



# Thoracic Trauma

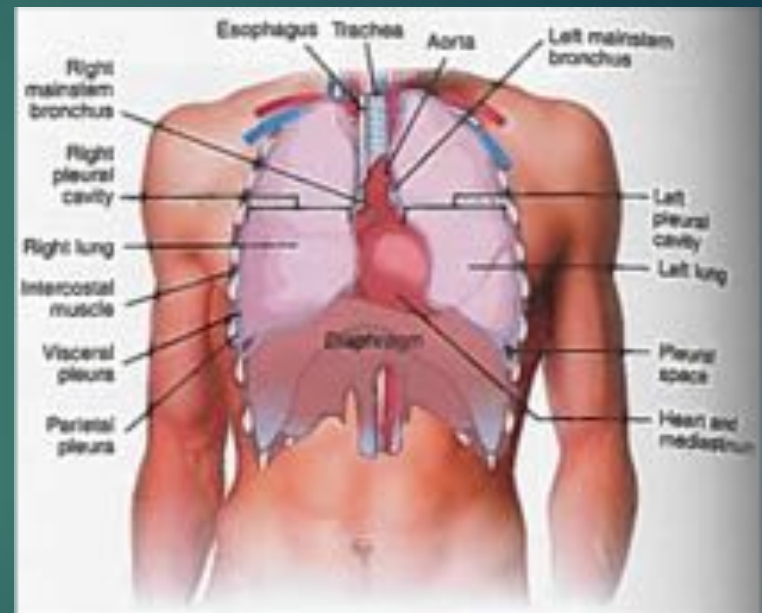
SUPERIOR EMS – STAFF TRAINING



# Anatomy & Physiology Review

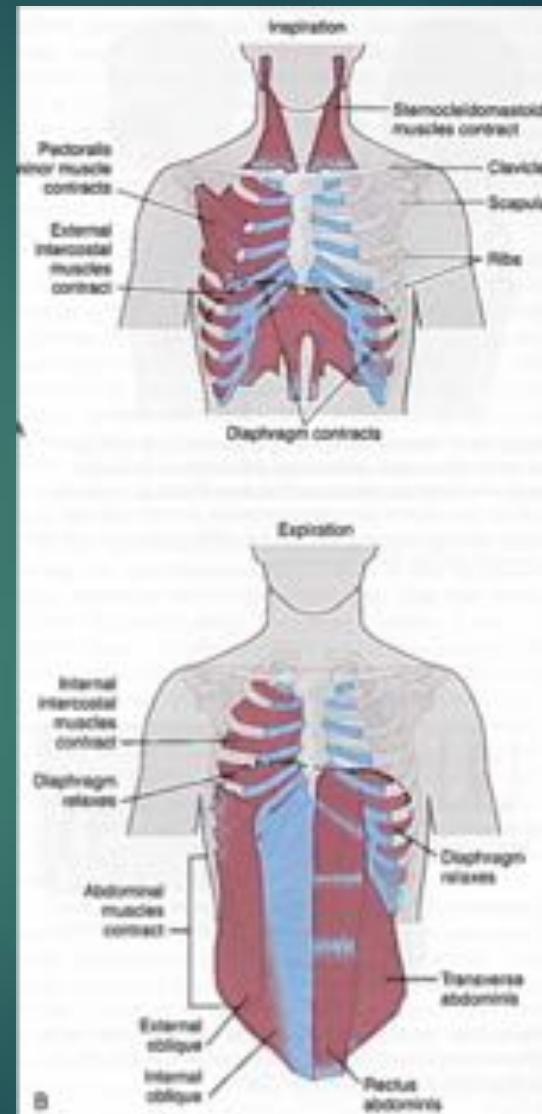
# Anatomy

- ▶ Hollow cylinder
- ▶ 12 paired ribs
- ▶ Ribs reinforced with muscle - “intercostal”
- ▶ Covered with pectoral muscle, serratus muscle, latissimus dorsi making a “padding”
- ▶ Cavity lined with the parietal pleura
- ▶ Lungs covered by the visceral pleura
- ▶ Pleural fluid in between to reducing collapse
- ▶ Between the lungs is the mediastinum (contains the trachea, heart, esophagus)

