

What You Need to Know About Thoracic and Abdominal Trauma

Paul
Wisniewski,
DO

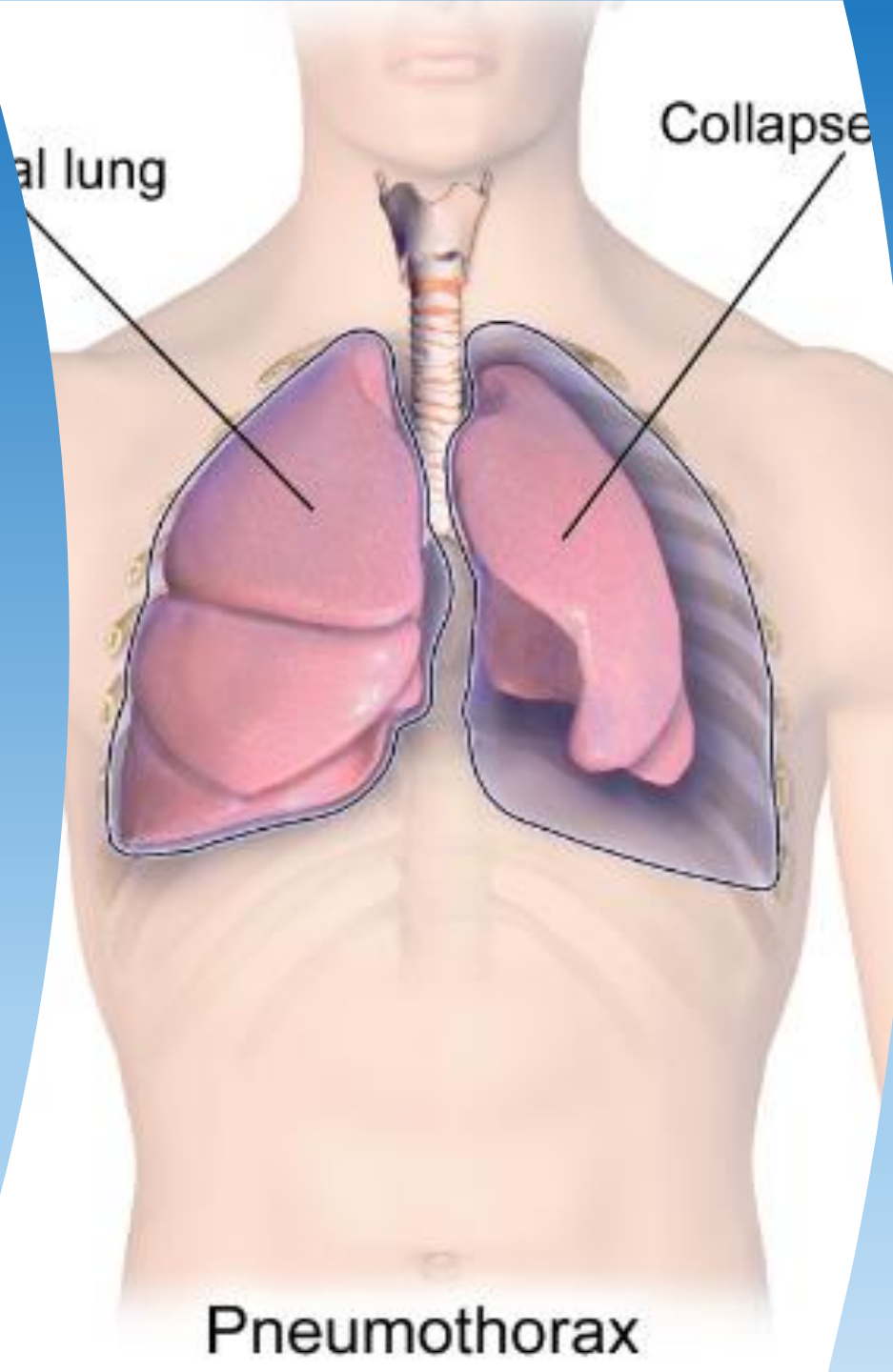
Trauma and
Critical Care

Thoracic Injuries

- Pneumothorax
- Tension Pneumothorax
- Hemothorax
- Cardiac tamponade
- Bronchial Tree injury
- Rib Fractures

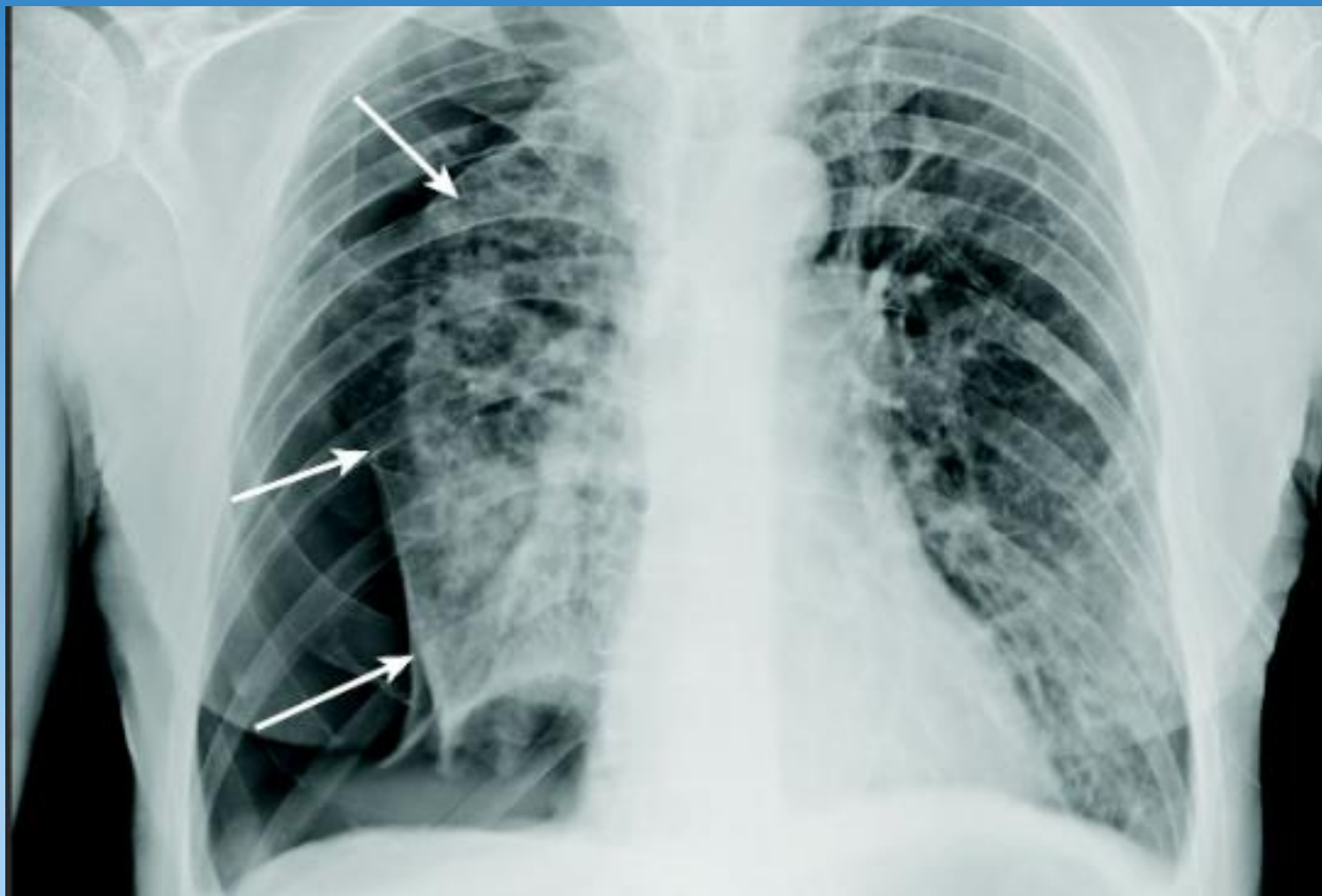


Pneumothorax



- This is when there is air in the pleural space
 - From bleb
 - Blunt or penetrating trauma
 - From central line attempt
 - Air either from the lung or from outside enters the space
- Causes
 - Chest pain
 - SOB
 - Desaturation
 - Sense of impending doom

