

# CHEST TRAUMA

CHAPTER



By: Asst pro. Dr. Ahmad Mujeeb Ahmadi دیوان بېگي کلينیک، کابل

۱۶/۶/۲۰۲۲

## **Introduction**

Even for those of us who deal with blunt trauma on a daily basis, a report from the field that a high speed collision has occurred with a victim who has sustained a "steering wheel injury" raises our overall level of concern. The management of thoracic trauma, with its attendant potential for life threatening injury, if approached from the standpoint of providing an airway, assuring adequate ventilation and controlling hemodynamics falls within the realm of all ER staff.

# CHEST TRAUMA(MAGNITUDE OF PROBLEM)

Trauma is leading cause of death hospitalization, short and long-term disability for all ages from first –forty years.

25% of all trauma death due to chest injuries

20-33% death preventable.

Deaths occur within first 4 hours trauma. Uncontrolled hyg, un corrected hypoxia or delay in surgical interventions

85% of pt with life threatening injuries can be managed simple interventions easily mastered by physicians and ER service personnel

# ■ AIRWAY

## :LOOK FOR

- **Associated injuries** to the head, face, cervical spine and injuries to the upper and lower airway.
- Low level of consciousness, airway obstruction or disruption, and inability to oxygenate the patient by mask indicate the **need for tracheal intubation**.
- **Blood in the airway**, recent food intake, and trauma itself with decreased gastric emptying, mandate an approach which minimizes the potential for aspiration of gastric contents. put NGT etc
- **Awake techniques** with direct visualization, i.e. fiberoptic or direct laryngoscopy, or rapid sequence induction with cervical immobilization may be appropriate depending on the clinical scenario and level of skill of the anesthesiologist

## **BREATHING**

Careful physical assessment ventilatory function of the thoracic trauma should include

-  inspection for respiratory rate,
-  presence of paradoxical motion of the chest wall, or obvious chest wounds.

 **Palpation**; should seek **pain, crepitus or subcutaneous emphysema** as clues to underlying pathology.

 **Auscultation** of the lung fields may detect a **pneumothorax or hemothorax** before a chest xray is performed, as well as assessing the adequacy of air entry.

 **Percussion** although theoretically of use in differentiating between **pneumo and hemothorax**, may be practically difficult in the atmosphere surrounding a typical resuscitation bay.

## ◆ CIRCULATION:

- ◆ **Hypotension:** in thoracic trauma is usually associated with hypovolemia it should be aggressively treated initially with volume expansion with crystalloids while other possible etiologies, i.e. pneumothorax, cardiac tamponade and blunt cardiac injury are assessed.
- ◆ **Arrhythmia** should raise suspicion of **blunt cardiac injury**
- ◆ **Hypertension** may dramatically worsen bleeding in thoracic trauma and may dislodge thrombus which is containing a major vessel disruption and therefore should be treated.
- ◆ **Two large bore peripheral IV's are a minimum for resuscitation and a central access is usually needed both for therapy and monitoring.**

# LINES AND MONITORING

Iv two large bore

Oxygen Mask, Intubation apparatus.

Pulse oximeter

Bp cuff noninvasive

EKG monitor

NGT/Foleys

Splints, oronasal airways, Cx Collar

Suction apparatus.

# ***LABORATORY VALUES***

The usual laboratory tests,

1. Complete blood count,
2. Electrolytes, glucose, BUN, creatinine,
3. Urinalysis,
4. ECG,
5. Blood type and crossmatch should be obtained.
6. Cardiac enzymes, ABG.