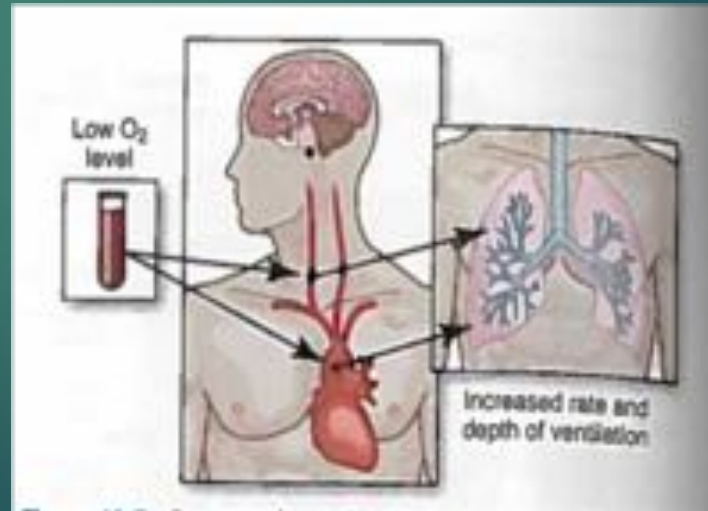
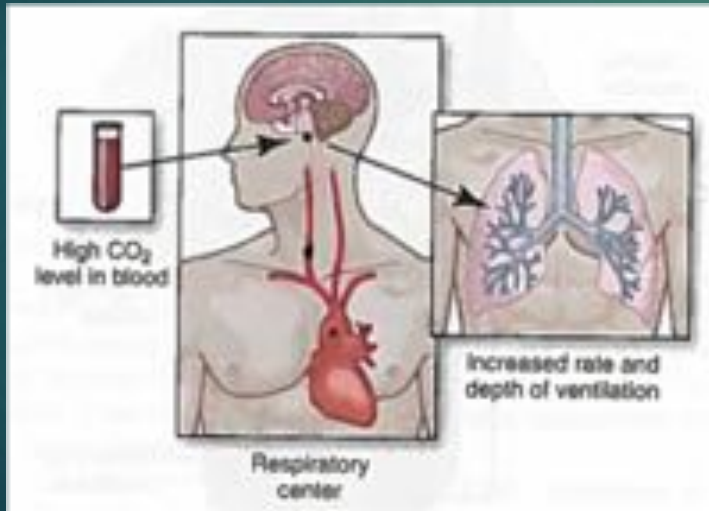


# Physiology

- ▶ Ventilation
  - ▶ Mechanical act of drawing air in
- ▶ Respiration
  - ▶ Delivery of oxygen to the cells
- ▶ Inhalation
  - ▶ Air enters the lungs
- ▶ Expiration
  - ▶ Air leaves the lungs



- ▶ Triggered by chemoreceptors that are sensitive to changes in the levels of carbon dioxide and oxygen saturations to either stimulate an increase or decrease in breathing rates.



Injuries

# Penetrating Injury

- ▶ Normally no space exists between the pleural membranes.
- ▶ In the event of a penetrating trauma, air can enter the pleural space through a wound during inspiration when the pressure inside the chest is lower than outside.
- ▶ When air enters the pleural space a **pneumothorax** may occur, resulting in the lung to collapse
- ▶ Should continued air enter the chest cavity with no way to escape, a **tension pneumothorax** may occur
- ▶ Lacerated tissues and torn blood vessels in the cavity can result in blood entering the pleural space causing a **hemothorax**. This can cause the lung to collapse
- ▶ Lung collapse = no ventilation in that lung.

