Congratulations
CHEST TRAUMA

Dr Naeem Zia
FCPS, FACS, FRCS
Learning objectives

• Anatomy of chest wall and thoracic viscera
• Physiology of respiration and nerve pathways for pain
• Enumerate different thoracic conditions requiring immediate management
• Investigations for a patient with thoracic trauma
• Management of urgent thoracic conditions
• **Trauma**, or injury, is defined as cellular disruption caused by an exchange with environmental energy that is beyond the body's resilience
• Trauma remains the most common cause of death for all individuals between the ages of 1 and 44 years and is the third most common cause of death regardless of age
Initial Evaluation and Resuscitation of the Injured Patient

• ATLS

• The initial management of seriously injured patients consists of
  • the primary survey,
  • concurrent resuscitation,
  • the secondary survey,
  • diagnostic evaluation, and
  • definitive care.
Primary survey

- identify and treat conditions that constitute an immediate threat to life.
- A
- B
- C
- D
- E
Anatomy of chest
Main Causes of Chest Trauma

- **Blunt Trauma**: Blunt force to chest.

- **Penetrating Trauma**: Projectile that enters chest causing small or large hole.

- **Compression Injury**: Chest is caught between two objects and chest is compressed.
Injuries of chest

- Simple/Closed Pneumothorax
- Open Pneumothorax
- Tension Pneumothorax
- Flail Chest
- Cardiac Tamponade
- Traumatic Aortic Rupture
- Diaphragmatic Rupture
Fractures and Dislocations

- Spine
- Ribs
- Clavicles
- Sternum
- Shoulders
Trauma Chest Radiograph

- Usually AP, often supine, frequently in poor inspiration.

- So, a challenge to interpret.
CT Chest
More sensitive and specific
Rib Fractures

- In themselves, not too much of a problem, but may be an indicator of underlying pleura, lung, liver, spleen, kidney injuries.
AIR where it shouldn’t be

- Pneumothorax
- Pneumomediastinum
- Subcutaneous emphysema
- Systemic venous air embolism
- Pneumopericardium
- Pneumoperitoneum/retroperitoneum
Simple/Closed Pneumothorax

• Opening in lung tissue that leaks air into chest cavity
• Blunt trauma is main cause
• May be spontaneous
• Usually self correcting
S/S of Simple/Closed Pneumothorax

- Chest Pain
- Dyspnea
- Tachypnea
- Decreased Breath Sounds on Affected Side
PNEUMOTHORAX: CT

- Much more sensitive than plain films.
- Even a small traumatic pneumothorax is important, especially if patient mechanically ventilated or going to OR: A simple pneumothorax can be converted into a life-threatening tension pneumothorax.
Treatment for Simple/Closed Pneumothorax

- ABC’s with C-spine control
- Airway Assistance as needed
- Provide supportive care
- Monitor for Development of Tension Pneumothorax
- In significant chest inj. + p.p. mechanical ventilation → prophylactic tube thoracostomy (prevention of tension P.)
Open Pneumothorax

• Opening in chest cavity that allows air to enter pleural cavity
• Causes the lung to collapse due to increased pressure in pleural cavity
• Can be life threatening and can deteriorate rapidly
• If the opening in the chest wall is approximately $2/3^{rd}$ of the diameter of trachea, air passes preferentially through the chest wall defect with each respiratory effort.
S/S of Open Pneumothorax

• Dyspnea
• Sudden sharp pain
• Subcutaneous Emphysema
• Decreased lung sounds on affected side
• Red Bubbles on Exhalation from wound (a.k.a. Sucking chest wound)
Subcutaneous Emphysema

- Air collects in subcutaneous fat from pressure of air in pleural cavity
- Feels like rice crispies or bubble wrap
- Can be seen from neck to groin area
Sucking Chest Wound
Treatment for Open Pneumothorax

• ABC’s with c-spine control as indicated
• High Flow oxygen
• Listen for decreased breath sounds on affected side
• Apply three way occlusive dressing to wound as a temporary measure
• A chest tube remote from the wound should be placed as soon as possible
Occlusive Dressing

Three way occlusive dressing
Tension Pneumothorax

- Air builds in pleural space with no where for the air to escape
- Results in collapse of lung on affected side that results in pressure on mediastium, the other lung, and great vessels
Tension Pneumothorax

Each time we inhale, the lung collapses further. There is no place for the air to escape.
Tension Pneumothorax

The trachea is pushed to the good side.