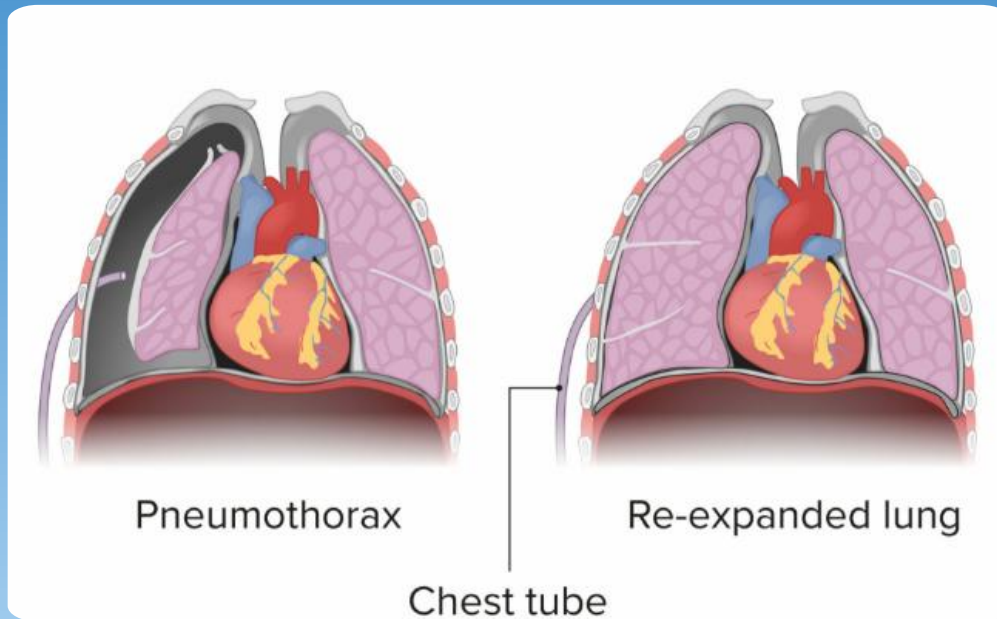




Pneumothorax



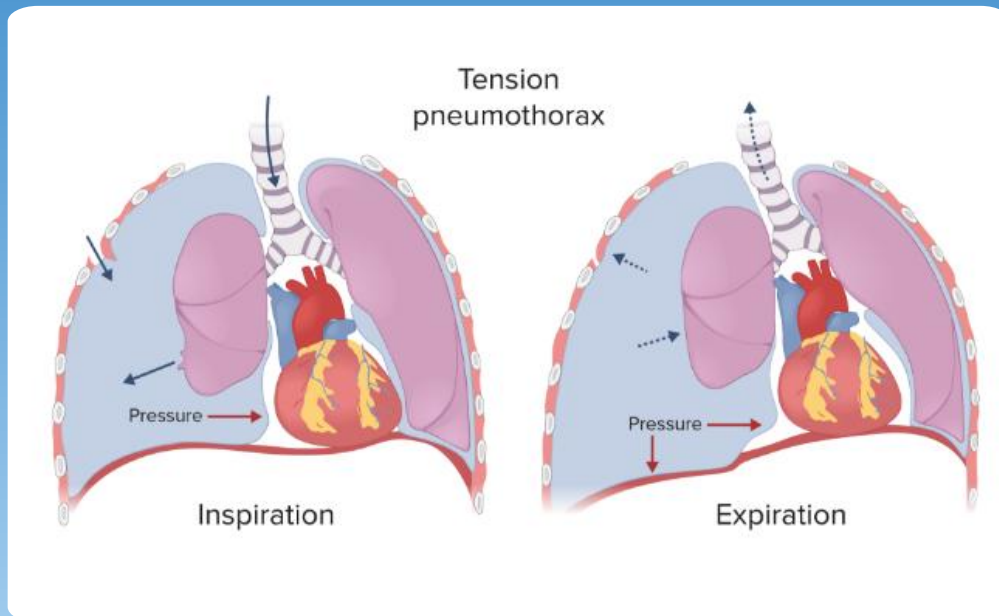
Pneumothorax



- Treat is Re-Expansion of the lung with placement of a chest tube
- The chest tube is placed to -20 cm H₂O this is the physiological resting pressure of the chest



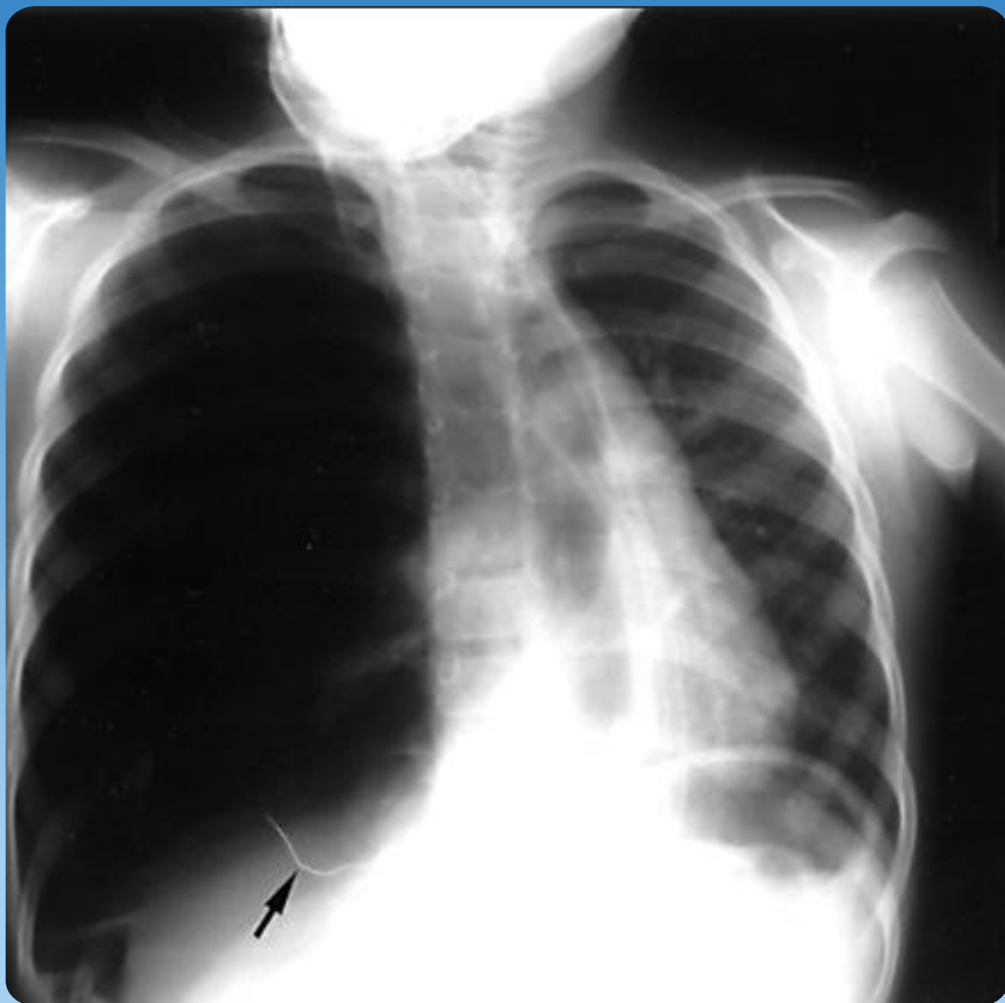
Tension Pneumothorax



- This is a Pneumothorax Ugly Cousin
- This is created by continuous air leaking into the pleural space
- Cuts off Pre-load to the heart
- Causes rapid death
- Two ways to get it
 - “Sucking chest wound”
 - Ventilator “blowing chest wound”



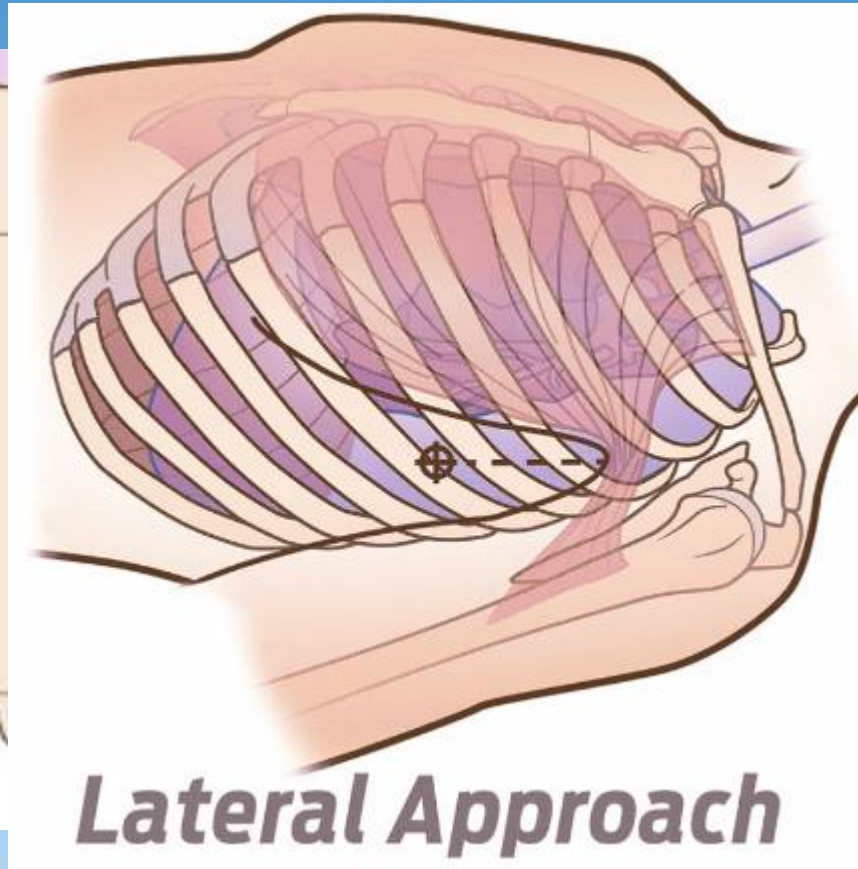
Tension Pneumothorax



- Shift of the mediastinum
- Tracheal deviation away from the pathology
- Distended neck veins
- No Breath sounds
- Patient looks like they are going to die.....because they are!