## ▶ General Assessment

### ▶ Observation

- ▶ Signs of hypoperfusion
- ▶ Visible wounds
- ▶ JVD
- ▶ Tracheal Deviation

### ▶ Auscultation

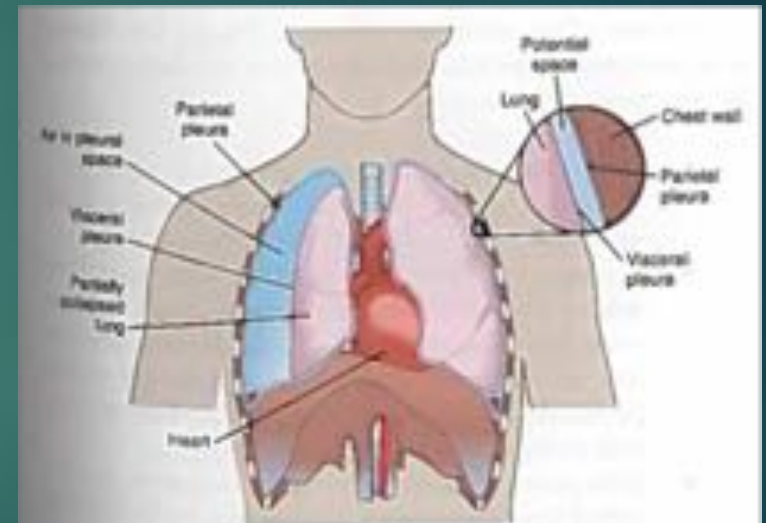
- ▶ Decreased or diminished breath sounds on the side of collapse

### ▶ Palpation

- ▶ May be tender, and may feel crepitus (subcutaneous emphysema)

### ▶ Tests

- ▶ Oxygen saturations <94% possible





## ▶ General Interventions

- ▶ Stabilize neck if needed
- ▶ Administer oxygen PRN, and ventilate as needed (with a low tidal volume to avoid increasing intrathoracic pressure)
- ▶ Semi-sitted if possible
- ▶ Control external hemorrhage and stabilize any impaled objects
- ▶ Seal the wound with an occlusive dressing (commercial dressing). If no commercial dressing is available leave the wound exposed.
- ▶ Ensure that the dressing covers the entire wound and several centimeters beyond the wound edge
- ▶ Incline the patient towards the affected side unless prohibited
- ▶ Monitor for pneumothorax, and if obvious remove the dressing
- ▶ Needle decompression can be considered if pneumothorax present



# Blunt Force Trauma

- ▶ When blunt force is transmitted through the chest wall to the thoracic organs
- ▶ Can result in a **pulmonary contusion** which is essentially bleeding into the alveoli
- ▶ Can result in a pneumothorax due to tears in the visceral pleura
- ▶ Can also cause fractured ribs, which can lacerate the lung resulting in a pneumothorax
- ▶ MOI is usually rapid and sudden deceleration injuries

## ▶ Assessment

### ▶ Observation

- ▶ Signs of hypoperfusion
- ▶ Signs of hypoxia
- ▶ Contusions, abrasions, lacerations on the chest
- ▶ Paradoxical movement of the chest
- ▶ JVD
- ▶ Tracheal Deviation

### ▶ Auscultation

- ▶ Decreased breath sounds to the injured side possible
- ▶ Adventitious breath sounds (i.e. crackles)
- ▶ Muffled heart sounds (blood collecting around the heart)

### ▶ Palpation

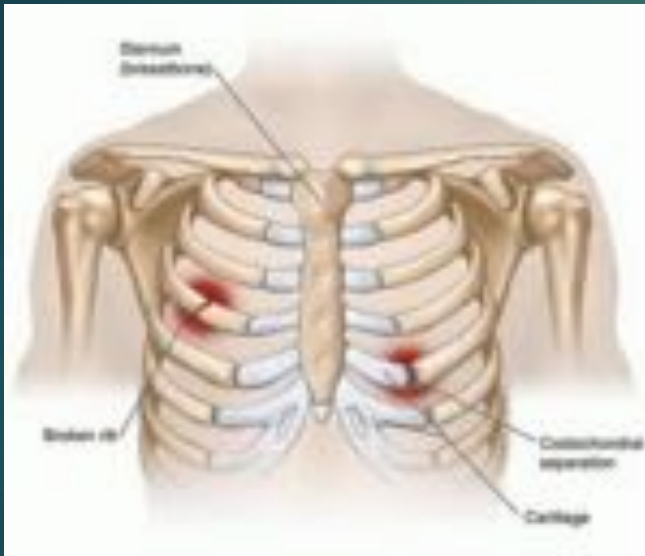
- ▶ Tenderness, subcutaneous emphysema

### ▶ Vitals

- ▶ O2 sats – ensure above 94%



# Rib Fractures



- ▶ General
  - ▶ 10% of all trauma patients have them
  - ▶ Can lead to or cause pulmonary contusions, pneumothorax due to trauma, etc.
- ▶ Assessment
  - ▶ c/o chest pain with breathing or movement
  - ▶ Difficulty breathing, laboured respirations
  - ▶ Palpation – pain and tenderness over the site, and crepitus possible
- ▶ Management
  - ▶ Pain relief – positioning, pain meds PRN, encourage deep breathing, avoid any rigid immobilization, keep O<sub>2</sub> sats above 94%
  - ▶ Transfer to definitive care