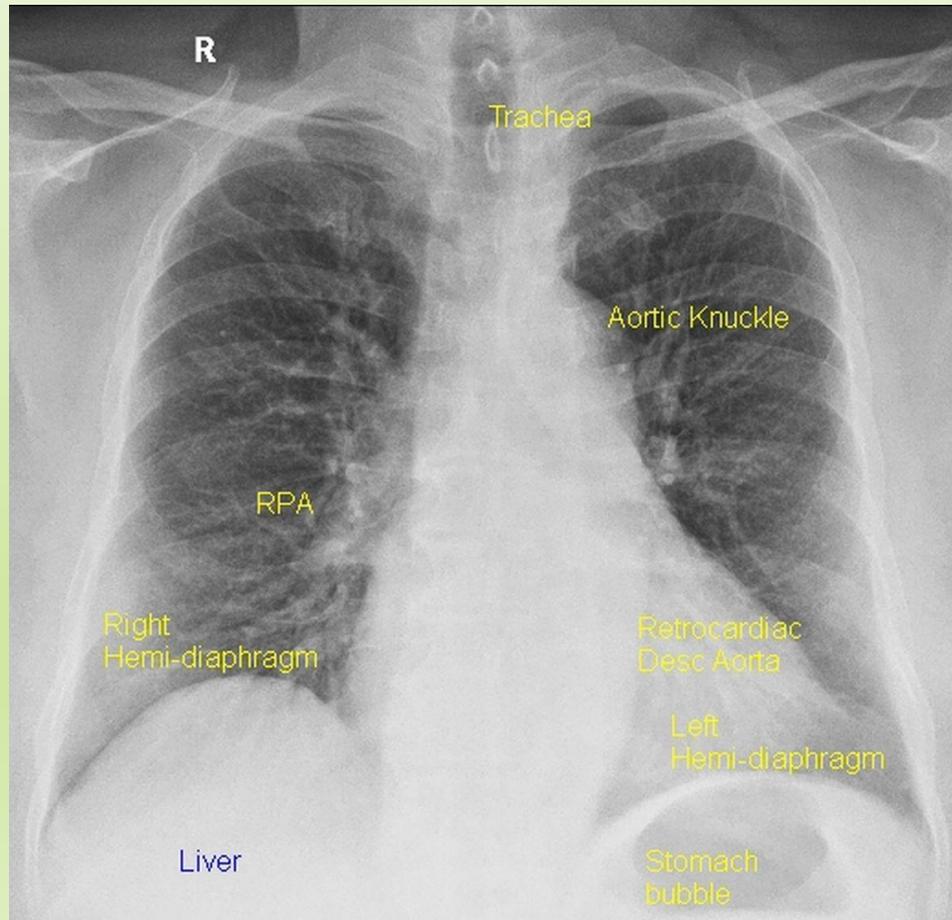
## ⊕ CXR

VERY important and only attention to life threatening problems should delay obtaining it.

- ⊕ **Systematic review** of the radiograph -reveal both suspected and unsuspected pathology.
- ⊕ **Bony thorax** including ribs, clavicles, scapulae, and vertebrae, should be examined for fracture.
- ⊕ **Soft tissues** ; evaluate for Emphysema or Opacification.
- ⊕ **The lung fields**; likewise demonstrate Pneumothorax, Hemothorax, consolidation suggestive of **lung contusion**.
- ⊕ **Radiographic abnormalities** of the mediastinum,
  - ⊕ Pneumomediastinum, -Airway rupture
  - ⊕ Widening of the mediastinum, -Aortic disruption
  - ⊕ Shift of the mediastinum - tension pneumothorax
- ⊕ **Assessment of the cardiac silhouette** may aid in the diagnosis

# CHEST X-RAY – OVERVIEW

Chest X-ray (CXR) PA view (**Figure 7.1**) is the one routinely taken for cardiac evaluation. Lateral view and oblique views are rarely taken in specific situations. But interpretation of these views is more challenging than the PA view, mainly because of lack of familiarity due to lower usage.



## ✚ **OTHER RADIOLOGY**

### *lateral cervical spin and pelvis films*

✚ Several imaging examinations are needed in the work up of thoracic trauma.

✚ **Echocardiogram**, *Precordial or Transesophageal*, useful in evaluating for **pericardial fluid**, **valve and wall motion**, and the presence and extent of **aortic disruption**.

✚ **Computerized tomography**; may reveal **Aortic disruption** and **Pneumothorax** not readily apparent on plain chest xray.