Heart is being compressed.
S/S of Tension Pneumothorax

- Anxiety/Restlessness
- Severe Dyspnea
- Absent Breath sounds on affected side
- Tachypnea
- Tachycardia
- Poor Color

- Accessory Muscle Use
- JVD
- Narrowing Pulse Pressures
- Hypotension
- Tracheal Deviation
  (late if seen at all)
TENSION PNEUMO ON FILM
Erect AP/PA view best
Shift of mediastinum/heart/trachea away from PTX side
Depressed hemidiaphragm
Degree of lung collapse is variable
Treatment of Tension Pneumothorax

- ABC’s with c-spine as indicated
- High Flow oxygen
- Treat for S/S of Shock
- If Open Pneumothorax – promptly close the defect with a sterile occlusive dressing. Tape it securely on three sides to provide a flutter type valve effect
• Monitor Cardiac Rhythm
• Establish IV access and Draw Blood Samples
• Airway control including Intubation
• Needle Decompression of Affected Side followed by tube thoracostomy.
Needle Decompression

• Locate 2-3 Intercostal space midclavicular line
• Cleanse area using aseptic technique
• Insert catheter (14g or larger) at least 3” in length over the top of the 3rd rib (nerve, artery, vein lie along bottom of rib)
• Remove Stylette and listen for rush of air
• Place Flutter valve over catheter
• Reassess for Improvement
Needle Decompression

Second Intercostal Space

Clavicle
Hemothorax

- Occurs when pleural space fills with blood
- Usually occurs due to lacerated blood vessel in thorax
- As blood increases, it puts pressure on heart and other vessels in chest cavity
- Each Lung can hold 1.5 liters of blood
PNEUMOMEDIASTIUM

- Usually from ruptured alveoli.
- Can also be from trachea, bronchi, esophagus, bowel and neck injuries.
PNEUMOMEDIASTINUM: Signs

- Linear paratracheal lucencies
- Air along heart border
- “V” sign at aortic-diaphragm junction
- Continuous diaphragm sign
PNEUMOMEDIASTINUM: Continuous diaphragm sign
PNEUMOMEDIASTINUM: CT
Trachea/bronchi injuries

- Tears occur within 2cm of carina
- Persistent pneumothorax
- Large pneumomediastinum
- “Fallen lung”
Subcutaneous Emphysema

- Causes: Same as pneumomediastinum
Hemothorax
Hemothorax

May put pressure on the heart
Hemothorax

Where does the blood come from.

Lots of blood vessels
HEMOTHORAX

- Venous or arterial bleeding
- 60% controlled by chest tube, 40% need operative management
- Can miss hundreds of cc’s on supine film
- Can be tension
HEMOTHORAX
S/S of Hemothorax

- Anxiety/Restlessness
- Tachypnea
- Signs of Shock
- Frothy, Bloody Sputum
- Diminished Breath Sounds on Affected Side
- Tachycardia
- *Flat Neck Veins*
CT: HEMOTHORAX
Treatment for Hemothorax

• ABC’s with c-spine control as indicated
• Secure Airway assist ventilation if necessary
• General Shock Care due to Blood loss
• Airway management to include Intubation
• If Development of Hemo/Pneumothorax needle decompression may be indicated followed by tube thoracostomy
Flail Chest

The breaking of 2 or more ribs in 2 or more places
Flail Chest

Rib 3 - 2 fractures
Rib 4 - 2 fractures
Rib 5 - 2 fractures
Rib 6 - 2 fractures
Flail Chest