# Flail Chest

## ▶ General

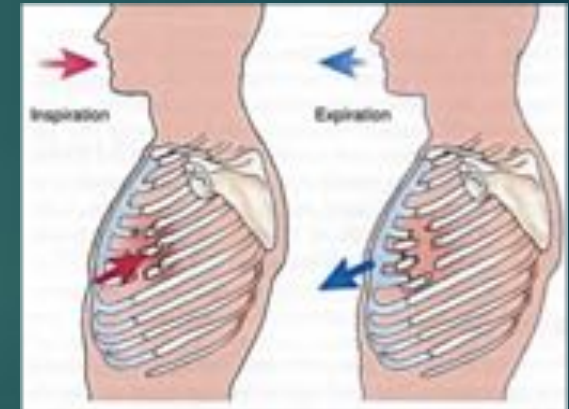
- ▶ When two or more adjacent ribs are fractured in more than one place along the length.
- ▶ Segment no longer in continuity with the structure and “floats”
- ▶ Due to the negative pressure, on inspiration the rib cage goes outward but the flail segment goes inward
- ▶ Risk of pulmonary contusion, laceration, or pneumothorax

## ▶ Assessment

- ▶ Pain more severe than simple fracture
- ▶ Resp rate goes up
- ▶ Paradoxical motion may be visible
- ▶ Tenderness, spasm and crepitus

## ▶ Management

- ▶ Pain management
- ▶ Ventilatory support – O<sub>2</sub> sats above 94%, prepare to ventilate patient
- ▶ No longer recommend to stabilize the segment.

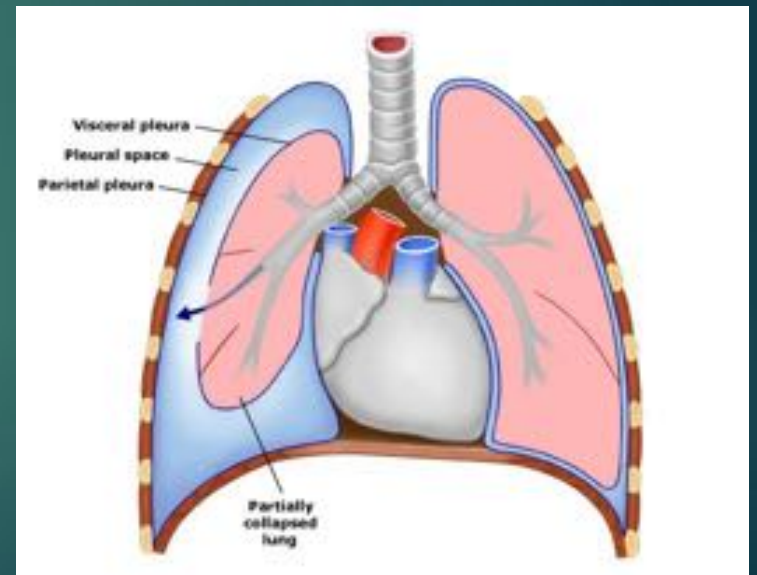


# Pulmonary Contusion

- ▶ General
  - ▶ Lung tissues is lacerated and bleeding into the alveolar air spaces
  - ▶ Swelling can also build up impeding gas exchange
- ▶ Assessment
  - ▶ Variable
  - ▶ Ventilation usually increases
  - ▶ Rales may be audible
- ▶ Management
  - ▶ Support ventilation
  - ▶ Maintain O<sub>2</sub> sats >94%