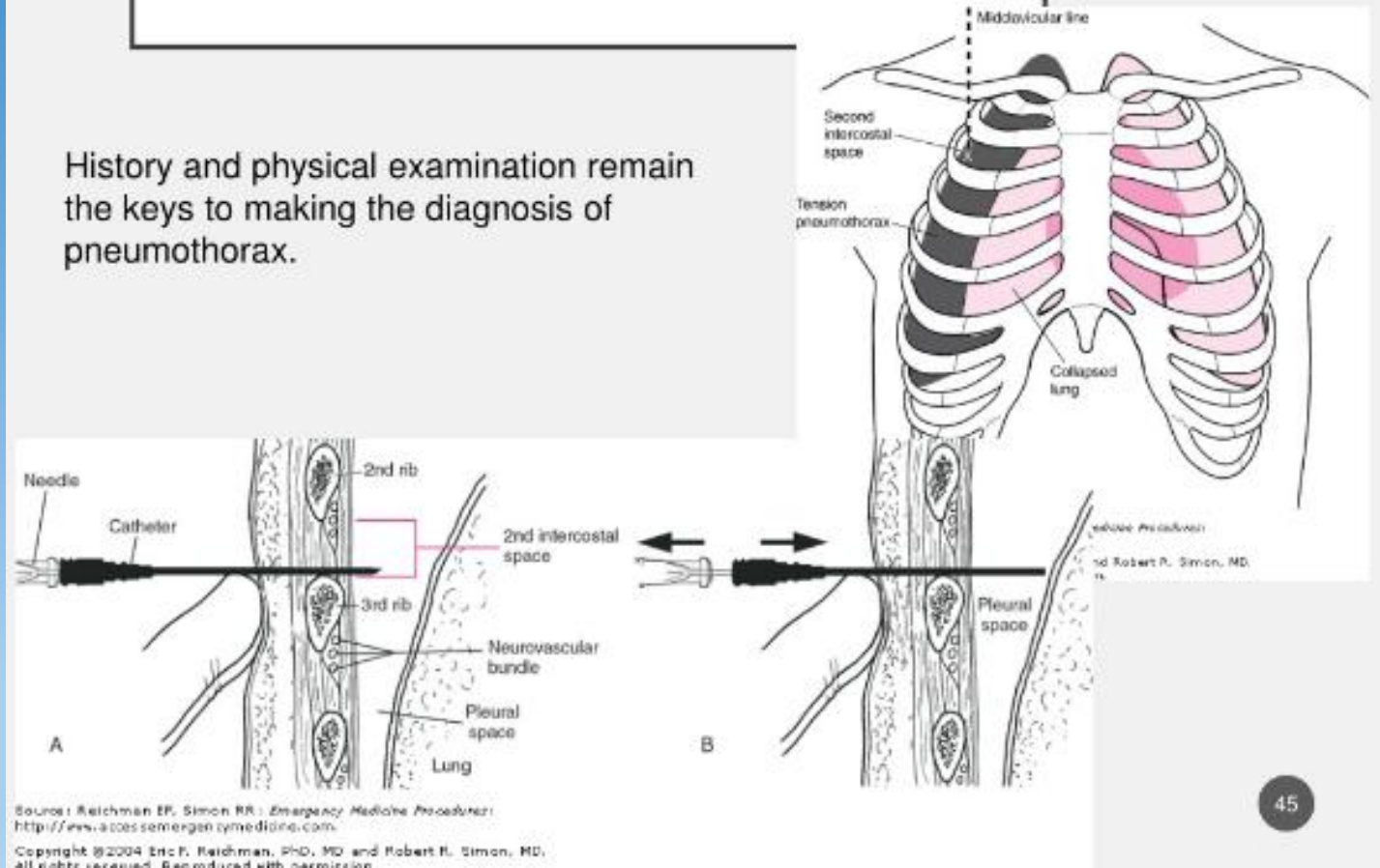
Tension Pneumothorax Needle decompression



Tension Pneumothorax

NEEDLE DECOMPRESSION

History and physical examination remain the keys to making the diagnosis of pneumothorax.



Tension Pneumothorax

- Key tips
 - Needle decompression is a temporizing maneuver
 - Chest tube is definitive treatment
 - 14-gauge needle or bigger
 - Finger thoracostomy is acceptable treatment option to temporize
 - 5 cm needle makes it to the pleural space 50 percent of the time
 - 8 cm needle makes it to the pleural space 80 percent of the time
 - Bury the needle!



Hemothorax

- Blood in the pleural space
- Either from blunt trauma
 - Rib fractures
 - Lung laceration
 - Spine fractures
- Penetrating trauma





Hemothorax

- Blood in the Pleural space
- Needs to be evacuated with a chest tube
- The lung with stop bleeding 85% of the time with just re-expansion
- 85% of chest trauma can be managed definitively with a chest tube



Hemothorax

- Surgical Exploration

- 1500 ml or more on chest tube placement
- 200 ml and hour for 3 or more hours
- Ongoing transfusion requirements to maintain hemodynamic stability
 - Chest tube may be clotted or partially occluded, and blood can be accumulating in the chest
- Remember to give 2 grams of ancef prior to chest tube placement. Lowers the incidence of empyema and infection
- Cant et al. reported no empyema in individuals who received cefazolin for 24 hours compared to a 5% incidence in the placebo group



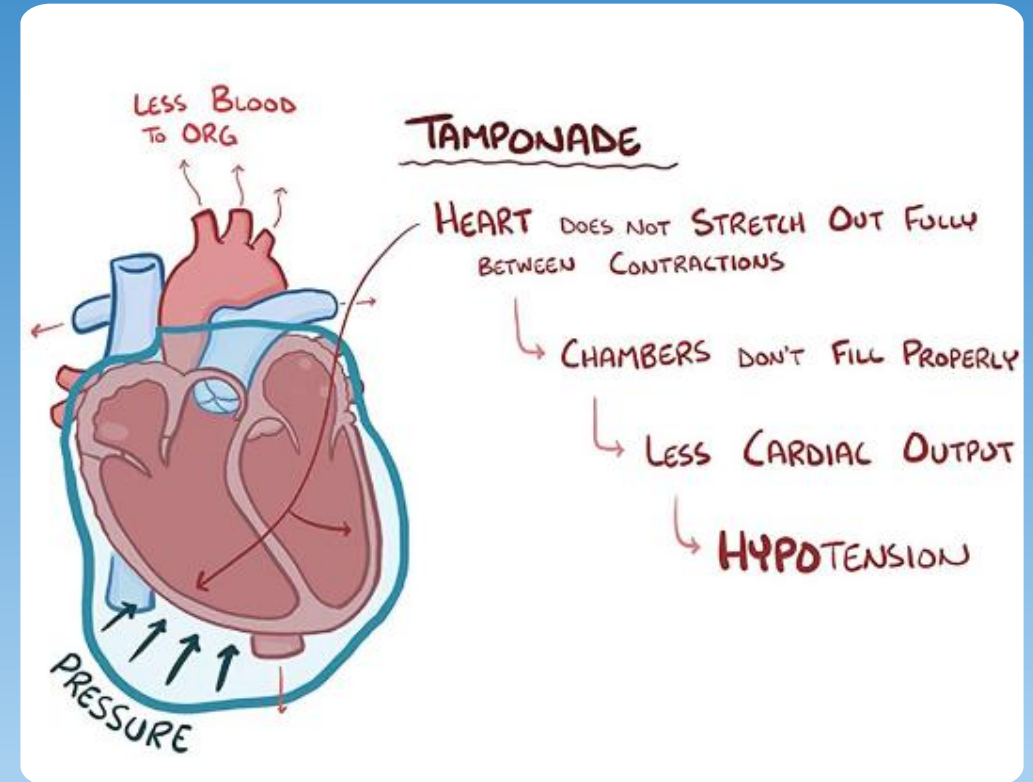
Cardiac tamponade

- This is Bad!
- If not recognized rapidly the patient will deteriorate and die
- In my opinion the subxiphoid view of the EFAST should be first!
- Stops pre-load (Beck's triad)
 - Distended neck veins
 - Muffled heart sounds
 - Hypotension
- No tracheal deviation → big difference between Tension Pneumothorax