• Multiple rib fractures, especially if individual ribs fractured more than once, may cause paradoxical motion.
• The major problem actually is associated pulmonary contusion
S/S of Flail Chest

- Shortness of Breath
- Paradoxical Movement
- Bruising/Swelling
- Crepitus (Grinding of bone ends on palpation)
Treatment of Flail Chest

- ABC’s with c-spine control as indicated
- High Flow oxygen
- Airway management to include Intubation and ventilation for prevention of hypoxia.
- Monitor Patient for signs of Pneumothorax or Tension Pneumothorax
- Pain control by either intermittent intercostal nerve blocks or epidural anaesthesia.
Pericardial Tamponade

- Blood and fluids leak into the pericardial sac which surrounds the heart.
- As the pericardial sac fills, it causes the sac to expand until it cannot expand anymore.
Pericardial Tamponade

- Once the pericardial sac can’t expand anymore, the fluid starts putting pressure on the heart.
- Now the heart can’t fully expand and can’t pump effectively.
Pericardial Tamponade

- With poor pumping the blood pressure starts to drop.
- The heart rate starts to increase to compensate but is unable.
- The patient’s level of conscious drops, and eventually the patient goes in cardiac arrest.
S/S of Pericardial Tamponade

BECK’S TRIAD
- Distended Neck Veins
- Muffled heart sounds
- Hypotension

KUSSMAUL’S SIGN
Rise in venous pressure with inspiration when breathing spontaneously
Treatment of Pericardial Tamponade

- ABC’s with c-spine control as indicated
- High Flow oxygen
- Treat S/S of shock
- What patient needs is pericardiocentesis
Pericardiocentesis

• Using aseptic technique, Insert at least 3” needle at the angle of the Xiphoid Cartilage at the 7\textsuperscript{th} rib
• Advance needle at 45 degree towards the clavicle while aspirating syringe till blood return is seen
• Continue to Aspirate till syringe is full then discard blood and attempt again till signs of no more blood
• Closely monitor patient due to small about of blood aspirated can cause a rapid change in blood pressure
Pneumopericardium

- Causes: penetrating trauma
- Rare
Traumatic Aortic Rupture

The heart, more or less, just hangs from the aortic arch. Much like a big pendulum.

If enough motion is placed on the heart (i.e., Deceleration From a motor vehicle accident, striking a tree while skiing etc) the heart may tear away from the aorta.
Traumatic Aortic Rupture

The chances of survival are very slim and are based on the degree of the tear.

If there is just a small tear then the patient may survive. If the aorta is completely transected then the patient will die instantaneously.
S/S Of Traumatic Aortic Rupture

- Burning or Tearing Sensation in chest or shoulder blades
- Rapidly dropping Blood Pressure
- Pulse Rapidly Increasing
- Decreased or loss of pulse or b/p on left side compared to right side
- Rapid Loss of Consciousness
Treatment of Traumatic Aortic Rupture

- ABC’s with c-spine control as indicated
- High Flow oxygen
- Treatment for Shock
- Emergency surgical repair
Diaphragmatic Rupture

• A tear in the Diaphragm that allows the abdominal organs enter the chest cavity
• More common on Left side due to liver helps protect the right side of diaphragm
• Associated with multiple injury patients
Diaphragm Rupture
S/S of Diaphragmatic Rupture

- Abdominal Pain
- Shortness of Air
- Decreased Breath Sounds on side of rupture
- Bowel Sounds heard in chest cavity
Treatment of Diaphragmatic Rupture

- ABC’s with c-spine control as indicated
- High Flow oxygen
- Treat Associated Injuries
- Observe for Pneumothorax due to compression on lung by abdominal contents
- Possible insertion of NG tube to help decompress the stomach to relieve pressure
- Patient needs BRIGHT LIGHTS AND COLD STEEL
Penetrating injuries
Blast injuries
Chest Injuries are common and often life threatening in trauma patients. So, Rapid identification and treatment of these patients is paramount to patient survival. Airway management is very important and aggressive management is sometimes needed for proper management of most chest injuries.