# Pneumothorax - Simple

- ▶ General
  - ▶ Presence of air within the pleural space
  - ▶ As the pressure of the air increases the lung collapses
- ▶ Assessment
  - ▶ Similar to rib fracture
  - ▶ Decreased breath sounds are classic signs
  - ▶ Respiratory distress
- ▶ Management
  - ▶ Oxygenate
  - ▶ Treat for shock
  - ▶ Maintain patient comfort
  - ▶ Transfer to definitive care



# Pneumothorax – Open

- ▶ General
  - ▶ Similar to simple, however some type of opening
  - ▶ i.e. gunshot, stabbing, impalement
  - ▶ When inhales air enters the pleural space due to the negative pressure in the thoracic cavity. Larger wounds can be just a free flow.
- ▶ Assessment
  - ▶ Respiratory distress
  - ▶ Wound
  - ▶ Audible sucking sounds from the wound, bubbling, etc.
- ▶ Management
  - ▶ Sealing the hole with an occlusive dressing (commercially designed) such as a chest seal to ensure a “valve” is formed
  - ▶ If no commercial chest seal is available, and significant blood loss is occurring apply a dressing and replace if saturated to avoid occluding the hole.





# Pneumothorax - Tension

## ▶ General

- ▶ Life threatening emergency where air continues to enter the pleural space without any exit or release
- ▶ The intrathoracic pressure builds up, and breathing diminishes, and venous return to the heart decreases
- ▶ The increased pressure eventually pushes the structures of the mediastinum towards the other side of the chest, further impeding venous return, ultimately shutting things down

## ▶ Assessment

- ▶ Apprehension, discomfort, chest pain, breathing difficulties, signs of shock
- ▶ Classic sign is **tracheal deviation** away from the injured side
- ▶ Diminished Breath sounds
- ▶ JVD, crepitis, tachycardia, and hypotension may occur.

## ▶ Management

- ▶ Decompression of the tension is required
- ▶ BLS – high concentration oxygen, BVM if needed,
- ▶ ALS – consider needle decompression



# Hemothorax



- ▶ General
  - ▶ Blood enters the pleural space, which can cause a tension hemothorax if blood cannot escape
- ▶ Assessment
  - ▶ Chest pain, shortness of breath, hypoperfusion
  - ▶ Tachycardia, confusion
  - ▶ Diminished breath sounds
  - ▶ \* note that JVD is typically NOT present due to diminished blood volume
- ▶ Management
  - ▶ Oxygen and ventilation PRN
  - ▶ Fluid resuscitation as indicated
  - ▶ Rapid transfer to definitive care

# Blunt Cardiac Injuries

## ▶ General

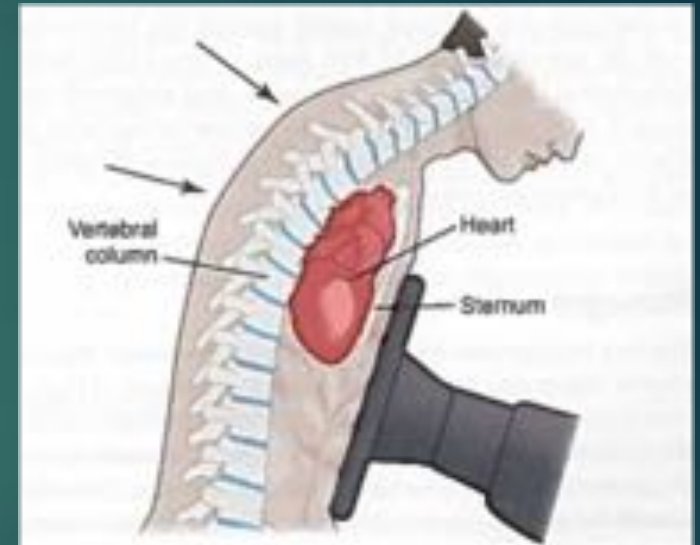
- ▶ Usual MOI is force to the anterior chest from rapid deceleration (i.e. frontal impact of an MVC)
- ▶ The heart gets compressed between the sternum and spinal column
- ▶ Causes abrupt increases in pressure within the ventricles, which can cause a number of things
  - ▶ Cardiac contusion – heart muscle bruises
  - ▶ Valvular Rupture - usually shows signs of CHF
  - ▶ Blunt Cardiac Rupture – heart dies essentially

## ▶ Assessment

- ▶ Based on MOI
- ▶ Chest pain, shortness of breath, dysrhythmias may be present, palpitations, bruising, sternal instability, floating sternum (flail sternum)
- ▶ Harsh murmur, CHF, JVD, abn breath sounds, tachycardia, PVCs, ST elevation

## ▶ Management

- ▶ Oxygen
- ▶ IV fluids
- ▶ ACLS meds as required.