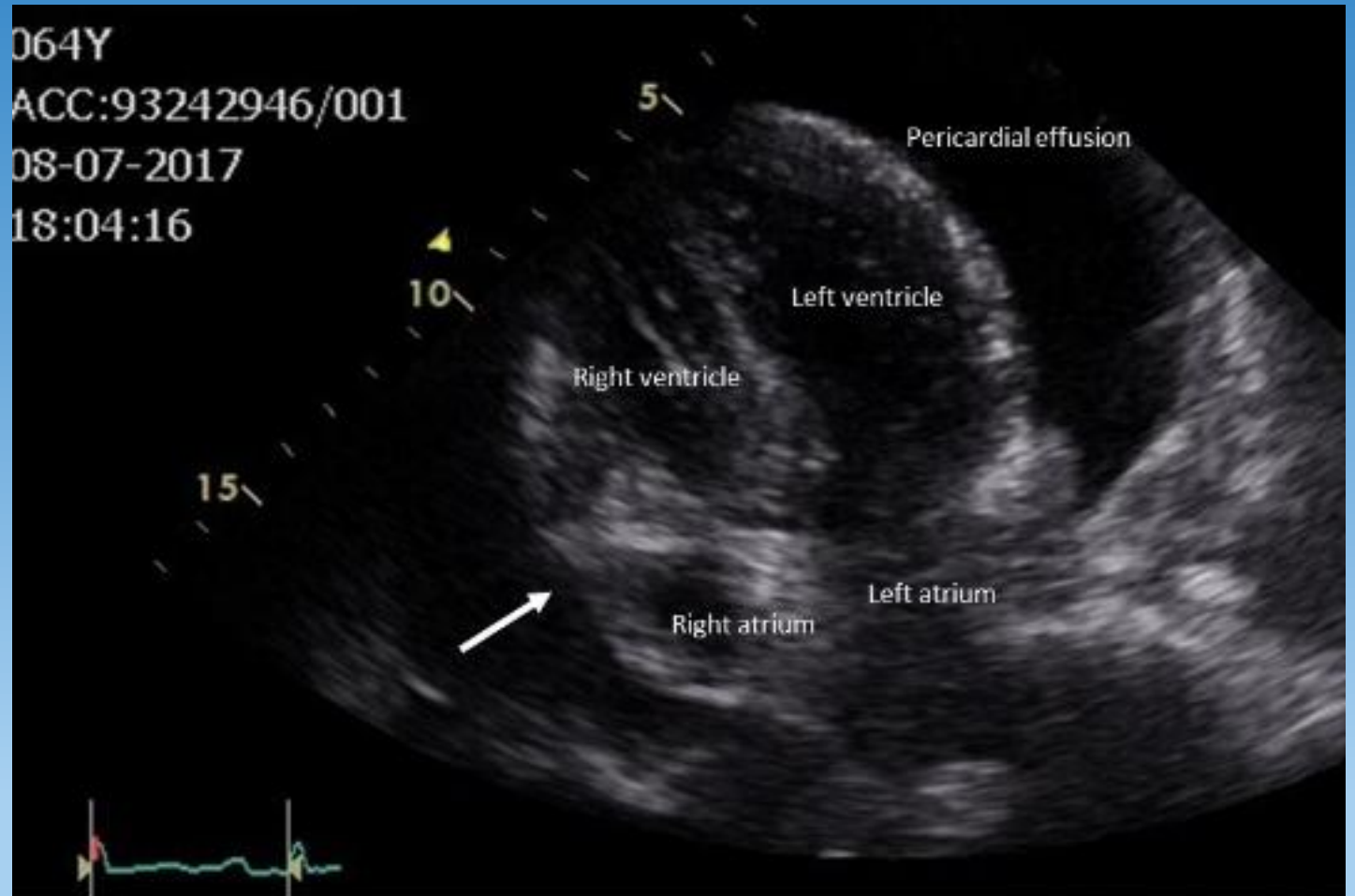


Cardiac Tamponade

- The pericardium is very rigid and does not stretch
- In comparison the ventricle with compress before the pericardium will stretch



Cardiac Tamponade

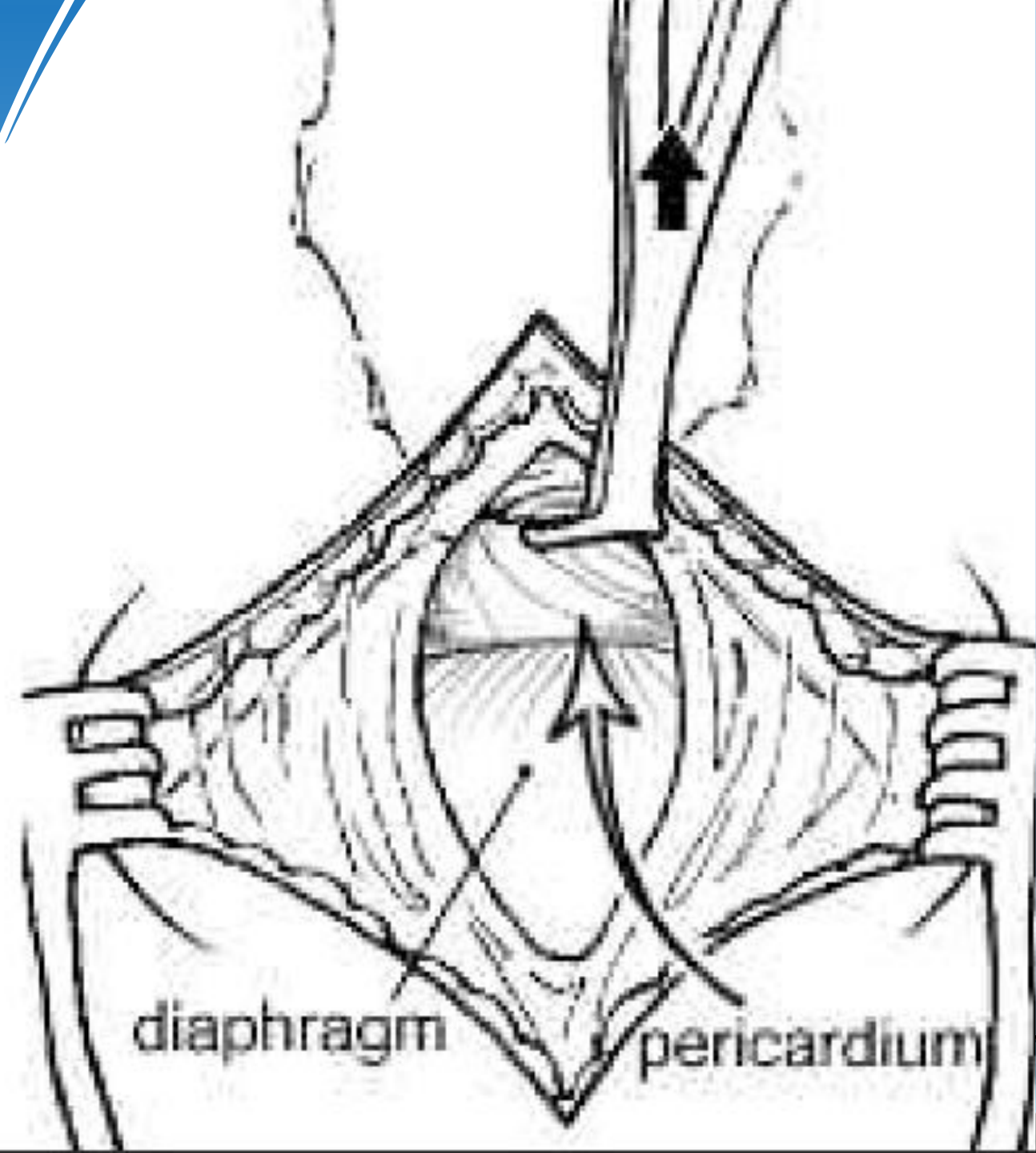


Cardiac Tamponade

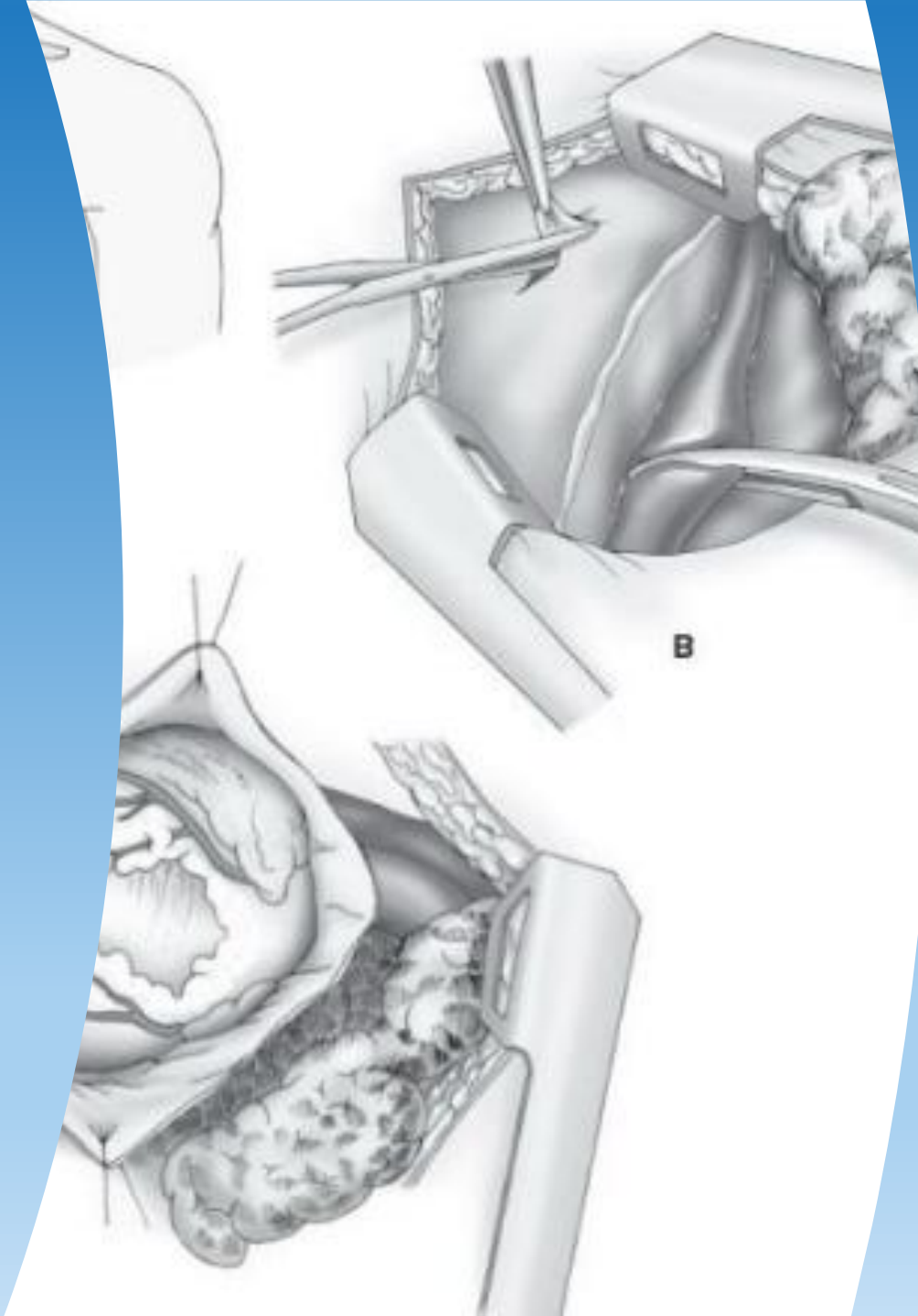
US Guide increases accuracy
and decreases complications



