THORACIC TRAUMA
ANAESTHESIA TUTORIAL OF THE WEEK 63

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Scenario A

The front, unrestrained passenger of a vehicle from an RTA is brought into the Emergency Department. On arrival they are in PEA cardiac arrest. They have obvious bilateral chest wall injuries.

- **What are the important causes of cardiac arrest in trauma?**
- **What is the immediate management if you suspected a tension pneumothorax or a cardiac tamponade?**

Scenario B

A young man presents to the Emergency Department with left sided stab wounds to the chest. His initial observations are shown.

Respiratory Rate	40/min
Saturations	88% on 15L/min O2
Heart Rate	110/min
BP	102/60

What is your initial approach to the injured man?
What important diagnoses do you need to consider?

During the primary survey you find that the young man is effectively maintaining his own airway but his chest sounds quiet on the left side and the percussion note is dull. There is reduced chest wall movement on the affected side. The trachea appears central and you think you can hear normal heart sounds. He is now is obvious respiratory distress.

Are you ready to progress onto the rest of the primary survey?
What is the most likely diagnosis?

A chest x-ray confirms a haemothorax

What is your management?
Which patients with a haemothorax are likely to require a thoracotomy?

Answers will be found in the main body of the text.

Incidence

Thoracic trauma is responsible for 25% of all trauma deaths in the UK
Many deaths occur immediately but a significant group can be salvaged.
85-90% of patients with thoracic trauma can be managed conservatively
Surgery is needed in 10-15% of cases

Chest injuries – general approach

Full ATLS protocol should be followed with the ABCDE approach to primary & secondary survey
During the B phase of the primary survey, life threatening chest injuries should be identified and treated.

The Life threatening chest injuries are :

- Tension pneumothorax
- Open pneumothorax
- Massive haemothorax
- Flail chest
- Cardiac tamponade

Other injuries that should be identified during the secondary survey are :

1) Aortic injury
2) Lung contusion
3) Myocardial contusion
4) Diaphragmatic rupture
5) Tracheobronchial injury
6) Oesophageal injury

This article will focus on the identification and treatment of the life threatening injuries that should be identified in the primary survey

Tension Pneumothorax

A tension pneumothorax develops when air enters the pleural space. There is a valve like effect of the ruptured pleura and air is forced in during inspiration and coughing but unable to escape. The accumulated air collapses the affected lung and pushes the mediastinum across the chest. As a result, the mediastinal structures are compressed, decreasing venous return and therefore cardiac output.

Causes in trauma

- Penetrating chest trauma e.g. stab wound
- Blunt chest trauma with or without rib fractures
- Positive pressure ventilation in a patient with pre-existing simple pneumothorax
- Following insertion of subclavian or internal jugular central venous catheter

Features

- Respiratory distress
- Tachycardia and Hypotension
- Unilateral reduced or absent air entry
- Hyper-resonance to percussion on affected side
- Increasing resistance to ventilation
- Tracheal deviation away from affected side
- Distended neck veins

The last two features can be difficult to identify.

Treatment

Once the diagnosis has been made clinically, treatment must not be delayed by waiting for a chest radiograph

- High flow oxygen via a face mask
- Needle thoracocentesis – in the second intercostal space in the mid-clavicular line or fifth intercostal space in mid-axillary line on affected side
- A tube thoracostomy should be performed as definitive treatment urgently

Needle thoracocentesis is a procedure that is associated with complications and there have been case reports of haemorrhage

Open Pneumothorax

An open pneumothorax occurs when there is a pneumothorax associated with a chest wall wound. If the defect is more than 0.75 times the diameter of the trachea then, during inspiration, air is entrained directly into the chest cavity This occurs as the hole in the chest wall provides less resistance to flow.

Features

α) Those of simple pneumothorax (reduced air entry, resonant percussion note and decreased expansion)
β) Presence of a 'sucking chest wound' – through which air can be heard to enter the thoracic cavity during inspiration

Treatment

1. 100% oxygen via a face mask
2. Intubation and positive pressure ventilation when oxygenation or ventilation is inadequate
3. Tube thoracostomy
4. Thoracotomy in many patients
5. If definitive closure is delayed a bandage can be applied to the wound and taped on 3 sides. An Asherman chest seal can also be used. This acts as a flap valve allowing air to escape from the pneumothorax in expiration but not to enter during inspiration

Massive Haemothorax

This is defined as blood loss of greater than 1500mls in one hemithorax. It can be associated with either blunt or pentrating chest injuries. Signs of hypovolaemic shock are often present due to the loss of into the thorax. Management of the haemothorax and the blood loss need to occur simultaneously.

Causes

- Rib fractures
- Intercostal vessel injuries
- Lung parenchymal venous injuries
- Less common – arterial injury

Features

- Evidence of overlying blunt or penetrating chest wall injury
- Reduced chest wall movement
- Quiet or absent breath sounds
- Dullness to percussion
- Rarely – tracheal deviation

Treatment

- High flow oxygen
- Chest drain insertion (placed anteriorly is there is an associated pneumothorax)
- Good IV access to allow simultaneous volume replacement
- Thoracotomy is indicated in some patients with a massive haemothorax. Indications include immediate drainage of >1500mls of blood from one hemithorax, ongoing bleeding of >250mls/hour, continuing blood transfusion.

Flail Chest

A flail chest occurs when two or more ribs are fractured in two or more places. This results in a section of the chest wall which is able to move independently. The flail segment moves inwards during inspiration and outwards in expiration. The segment can occur laterally or anteriorly according to the location of the rib fractures. Flail chest can be associated with a significant lung injury underlying the fractures.

Features

1) Severe chest wall pain
2) Paradoxical chest wall movement (if the patient is able to splint their chest wall due to severe pain this may not be obvious)
3) Hypoxia (from inadequate ventilation or underlying lung contusion)
4) Crepitus or palpable rib fractures
5) Rib fractures on chest x-ray

Management

- High flow oxygen
- Analgesia to allow adequate ventilation
- Endotracheal intubation and IPPV may be needed in some cases

Cardiac Tamponade

In trauma, this is an accumulation of blood in the pericardium. It normally results from a left sided penetrating injury but can also occur in blunt trauma. As blood accumulates the ventricles cannot completely fill or contract. This leads to haemodynamic instability and PEA cardiac arrest. Presentation may be similar to a left sided tension pneumothorax.

Features

- Faint heart sounds
- Distended neck veins
- Hypotension
- PEA cardiac arrest

Management

- If cardiac tamponade is suspected it can be diagnosed using FAST (focussed assessment sonogram in trauma) or pericardiocentesis
  In addition pericardiocentesis can be used to treat cardiac tamponade by aspirating blood from the pericardium
- Definitive treatment is cardiothoracic surgery

This article looks at 5 immediately life-threatening chest injuries that can be identified in the primary survey. There are other chest injuries that can be diagnosed during the secondary survey as a result of further examination and imaging. These include ruptured diaphragm, oesophageal rupture, ruptured bronchus and pulmonary contusion.

References

1. Advanced Trauma Life Support for Doctors, American College of Surgeons Committee on Trauma, Student Course Manual 7th Edition

2. Advanced Paediatric Life Support – The Practical Approach 4th Edition, Advanced Life support Group