural space (lung up/down)	<ul style="list-style-type: none">• Complicates transport (ie CT)• Takes longer• Tube may become blocked, kinked or displaced

List 3 management options for a high-flow bronchopleural fistula with failure of ventilation in an intubated patient. (3 marks)

- Insert additional ICCs with suction to inflate affected lung
- Selectively intubate and ventilate contralateral lung
- Isolate affected lung/lobe with bronchial blocker
- Thoracotomy and lobectomy or hilar clamping
- VV ECMO

List 2 negative effects of a high-flow bronchopleural fistula on effective mechanical ventilation. (2 marks)

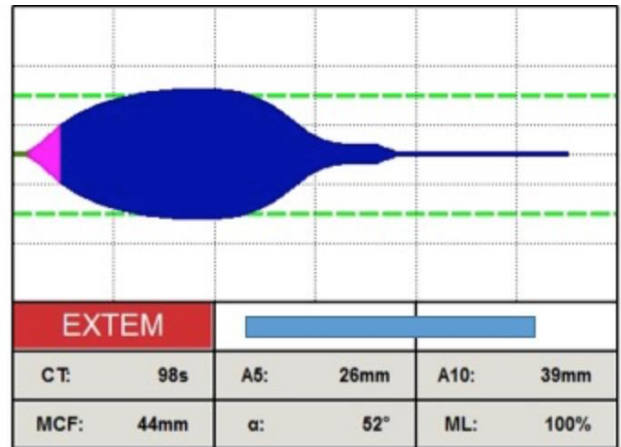
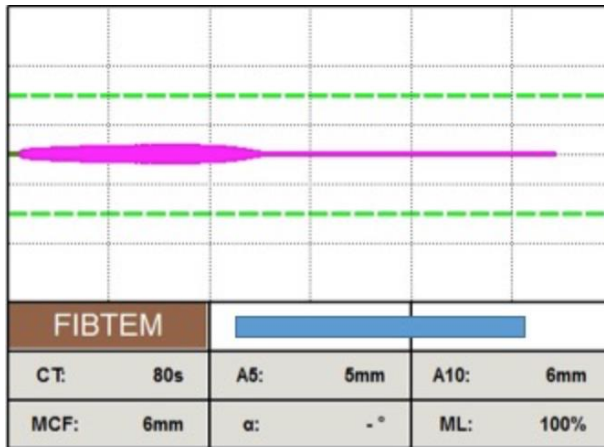
- Failure to generate adequate inspiratory pressure
- Failure to maintain PEEP
- Loss of heat and humidification due to high fresh gas flow through airway and out fistula
- Inability to effectively measure tidal volumes
- High oxygen use (particular issue in retrieval medicine)

Explain how low cardiac output causes arterial hypoxemia. (2 marks)

Low cardiac output results in reduced tissue oxygen delivery, resulting in higher peripheral oxygen extraction. Poorly saturated blood returning to the lungs will magnify any pulmonary cause of hypoxia ie shunting, V/Q mismatch.

Question 2

Describe the abnormalities in this ROTEM result and list two treatments. (4 marks)



- Abnormalities
 - Low FIBTEM amplitudes / hypofibrinogenemia
 - Hyperfibrinolysis
- Treatments
 - Fibrinogen replacement - cryoprecipitate or fibrinogen concentrate
 - Tranexamic acid

<https://derangedphysiology.com/main/required-reading/haematology-and-oncology/Chapter%201.2.0.1/intepretation-abnormal-rotem-data>

Describe two advantages each for conventional laboratory (INR, aPTT, platelet count) versus viscoelastic (TEG, ROTEM) testing of coagulopathy in trauma. (4 marks)

	Advantages
Conventional testing	<ul style="list-style-type: none"> • Widely available • Familiar • Available guidelines for resuscitation targets • Lower cost
Viscoelastic testing	<ul style="list-style-type: none"> • Usable results within 5-10 minutes • More closely reflects in vivo coagulation • Guides choice of product resuscitation more closely • Demonstrates hyperfibrinolysis • Easily repeated to detect response to product treatment