Cardiac Tamponade Pericardial Window



Cardiac Tamponade



- Goals
 - 1. Cross Clamp the Aorta
 - Resuscitate the heart and brain
 - 2. Open the pericardium
 - Release any tamponade
 - Open cardiac massage
 - 3. Control any bleeding from the left lung
 - 4. Remember to place a chest tube on the right side to rule out blood in the right chest
 - Once you have perfusing cardiac rhythm please go to OR
 - You will need to clamp the internal thoracic artery on the left inferiorly and superiorly as it most likely will have been divided. DO not attempt to suture ligate very difficult. Place clamp on it in ED and then put hemoclip on it in the OR.

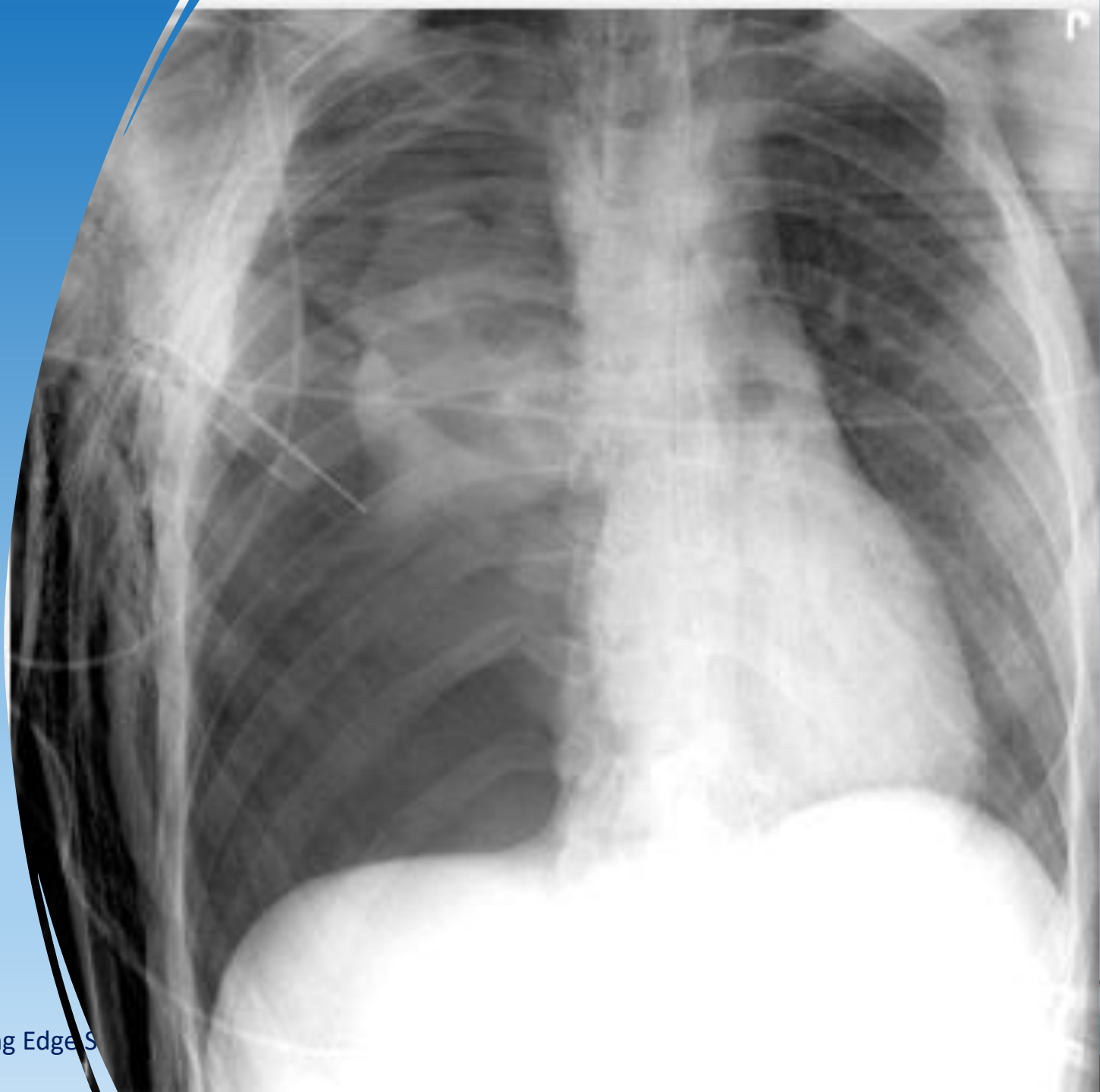


Bronchial Tree Injury

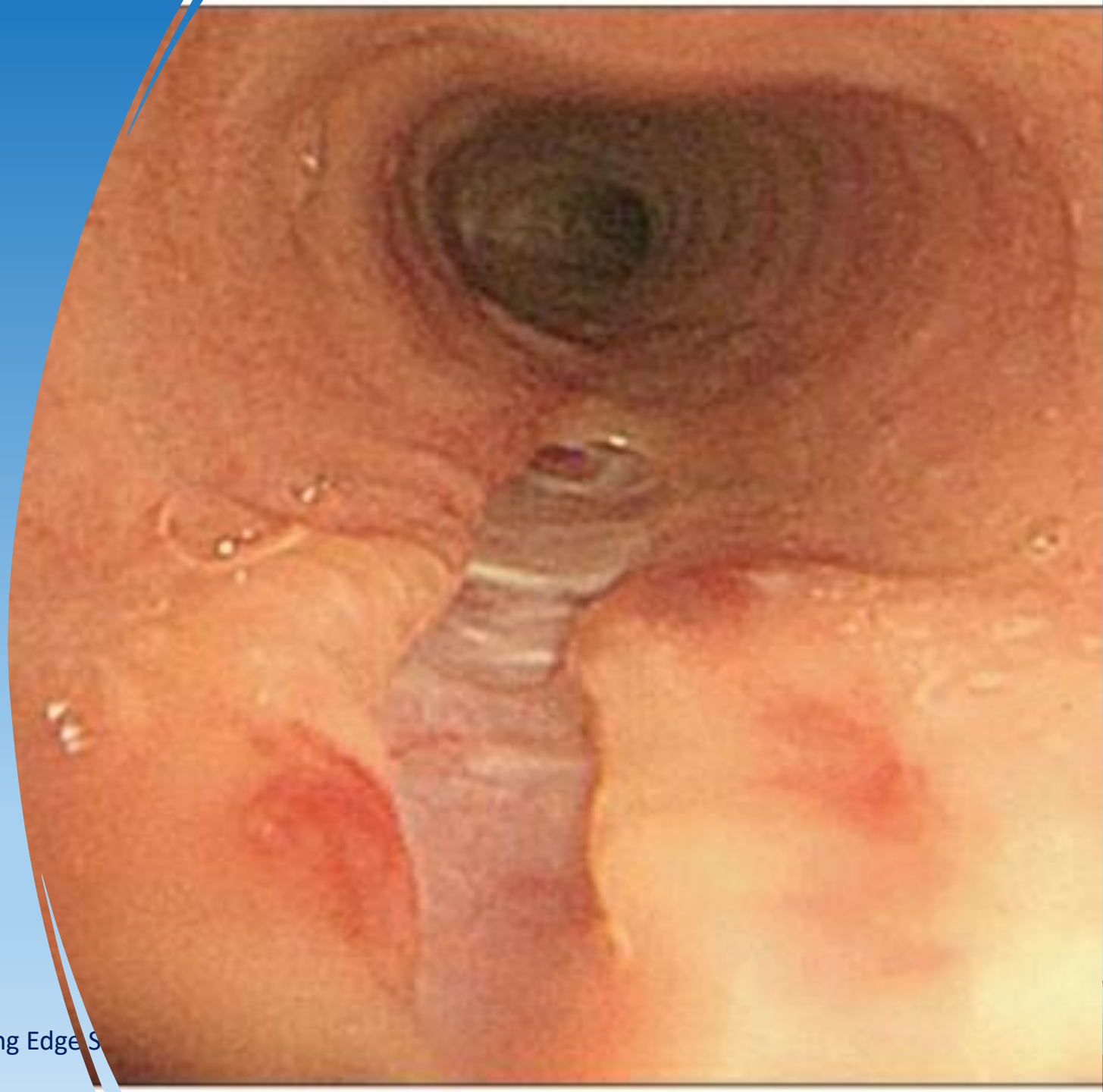
- This is difficult to Recognize!
- The patient will be in extremis and have a pneumothorax
 - The patient will have a significant air leak in the chest tube pleurovac when you place it.
 - The patient will get worse with chest tube placement. They will desaturate and respiratory will tell you they are not getting any vent return if intubated
 - This is the only time you clamp a chest tube!!!