✚ **Arteriography** is used to precisely locate **vascular injury**

# ■ RIB FRACTURES

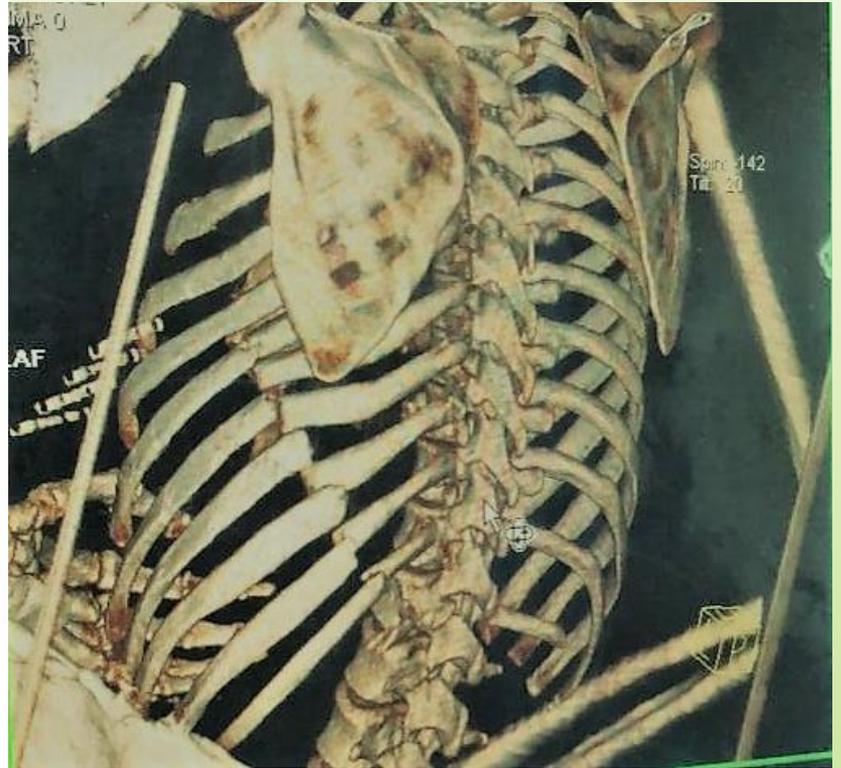
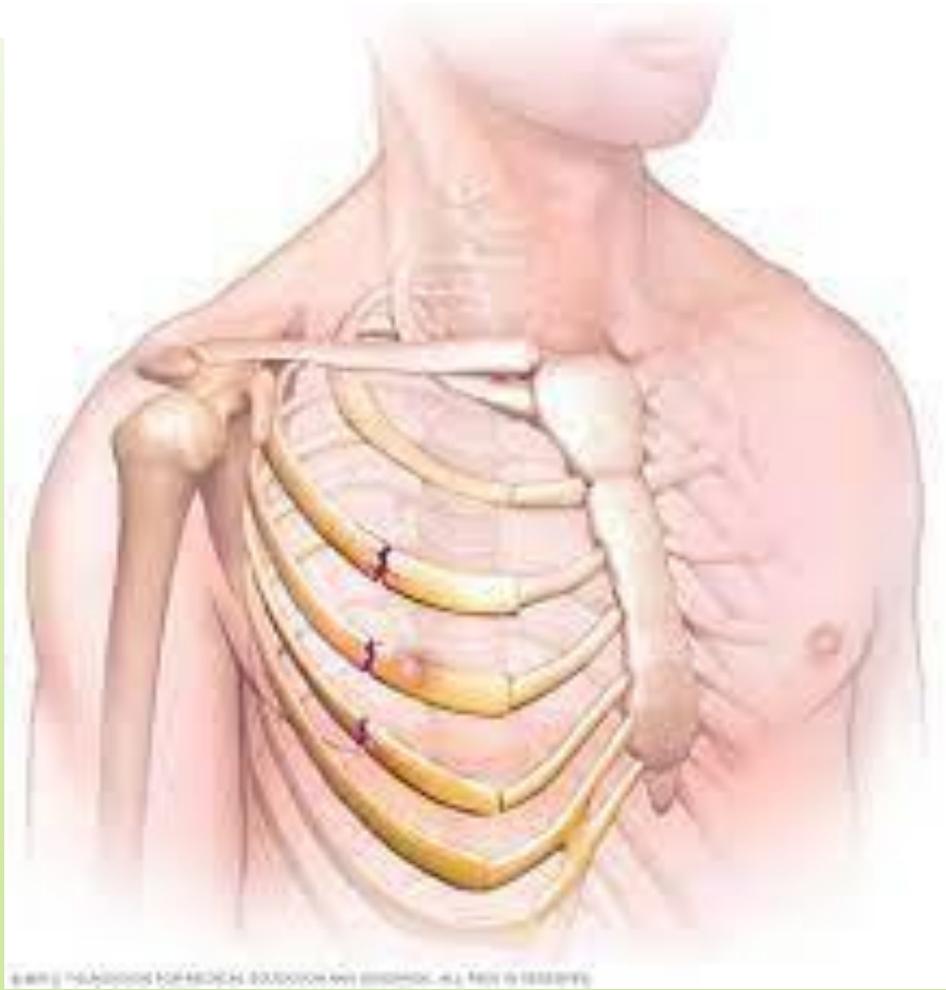
Rib fractures should be taken in context. Their **presence** indicate a need for examining the underlying lung

- for contusion,
- laceration,
- hemo or pneumothorax.

■ Multiple or anterior and posterior rib fractures may cause a flail segment.

■ Fracture of the relatively protected first through third ribs indicates severe impact and mandates careful search for associated injury.

# RIB FRACTURES



## ➤ PULMONARY CONTUSION

Frequently manifests itself as **Hypoxemia**.

➤ Goals for treatment are to prevent it

➤ Oxygen therapy,

➤ Positive pressure either with a CPAP mask

➤ Intubation and mechanical ventilation with PEEP.

➤ Splinting from the **pain** associated with rib fractures requires adequate pain management, i.e. parenteral narcotics, interpleural local anesthetics, or epidural narcotics/local anesthetics.

➤ The contused lung is prone to **capillary leak** and therefore **careful fluid management** is indicated

# ➤ PULMONARY CONTUSION



CT: Bilateral pulmonary consolidations, predominately affecting posterior and apical lung zones, in keeping with pulmonary contusions. Bilateral clavicular fractures.



CXR: Bilateral opacities along both lung fields, more on right lung. Bilateral distal clavicular fracture.

