ROYAL COLLEGE
OF PHYSICIANS AND SURGEONS OF CANADA
COLLÈGE ROYAL
DES MÉDECINS ET CHIRURGIENS DU CANADA

Sample Applied Exam – Emergency Medicine

Scenario: Penetrating Thoracic Trauma

Objective(s) of the scenario:

- Demonstrate safe and efficient management of a combative trauma patient with careful attention to the potential for hemodynamic decompensation, as well as accounting for the safety of both the patient and medical staff
- Demonstrate appropriate investigation and resuscitation of a hemodynamically unstable patient with penetrating thoracic trauma
- Recognize the indications for emergent chest tube thoracostomy and describe the appropriate technique for chest tube insertion
- Recognize the indications for emergent OR thoracotomy
- Recognize the indications for emergency department thoracotomy and describe how to complete this procedure

Scenario:

You are working in a Level 1 trauma centre at 2:00 a.m. when emergency medical services (EMS) arrive at your emergency department with a 27-year-old woman who has been stabbed multiple times in an altercation at a local shelter for people experiencing homelessness. Police have recovered the weapon and report that it was a sharp knife with a 10-cm metal blade. The patient was suspected to have ingested several alcoholic beverages prior to sustaining her injuries. She has been uncooperative with EMS assessment and intervention, requiring physical restraint and preventing them from obtaining IV access. No past medical history is available.

On arrival to the ED, the patient is combative, uncooperative with assessment, spitting and yelling at staff. She has three 2-cm wounds visible to her left hemithorax: on the anterior axillary line of the third intercostal space, and on the midclavicular line of the fourth and fifth intercostal spaces. Her vital signs are: T 37.0°C, HR 120 bpm, BP 98/40 mm Hg, RR 24/min, oxygen saturation 88% on room air. Chest auscultation reveals diminished breath sounds on the left side. Pupils are equal and reactive, 5 mm bilaterally. She moves all limbs equally and there are no external signs of head trauma. No other wounds are visible. Point-of-care glucose measures 6.7 mmol/L.

Question 1

Outline your management at this point.

MODEL ANSWER

- Priorities should focus first on obtaining vascular access (two large bore IVs); placing the patient on cardiorespiratory monitoring; and applying supplemental O_2. Place the patient in a resuscitation / trauma bay with minimum 1 RT and 2 RNs in support. All personnel to don PPE (gown, gloves, mask, eye shield)
- Trauma team or local equivalent should be activated
- Security personnel should be involved and soft physical restraints applied. Pharmacological restraint should take into account the potential for hemodynamic deterioration. Relatively hemodynamically neutral agents (e.g. – haloperidol 5-10mg IM; ketamine 4mg/kg IM) should be favoured over those with a potential to drop BP / suppress respirations (benzodiazepines, propofol)
    - Once an IM dose of appropriate pharmacological restraint is administered the patient becomes calm (GCS 13: E3/V4/M6) and the rest of the case can proceed
- IV crystalloid resuscitation may be initiated at this point, however a strong candidate should hold IV fluids and favor observation of vital sign trends and continued reassessment of end organ perfusion parameters
- Obtain chest radiography
- Perform ED ultrasound ('FAST' exam)
- Obtain blood for lab analysis: CBC, lytes, creatinine, glucose, type & crossmatch, ethanol / acetaminophen / ASA levels, serum bhcg, INR, +/- venous blood gas
- Administer tranexamic acid: 1000mg IV over 10 minutes then 1000mg over 8 hrs

Question 2

Interpret the chest radiography performed (show image).

MODEL ANSWER

- CXR demonstrates diffuse haziness over the left hemithorax, consistent with hemothorax

Upon reassessing the patient, the vital signs are now: HR 125 bpm, BP 68/30 mm Hg, RR 24/min, oxygen saturation 85% on non-rebreather (NRB) mask.

(If requested, the FAST exam demonstrates no free intra-abdominal fluid or pericardial fluid. There is pleural fluid on the left, with visible lung sliding anteriorly.)

Question 3

Provide your NEXT steps in management.