Bronchial Tree Injury



Bronchial Tree Injury



Tracheal Bronchial Tree Injury

How do you save this persons life?

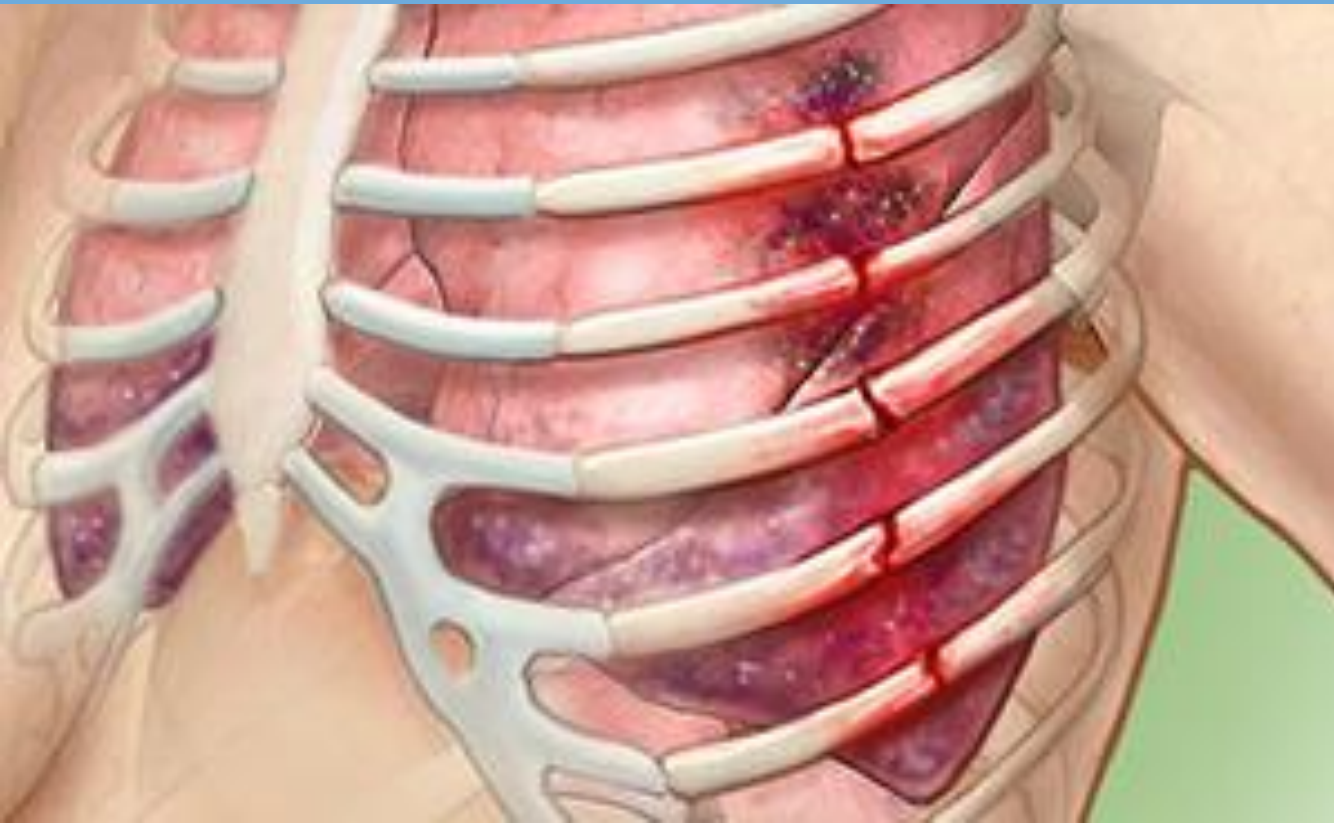


Bronchial Tree Injury

- Clamp the chest tube
- Put the bronchoscope through the ET tube
- If Tracheal injury, then put scope past injury and advance the balloon past injury and inflate cuff → temporized
- If left of Right mainstem bronchus. Intubate the other mainstem and then inflate the cuff
 - Cut tidal volume in half
 - Keep chest tubes to suction (unclamp)
 - Temporized
 - Needs surgical repair
 - More than 30 % circumference then it needs resection....