# ✦ Pneumothorax and Tension Pneumothorax

- ✦ A high index of suspicion for the presence

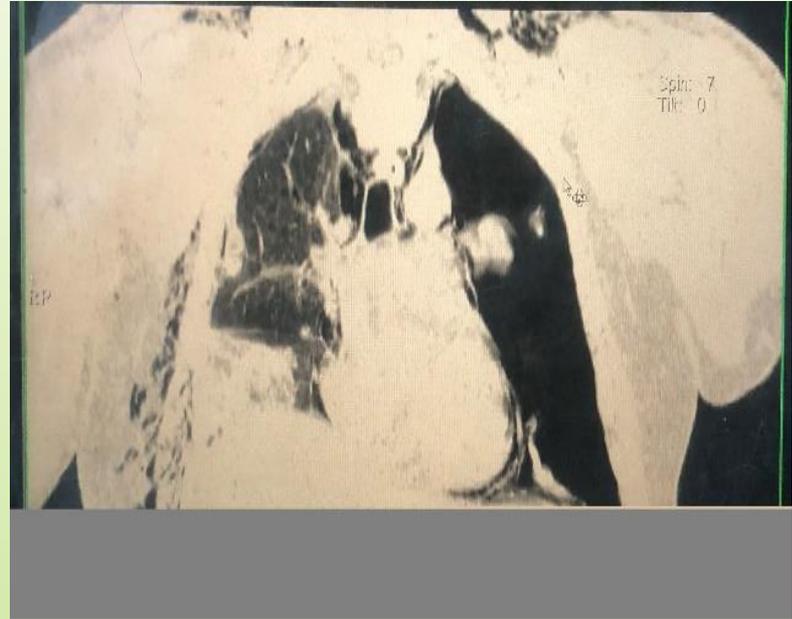
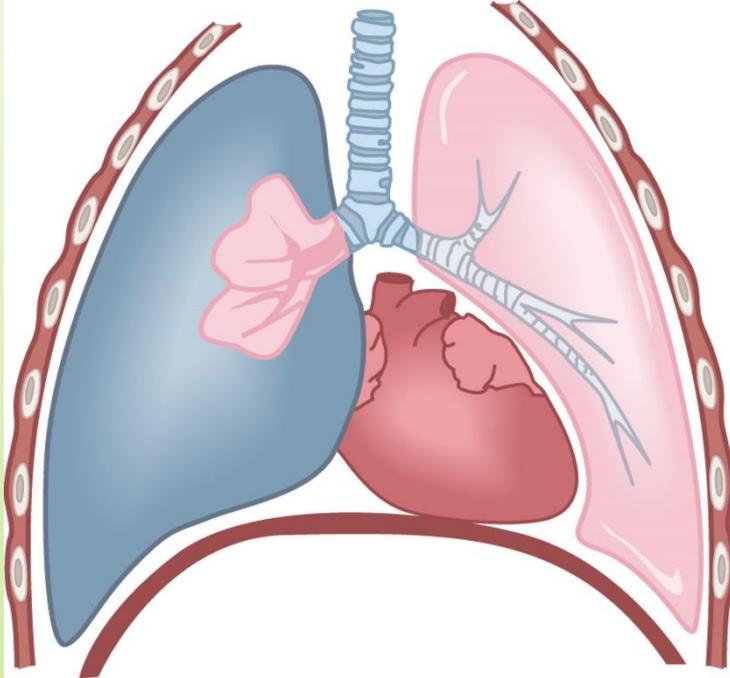
- ✦ Auscultation may be difficult in the ER.

- ✦ Other signs of tension pneumothorax, tracheal deviation, hypotension, hypoxemia should trigger **chest decompression** prior to CXR.

- ✦ If the patient is stable an xray may precede the thoracostomy.

- ✦ Patients with multiple rib fractures may harbor a subclinical pneumothorax and may require "prophylactic" thoracostomy prior to OR

In a tension pneumothorax, air continuously fills the pleural space, the lung collapses, pressure rises, and the trapped air compresses the heart and the other lung.



## ● HEMOTHORAX

Up to 40% of the blood volume can be accommodated in one hemothorax.

● 1500 ml of initial blood output in ICT drainage is an indication for thoracotomy (a large vessel or cardiac rupture)

● **Bronchial injury:** (Blunt injury to the lower airways is usually caused by deceleration or compression injury.DX by

● Non resolving pneumothorax

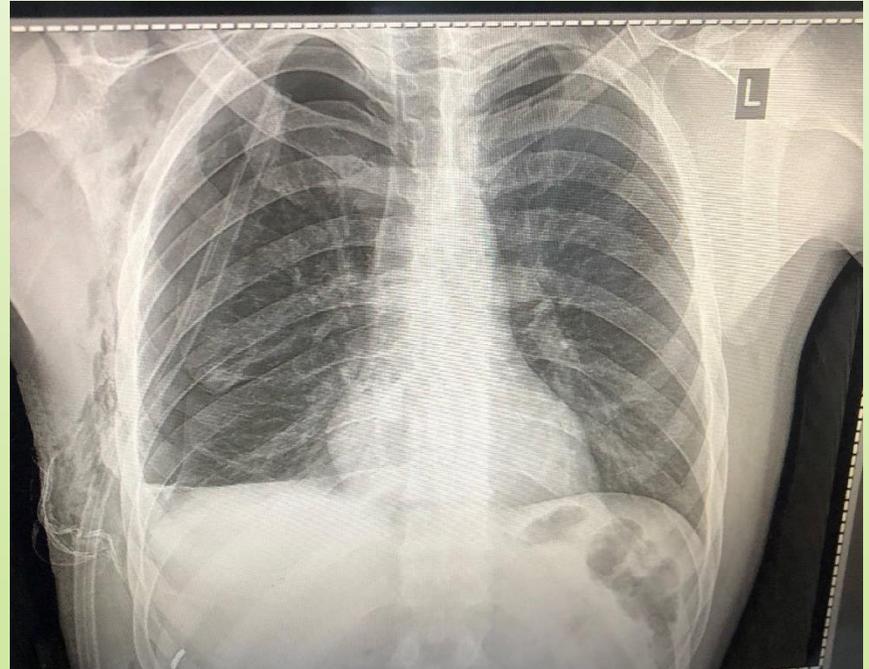
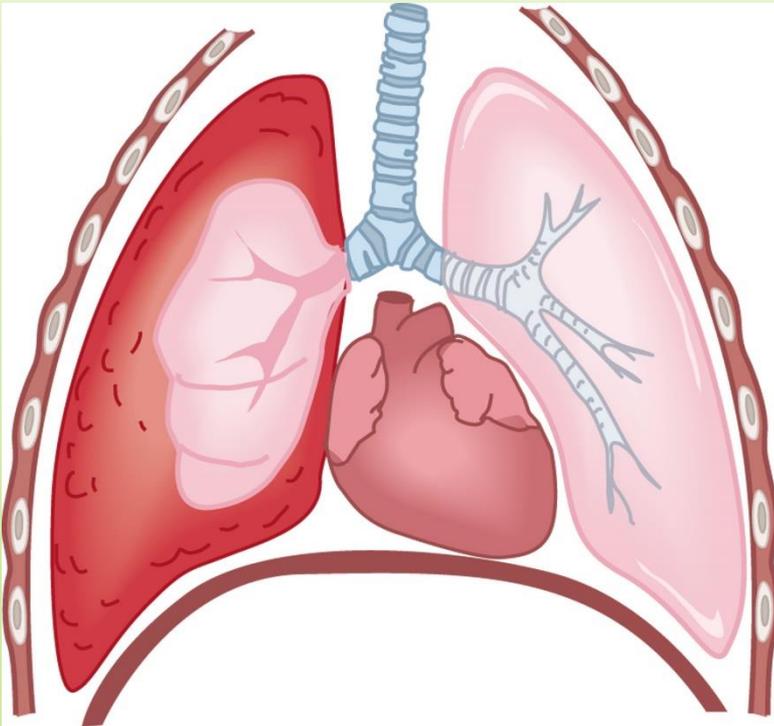
● Persistent air leak with tube thoracostomy.