# Cardiac Tamponade

## ▶ General

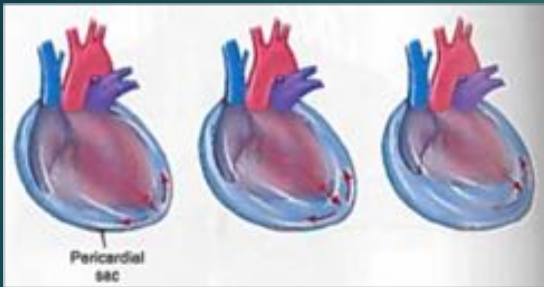
- ▶ Injury around the heart resulting in fluid acutely accumulating between the pericardial sac and the heart
- ▶ Pressure formulates in the sac because of the fluid accumulation impeding venous return, reducing cardiac output and blood pressure
- ▶ Leads to pulseless electrical activity (PEA)
- ▶ Most common MOI – stabbing

## ▶ Assessment

- ▶ MOI
- ▶ Distant or muffled cardiac sounds
- ▶ JVD
- ▶ Hypotension
- ▶ ECG has varying QRS wave heights

## ▶ Management

- ▶ Oxygen PRN
- ▶ IV fluids
- ▶ Resuscitation PRN
- ▶ Transfer of care to a definitive care facility

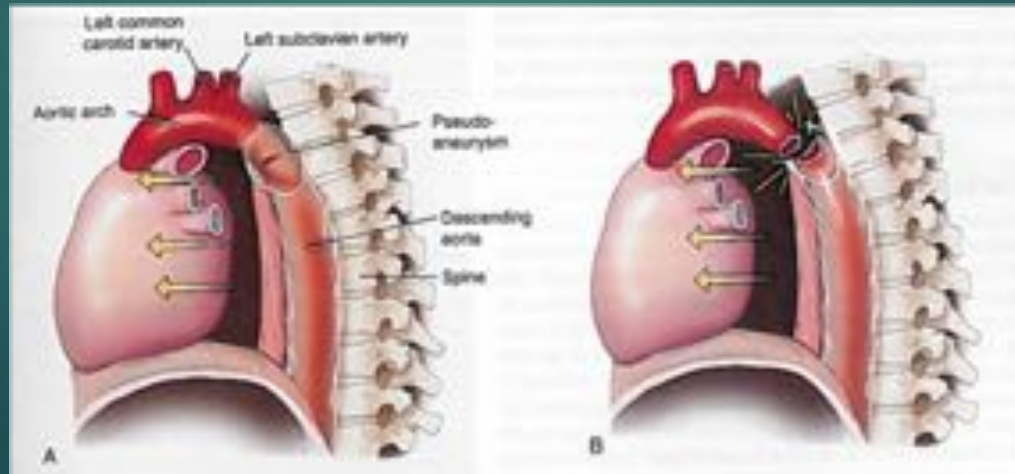


# Commotio Cordis

- ▶ General
  - ▶ A blow to the chest that results in immediate cardiac arrest
  - ▶ Many of these incidents happen in sports
  - ▶ Typically no physical trauma to surrounding structures
- ▶ Assessment
  - ▶ Vital Signs Absent
  - ▶ V-Fib is most common rhythm
- ▶ Management
  - ▶ Cardiac arrest management

# Traumatic Aortic Disruption

- ▶ General
  - ▶ A deceleration/acceleration MOI with significant force
  - ▶ Aorta shears often just below the left subclavian artery
  - ▶ Tear can either be complete or partial
- ▶ Assessment
  - ▶ High-energy deceleration/acceleration MOIs
  - ▶ Really hard to assess pre-hospital needs definitive diagnostics
- ▶ Management
  - ▶ DEFINITIVE CARE
  - ▶ Oxygen
  - ▶ IV access



# Needle Decompression