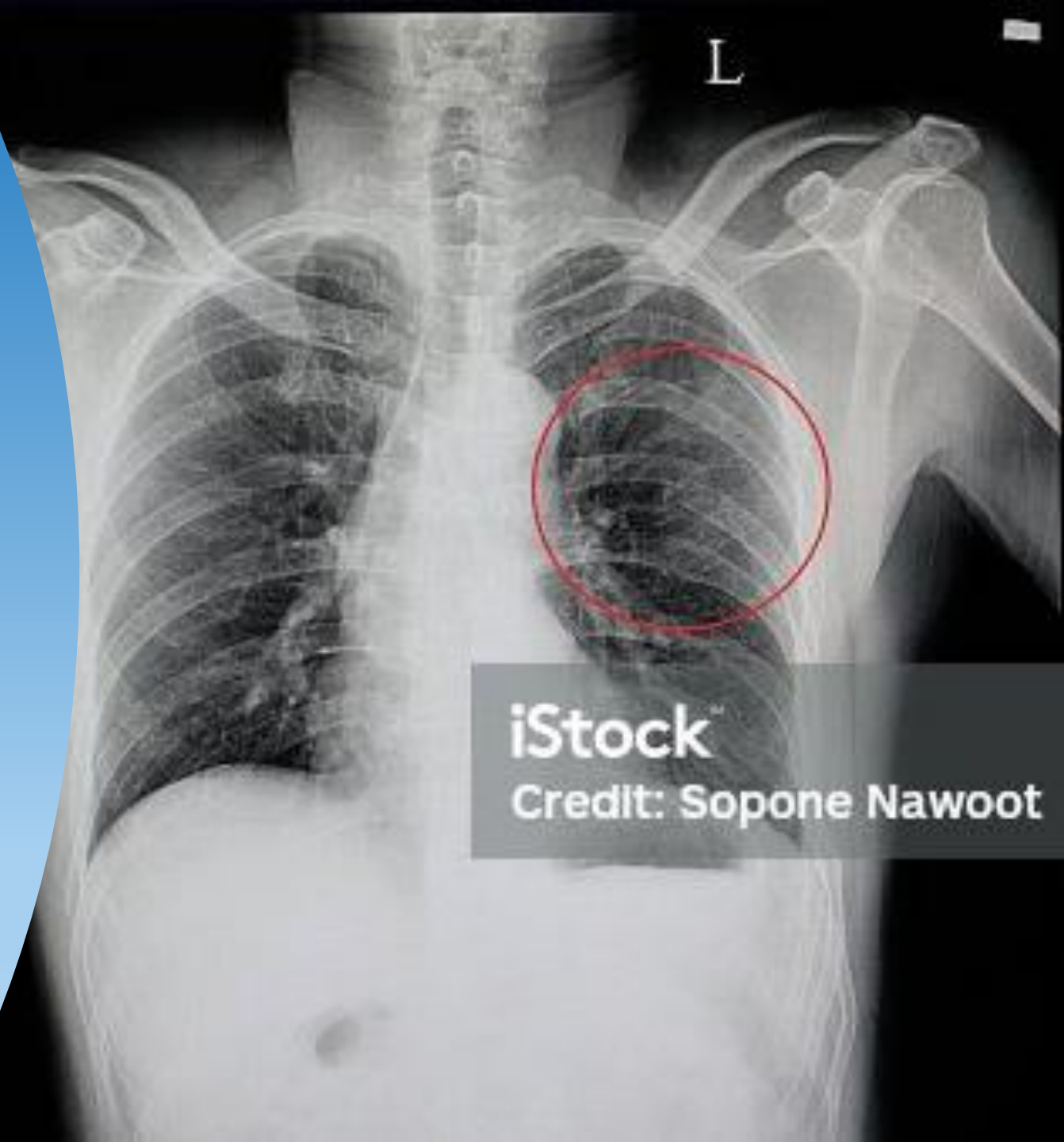


Rib Fractures



Rib Fracture

Rib Fractures

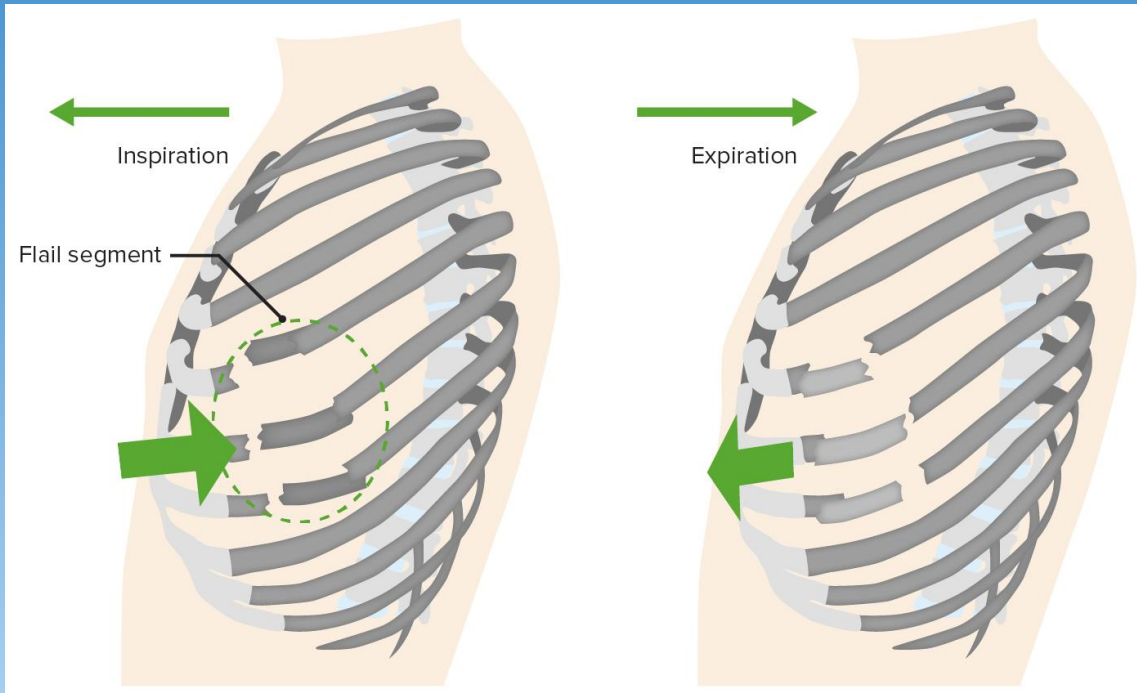


Rib Fractures

- Elderly patients who sustain blunt chest trauma with rib fxs have twice the mortality and thoracic morbidity of younger patients with similar injuries. For each additional rib fracture in the elderly, mortality increases by 19% and the risk of pneumonia by 27%.
- Rib Fracture protocol exists at many hospitals for any patient over the age of 65



Flail Chest



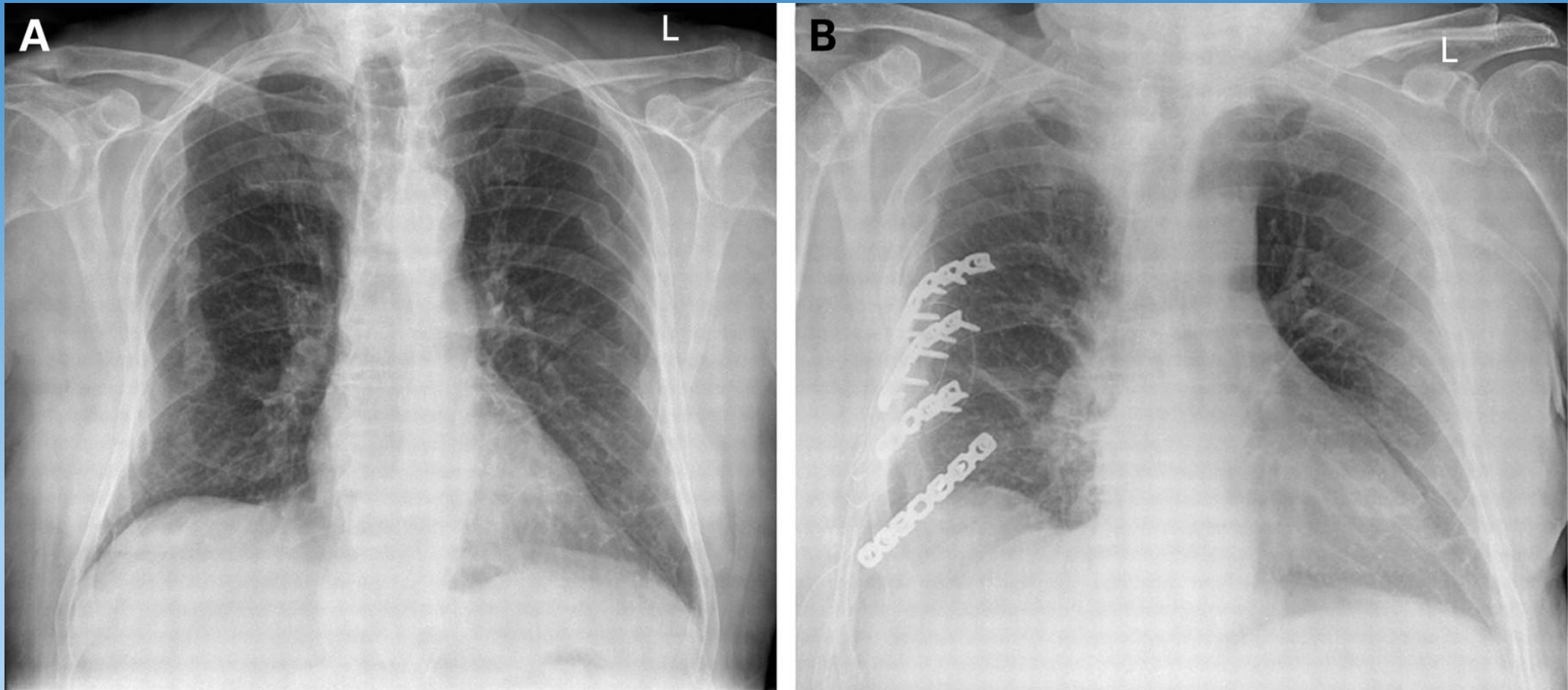
- Paradoxical motion from negative pressure of chest
- 2 or more ribs fractured in 2 or more places
- Immediate treatment
 - Handle pneumothorax or sucking chest wound
 - Positive pressure ventilation

Long term treatment may be internal rib fixation

Patient will fatigue out without intubation.
Most have underlying pulmonary contusions



Rib Fixation



Flail Chest

- Flail chest is a condition defined as two or more contiguous rib fractures with two or more breaks per rib and has mortality estimates conservatively ranging from 9% to 20%.
- Such high mortality rates are attributed to a higher incidence of concomitant injuries and respiratory difficulties



Management
of Solid
Organ
Injuries
(Liver,
Spleen,
Kidneys)

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Learning Objectives

Blunt versus Penetrating Injury

Solid Organ injury and management

FAST scan and role in trauma bay

Role for MTP in abdominal trauma

Role for interventional radiology in abdominal trauma

Pelvic and retroperitoneal bleeding

REBOA

Disclosures

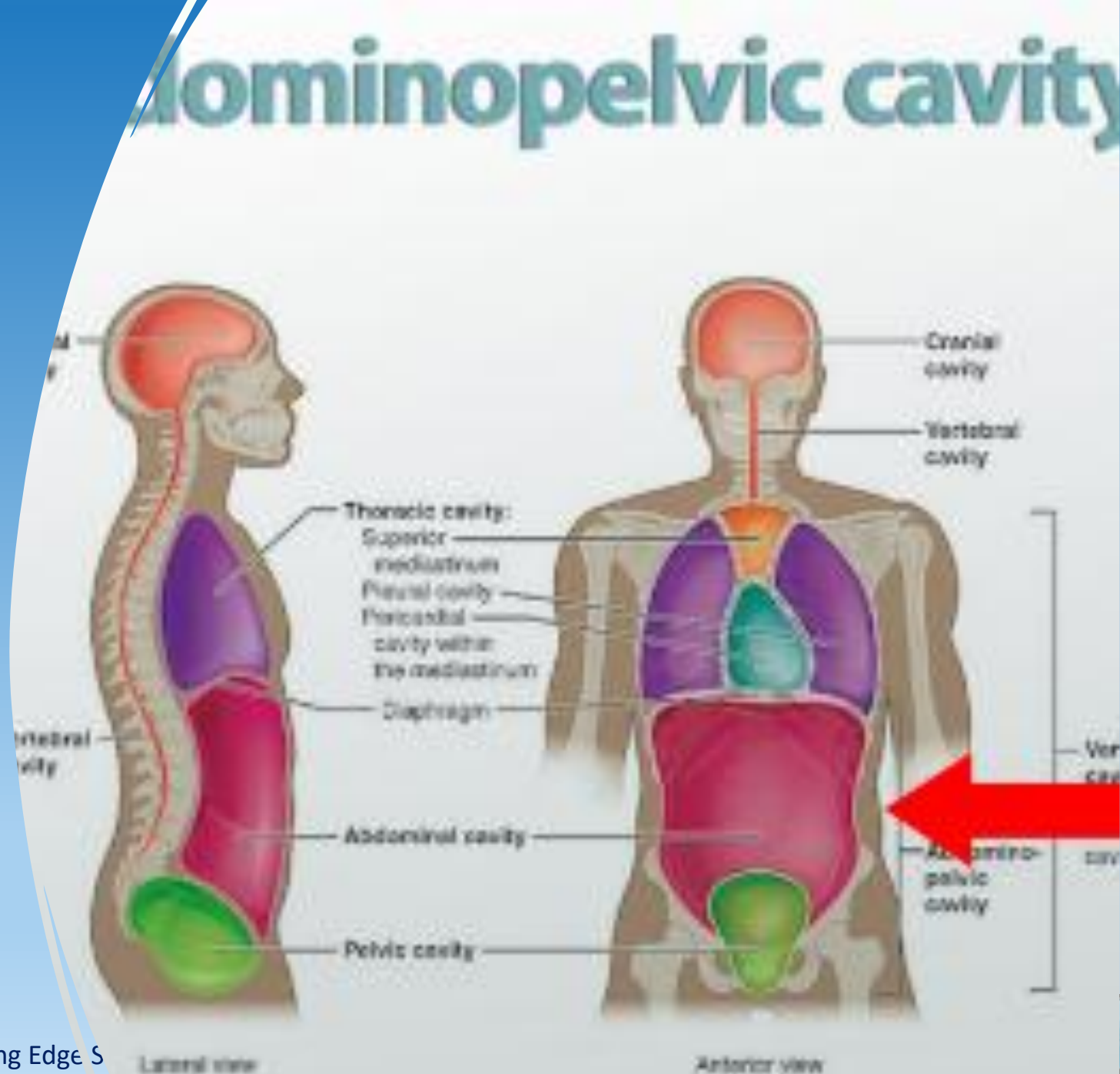
I have not financial
disclosures

But I wish I did



Blunt versus Penetrating Injury

- This is a 39-year-old male that presents with a gun shot wound to the abdomen.
- Where does the abdomen stop and where does the chest start?