Topic-Based SAQ Quiz: Trauma

List three causes of persistent bleeding despite a normal ROTEM result. (3 marks)

- Surgical bleeding ie vascular injury
- Hypothermia
- Acidosis
- Hypocalcemia
- Drug effect - anti-platelets, anticoagulants

d) List two likely causes of cardiac arrest in this patient. (2 marks)

- Hypovolemia due to uncontrolled hemorrhage
- Reperfusion injury with acidosis and hyperkalemia

Question 3

List four causes of mydriasis in patients with head injury (4 marks)

- Traumatic mydriasis
- Orbital compartment syndrome
- Superior orbital fissure fracture
- Optic canal fracture
- Optic nerve injury
- Ipsilateral subfalcine/uncal herniation
- Contralateral Kernohan's notch phenomenon
- Vitreous hemorrhage
- Retinal detachment

List two causes of miosis in patients with head injury.

- Opiate effect
- Pontine hemorrhage/injury
- Horner's syndrome
 - 1st order - eg cervical cord injury
 - 2nd order - eg carotid dissection, clavicle fracture
 - 3rd order - eg nasociliary, long ciliary nerve injury

List 3 signs of foraminal/tonsillar herniation.

- Coma
- Abnormal respiratory pattern
- Cardiovascular instability - bradycardia, hypertension

Describe the difference in pupillary responses between the following pathologies in head injury. (6 marks)

	Direct response	Consensual response
Ipsilateral occipital cortical injury	Normal	Normal

	Direct response	Consensual response
Ipsilateral oculomotor nerve injury	Absent	Absent
Ipsilateral vitreous haemorrhage	Absent	Normal

e) A venous blood gas reveals a sodium of 154mM. List two causes for this finding in this patient.

- Administration of hypertonic saline
- Central diabetes insipidus

Question 4

List 4 techniques that could be used to secure the airway in this case, and for each, list two advantages and two disadvantages. (12 marks)

	Advantages	Disadvantages
Rapid sequence intubation	<ul style="list-style-type: none"> - Familiarity - Fastest technique to secure airway - Muscle relaxation facilitates face-mask ventilation, LMA placement, and laryngoscopy 	<ul style="list-style-type: none"> - Requires compliance for pre-oxygenation - Risk of inability to oxygenate after relaxant given - Cricoid pressure, if used, may worsen laryngotracheal injury - Face-mask ventilation may worsen subcutaneous emphysema - Risk of active or passive regurgitation of swallowed blood - Bail-out to cricothyroidotomy in setting of possible laryngotracheal injury may result in complete airway separation

	Advantages	Disadvantages
Delayed sequence intubation	<ul style="list-style-type: none"> - Does not require patient compliance for pre-oxygenation and assessment - Relatively fast - only adds necessary time to RSI ie time for preoxygenation and positioning - May allow NGT passage though this would be risky in patient with possible laryngotracheal or esophageal injury 	<ul style="list-style-type: none"> - Adverse effects of ketamine <ul style="list-style-type: none"> - Hypertension - Laryngospasm from blood - Apnea with rapid administration - Adverse effects as for RSI after relaxant given <ul style="list-style-type: none"> - Risk of inability to oxygenate after relaxant given - Cricoid pressure, if used, may worsen laryngotracheal injury - Face-mask ventilation may worsen subcutaneous emphysema - Risk of active or passive regurgitation of swallowed blood - Bail-out to cricothyroidotomy in setting of possible laryngotracheal injury may result in complete airway separation
Gas induction and laryngoscopy	<ul style="list-style-type: none"> - Maintains spontaneous breathing - Requires minimal cooperation - Does not require face mask ventilation which may worsen emphysema 	<ul style="list-style-type: none"> - Requires anaesthetist and anaesthetic machine - Risk of <ul style="list-style-type: none"> - Apnea requiring conversion to relaxed intubation - Laryngospasm during - Airway obstruction may result in insufficient ventilation to achieve appropriate depth of anaesthesia
Awake fiberoptic intubation	<ul style="list-style-type: none"> - Maintains spontaneous breathing - Allows visualisation of injury above and below vocal cords - Does not require face-mask ventilation - No hemodynamic effects of sedative/anaesthetic drugs 	<ul style="list-style-type: none"> - Requires compliant patient - Requires time for effective topicalisation - Bronchoscopy <ul style="list-style-type: none"> - Requires personnel with appropriate skill and equipment - May cause nasopharyngeal bleeding/further trauma