● **Tracheal or bronchial injury;** Management issues for the anesthesiologist.

● **Fiberoptic evaluation** of the airway may guide for intubation as well as aid in the location of injury for surgical correction. Lung isolation procedures are frequently employed during repair

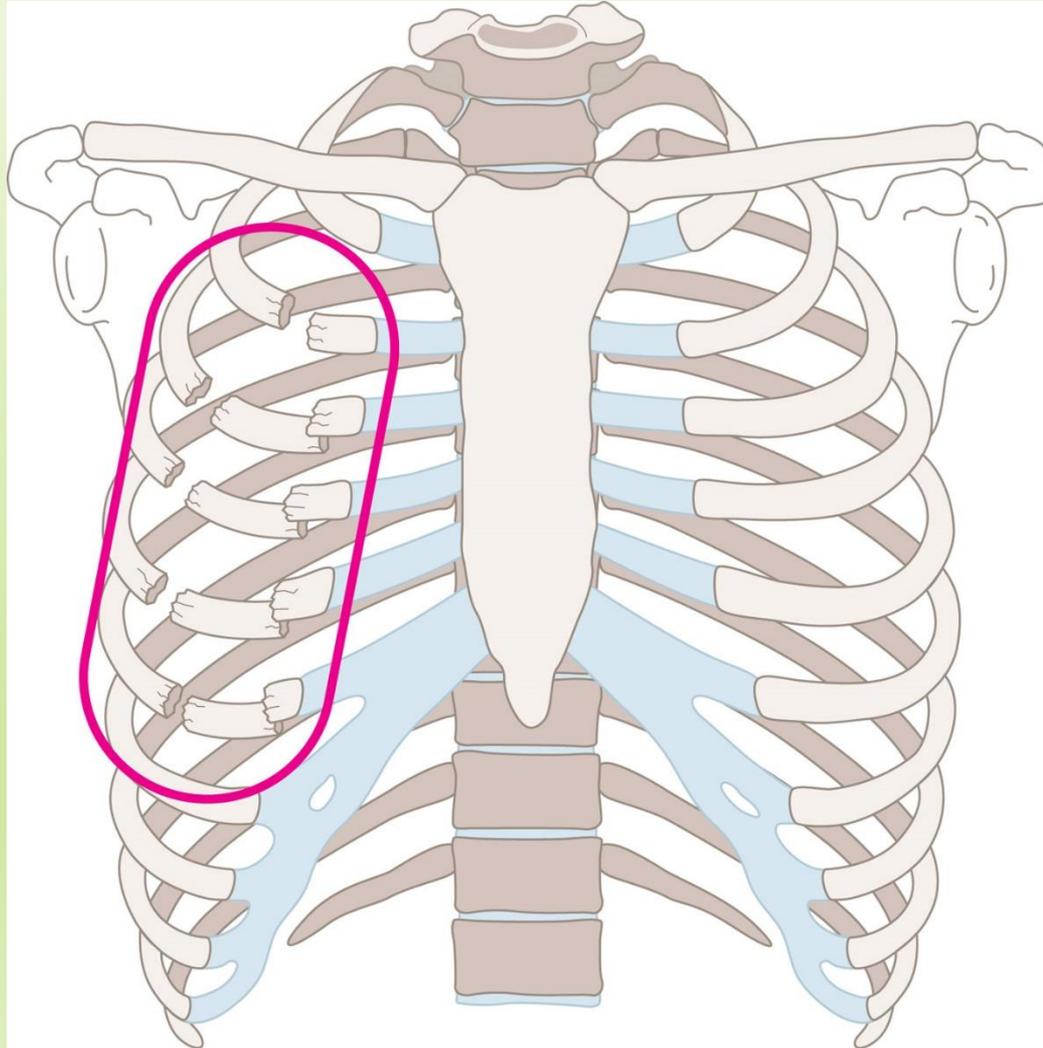
# HEMOTHORAX

In a hemothorax, blood leaks into the chest cavity from lacerated vessels or the lung itself, and the lung compresses.