MODEL ANSWER

- Initiate volume resuscitation if not already started. PRBC (O NEG) is preferred if immediately available. IV crystalloid is an acceptable alternative when blood products are not immediately available, e.g. – IV 0.9%NaCl or Ringer's Lactate to a maximum volume of 2L.
- Left chest tube thoracostomy should be performed for hemothorax:
  - Identify 4th or 5th intercostal space in mid-anterior axillary line
  - Instill local anesthetic: e.g. – lidocaine 1-2% with epinephrine
  - Using 10 blade scalpel incise through subcutaneous tissues to the level of the intercostal muscles
  - Using finger or curved clamp, bluntly dissect through intercostal musculature into pleural space. Open clamp tips to expand a hole in parietal pleura. Insert a finger and leave in place to maintain dissection tract and confirm intrathoracic location by palpating parietal pleura
  - Insert a large bore (36Fr) chest tube into pleural space directly or using a curved clamp, using finger for guidance. Secure to suction / drainage with underwater seal. Suture in place using retention suture (+/- horizontal mattress for later wound closure at time of removal)
  - Obtain repeat CXR to confirm placement

A chest tube is placed resulting in 600 mL of immediate drainage; 2 units of PRBC have been infused. Repeat vital signs: HR 120 bpm, BP 78/40 mm Hg, RR 22/min, oxygen saturation 96% on NRB mask.

Question 4

Outline your NEXT steps in management.

MODEL ANSWER

- Continue volume resuscitation. Anticipate the need for massive transfusion and indicate the need for these resources (e.g. – activation of local pathway, notification of blood bank, bringing massive transfusion pack to the bedside, etc.) Once a total volume of 4 units of PRBC is reached, additional blood products should be transfused in a foundational ratio (e.g. – PRBC/FFP/Platelets of 1:1:1: or 2:1:1 or 2:1: PRN, etc.)
- Notify trauma surgeon of potential need for OR thoracotomy. Initial drainage is not massive however ongoing hemodynamic instability is a potential indication for operative management
- Do not attempt to transport the patient out of the department for cross sectional imaging at this time.

FOUR units of PRBC have been infused over a total of 20 minutes since the beginning of the resuscitation. Current vital signs are as follows: HR 125 bpm, BP 62/30 mm Hg, RR 24/min, oxygen saturation 95% on NRB mask. The chest tube has drained an additional 1000 mL (for a total of 1600 mL).

Question 5

Outline your NEXT steps in management.

MODEL ANSWER

- Continue massive transfusion (see above)
- Repeat FAST exam (demonstrates no fluid in the abdomen or pericardium)
- The patient requires definitive operative management. Preparations should be underway for immediate transfer to the OR for thoracotomy. Recognize that ED thoracotomy may be imminent and call for the thoracotomy tray to the bedside (however procedure should NOT be initiated at this time)
- (The candidate may attempt to capture a definitive airway at this point. The examiner should not request a detailed description of this.)

You note that the patient is no longer making respiratory efforts, and there is no longer a palpable carotid pulse.

Question 6

Outline your NEXT steps.

MODEL ANSWER

- ED thoracotomy should be initiated immediately
  - Don all appropriate PPE (if not already mentioned at start of case)
  - Perform endotracheal intubation (preferably should delegate this act to another physician). Advance tube to 30cm depth to intubate right lung selectively
  - Quickly perform sterile skin prep of left hemithorax
  - Perform incision along left inframammary fold from right sternal border to left posterior axillary line
  - Use scissors to incise through intercostal muscles in 4th or 5th intercostal space; use of a scalpel increases risk of lung laceration
  - Manually separate ribs, then insert and open rib spreaders with crank handle oriented towards the axilla
  - Identify the pericardium; if pericardial tamponade is suspected then grasp the pericardium with forceps and perform pericardiotomy, anterior and parallel to phrenic nerve
  - Identify myocardial wounds and attempt repair; options include:
    - Digital pressure
    - Staple closure
    - Suture with Teflon pledgets
    - Placement of Foley catheter followed by balloon insertion and mild traction
- Perform manual cardiac massage, avoiding focal digital pressure and directing compressions perpendicular to septum; perform internal defibrillation if VFib / VTach present

Domains tested:

- Clinical Reasoning/Judgement (Synthesis/Integration of data)
- Diagnosis
- Clinical /Patient Management
- Organization, Logic and Flow