	Advantages	Disadvantages
		<ul style="list-style-type: none"> - May worsen hypertension in setting of vascular injury - Airway bleeding may obscure view
Topical anaesthesia and laryngoscopy	<ul style="list-style-type: none"> - Maintains spontaneous breathing - Will not cause nasopharyngeal trauma - No hemodynamic effects of sedative/anaesthetic drugs 	<ul style="list-style-type: none"> - Requires compliant patient - Takes time to topicalise - More difficult laryngoscopy than with anaesthesia and relaxation - Higher chance of vomiting and laryngospasm - May worsen hypertension in setting of vascular injury
Awake surgical tracheostomy	<ul style="list-style-type: none"> - Maintains spontaneous breathing - No requirement for face-mask ventilation - No hemodynamic effects of sedative/anaesthetic drugs - Lower risk of loss of airway 	<ul style="list-style-type: none"> - Requires surgeon - Requires compliant patient - Risk of tracheostomy complications <ul style="list-style-type: none"> - Blockage - Displacement - Bleeding - Long term complications
Dissociated fiberoptic intubation	<ul style="list-style-type: none"> - Maintains spontaneous breathing - Allows visualisation of injury above and below vocal cords - Does not require face-mask ventilation 	<ul style="list-style-type: none"> - Bronchoscopy <ul style="list-style-type: none"> - Requires personnel with appropriate skill and equipment - May cause nasopharyngeal bleeding/further trauma - May worsen hypertension in setting of vascular injury - Airway bleeding may obscure view - Adverse effects of ketamine <ul style="list-style-type: none"> - Hypertension - Laryngospasm from blood

	Advantages	Disadvantages
		- Apnea with rapid administration

List 4 difficulties or complications during or after emergency cricothyroidotomy specifically in a patient with possible laryngotracheal injury. (4 marks)

- Complete laryngotracheal separation
- Inability to find cricothyroid membrane due to hemorrhage or subcutaneous emphysema
- Bougie finding inferior false passage after passing through cricothyroid membrane
- Neck or mediastinal emphysema from ventilating superior to tracheal injury
- Expanding emphysema/swelling/hematoma displacing tube
- Pretracheal tissue too deep for tracheostomy tube due to emphysema/swelling/hematoma

Question 5

During the transfer off the retrieval stretcher, the ventilator alarms for high airway pressure. List 5 potential causes in this patient. (5 marks)

- Pneumothorax secondary to blast injury
- Primary blast lung injury
- Thoracic burns requiring escharotomy
- Pulmonary edema secondary to aggressive fluid resuscitation
- ETT obstruction from respiratory burn secretions
- Ventilator dyssynchrony
- Anaphylaxis to administered medication

An arterial blood gas shows a hemoglobin of 188g/L. List 2 causes of this finding in this patient. (2 marks)

- Intravascular fluid loss secondary to severe burn
- Central diabetes insipidus secondary to severe head injury

List 4 causes for an elevated lactate in this patient. (4 marks)

- Shock
- Hypoxemia

Topic-Based SAQ Quiz: Trauma

- Carbon monoxide poisoning
- Cyanide poisoning
- Adrenalin infusion