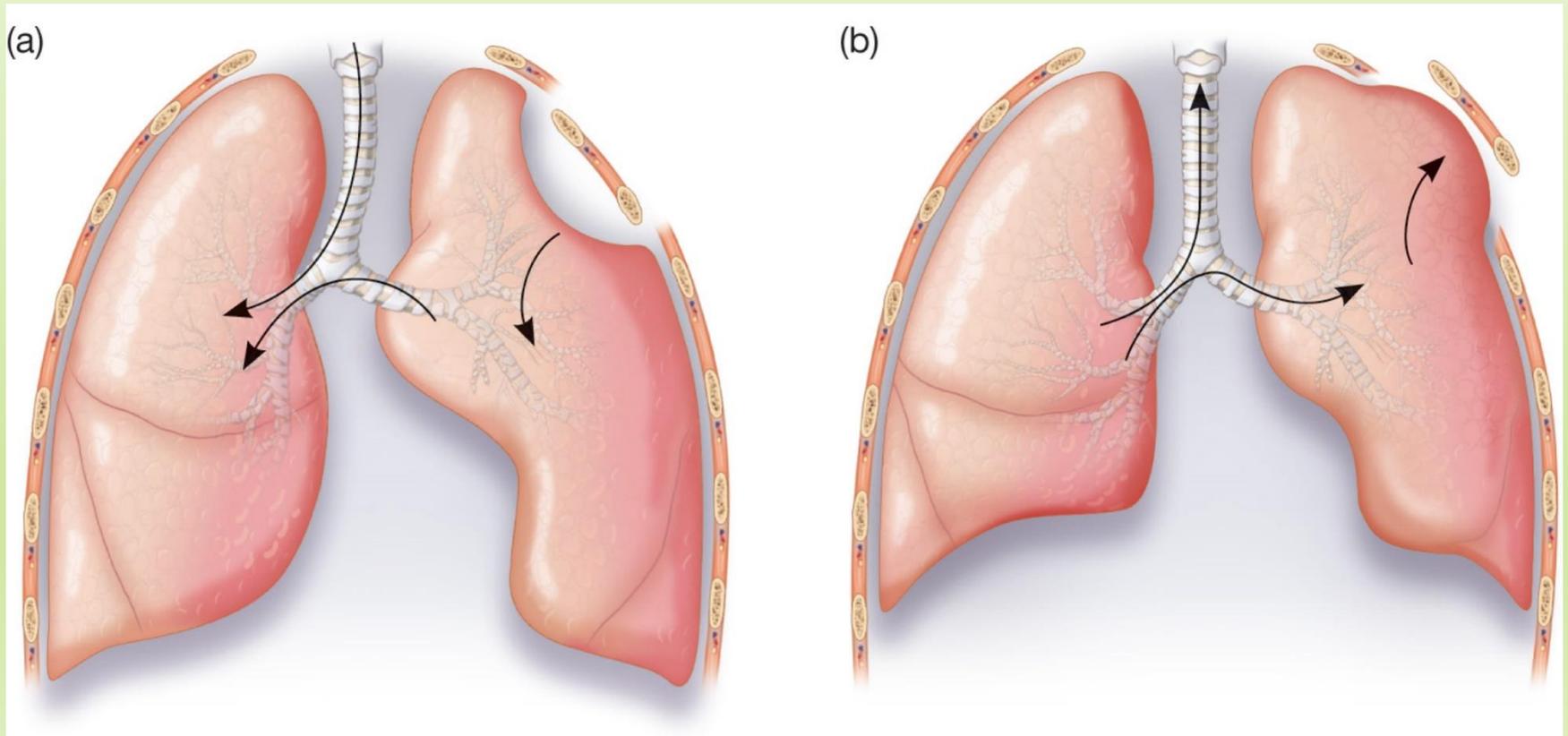
# ● Flail chest

Flail chest occurs when blunt trauma causes the fracture of two or more ribs, each in two or more places.



# ● Flail chest

With a flail chest, (a) the flail segment is drawn inward as the rest of the lung expands with inhalation; (b) the flail segment is pushed outward as the rest of the lung contracts with exhalation.



## ● WIDENED MEDIASTINUM

● on CXR in the blunt trauma victim is usually associated with aortic injury.

● (Several technical factors of the AP portable films taken in the emergency setting, i.e. supine position, expiratory film, and the magnification effect of a short beam distance, may make the mediastinum appear widened.

● Loss of the aortic knob contour,

● Shift of the esophagus (nasogastric tube) to the right and

● An apical cap in addition to **mediastinal** widening indicate need for further workup

# Chest x-ray showing widened mediastinum



## ◆ AORTIC INJURY

◆ 80-90% of patients with thoracic aortic rupture die in the pre-hospital setting. Those who survive to reach the hospital may have minimal symptoms.

◆ The chest film may give the first suggestion of injury.

◆ The rupture is usually at the isthmus just distal to the left **subclavian artery**.

◆ **Control of blood pressure** is critical to avoid further dissection.

◆ **Emergent surgery** with poor **hemodynamic** stabilization has high mortality

## ⊕ Approach to Thoracic Aortic Tear

**Monitors:** Routine plus invasive right sided aline, femoral aline, large bore CVP, pulmonary cath, TEE

**Large bore intravenous lines** with fluid warmers

**Induction strategy** which minimizes hemodynamic changes.

**Double lumen tube** for lung isolation

**Control of proximal hypertension** during crossclamp **vasodilators/beta blockers** limit intravenous fluids

**Control of hypotension** after release of clamp with fluid loading and tapering of vasodilator.

**Strategies for renal/spinal preservation:** short crossclamp, shunt, atriofemoral bypass, femoral vein-femoral artery bypass, mannitol

**Pain control epidural?**

## ■ BLUNT CARDIAC INJURY

Blunt trauma to the heart ;

- spectrum of myocardial concussion,
- contusion to myocardial rupture.

■ The right atrium and ventricle are the most frequently injured chambers because of their **anterior** positioning in the chest, followed by left atrium and left ventricle.

- Survival from one chamber rupture is about 40%
- Two chamber rupture has uniform mortality.

■ Once again **echocardiography** is extremely useful in the diagnosis of this injury

## ▶ **Myocardial Contusion**

Patients with suspected MC are no longer routinely subjected to prolonged observation in a monitored setting. If ECG and echocardiogram are normal patient may go home after 12 hours if no other injuries are present.

▶ Young patients rarely have cardiac related complications even when cardiac contusion is diagnosed.

▶ The Best test for diagnosis remains controversial. ??

▶ **ECG is unreliable**- unless ST elevation is present.

▶ **CPK MB isoenzymes** -may be nondiagnostic.

▶ **Cardiac troponin I** which may be more specific for myocardial damage has not been adequately evaluated.

▶ **Echocardiography** is useful for detecting wall motion abnormalities, pericardial effusions and in combination with abnormal CPK MB may predict complications.

▶ **Radionuclide angiography** may also be predictive of complication.

▶ **Thallium scanning** can detect areas of decreased perfusion, but cannot differentiate an acute from preexisting lesion

## ■ Pericardial Tamponade

Suspect when;

■ **Hypotension** (unexplained by other findings ie tension pneumothorax, Hemothorax, abdominal or other Hemorrhage).

■ Neck vein distention may be masked by the cervical collar.

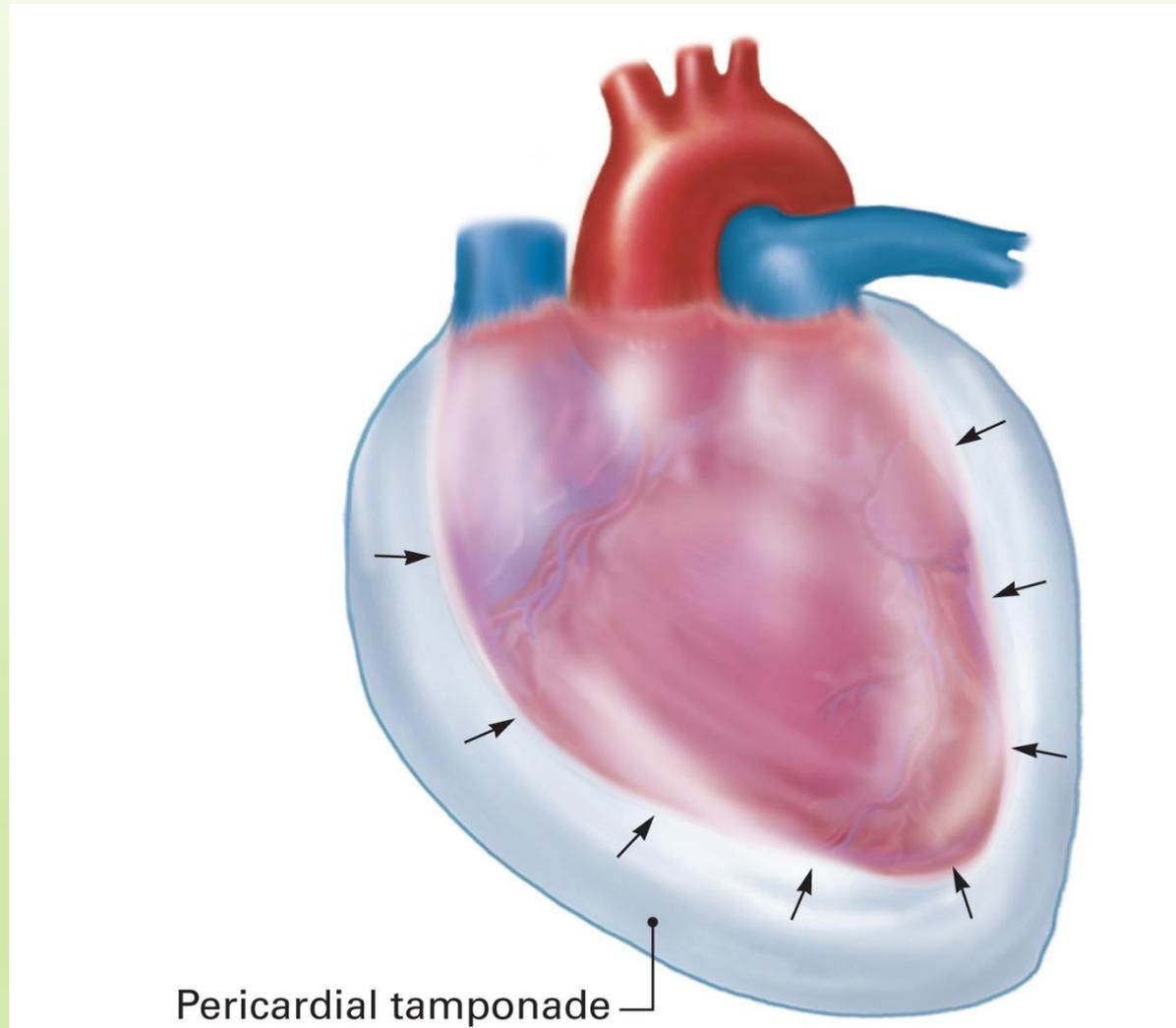
■ **Echocardiography** is probably the best diagnostic tool.

If a PA catheter is present equalization of pressures may be seen.

■ **Prompt drainage** via pericardial window is the best treatment. May be performed with local anesthesia.

Hemodynamic changes are minimized with the spontaneously breathing patient. Underlying injury may be ruptured heart, aortic disruption, or myocardial contusion without rupture

IN PERICARDIAL TAMPONADE, ACCUMULATING BLOOD COMPRESSES THE HEART INWARD.



## **DIAPHRAGMATIC RUPTURE**

The symptoms are similar to pneumothorax

as the lung is compressed and hypoxemia develops.

Diagnosis is made with the chest xray.

Loss of the diaphragmatic contour,

Presence of bowel or NG tube in the chest or

Elevation of the right hemidiaphragm are all suggestive.

Intubation and mechanical ventilation are needed for adequate oxygenation.

Hemothorax may be from a ruptured spleen

# DIFFERENTIAL FIELD DIAGNOSIS OF CHEST INJURY

Sign or Symptom	Tension Pneumothorax	Open Pneumothorax	Flail Chest	Hemothorax	Pericardial Tamponade
<b>Breath sounds</b>	Severely decreased or absent unilaterally and possibly decreased on the uninjured side	Decreased on the injured side	Decreased on the injured side	Decreased on the injured side	Present, clear, and equal bilaterally
<b>Blood pressure</b>	Decreased with a narrow pulse pressure	Normal if not associated with other trauma	Normal if not associated with other trauma	Decreased with a narrow pulse pressure	Decreased with a narrow pulse pressure
<b>Pulse</b>	Weak and rapid peripheral pulses	Tachycardia possibly present due to hypoxia, but peripheral pulses normal unless with other associated trauma	Tachycardia possibly present due to hypoxia, but peripheral pulses normal unless with associated trauma	Weak and rapid peripheral pulses	Weak and rapid peripheral pulses
<b>Jugular veins</b>	Distended (late finding) if patient not hypovolemic	Normal	Normal	Flat	Distended (late finding) if patient not hypovolemic
<b>Respiratory distress</b>	Severe	Present	Present	Present	Possible
<b>Pulsus paradoxus</b>	Present	Absent	Absent	Absent	Present
<b>Asymmetrical chest</b>	Present	Absent	Absent	Absent	Absent
<b>Paradoxical chest movement</b>	Absent	Absent	Present	Absent	Absent
<b>Decreased SpO<sub>2</sub></b>	Severe	Present to severe	Present to severe	Present	Present

# SUMMERY

Trauma is one of the most sudden, dramatic and often irreversible medical conditions. Injury to the chest is, in turn, one of the most important aspects of trauma, directly accounting for 25% of all trauma related deaths and playing a major contributing role in another 25% of trauma deaths. These figures are all the more tragic when one considers that most trauma is related to motor vehicle accidents which often involve otherwise healthy young adults. This review is not intended to be an all encompassing synopsis of trauma imaging, but rather a down and dirty overview of those injuries which most impact the patient well being. **First it must be said that radiographs play no role in the initial evaluation of a critically injured patient.** The basic ABCs of cardiopulmonary resuscitation always take precedence. **If a patient is having difficulty breathing and a pneumothorax is suspected, a chest tube should be placed; this is both diagnostic and therapeutic.** *A chest film only delays the therapy.* Once a patent airway, adequate ventilation and systemic circulation are established, than imaging may proceed. Once a patient is stabilized, chest imaging is indicated in almost every trauma patient. Those injuries which are most threatening should be identified promptly. **Tension pneumothorax, aortic rupture, misplaced lines and tubes, cardiac tamponade from hemopericardium, spine and rib injury, simple pneumothorax, and hemothorax must all be identified if present.** If these cannot be adequately evaluated on a routine chest film, this should be noted to the ER physician and other studies, (e.g. CT, angiography, MRI) should be suggested.

لہ توجہ مو منتہ!