Blunt versus Penetrating Injury

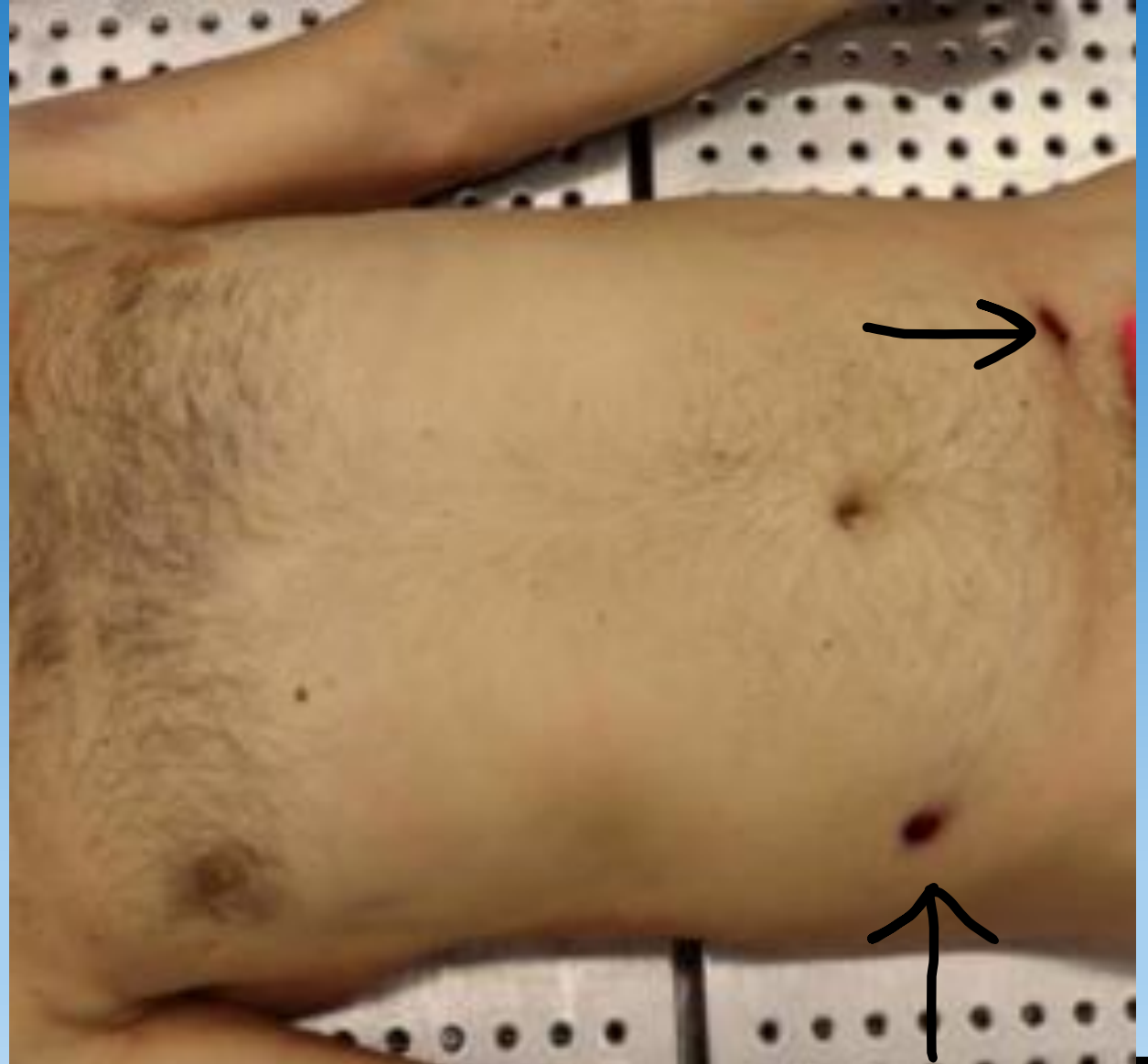
Boundaries

- Superior: diaphragm.
- Anterior: parietal peritoneum of posterior abdominal wall.
- Posterior: posterior abdominal wall muscles (e.g., quadratus lumborum)
- Lateral: fuses with the extraperitoneal connective tissue of the anterolateral abdominal wall.
- Inferior: pelvis.



Blunt versus Penetrating Injury

- Tip:
- When ct scanning patient always scan chest abdomen and pelvis
- Vitals
- HR 130
- BP 85/40
- R 25
- Sat 100%
- Stable or Unstable?



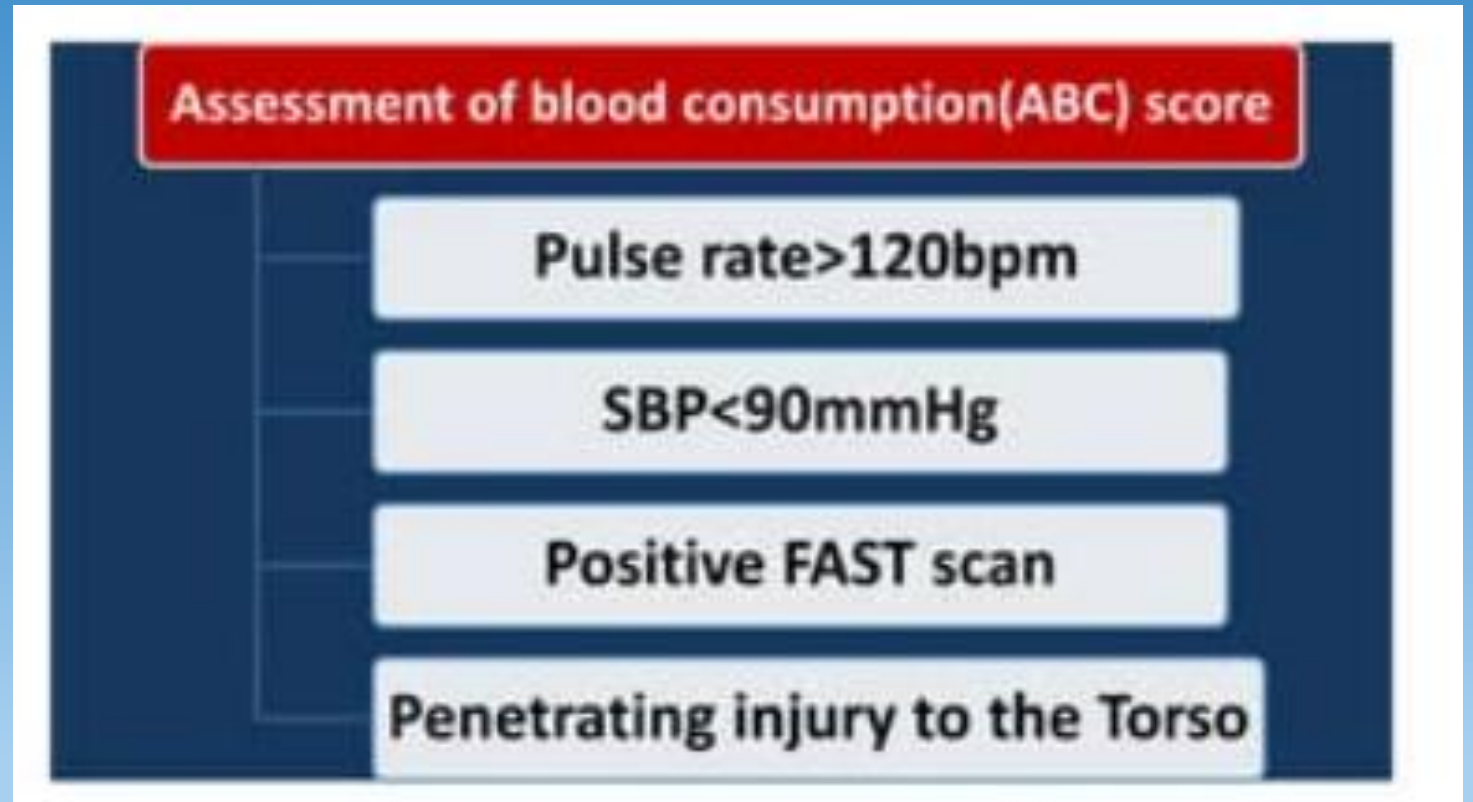
Blunt versus Penetrating Injury

- Resuscitation is a process not a location.
- What to do Next?
 - ABCDE
 - FAST scan positive
- Find single GSW with entrance and exit
- CXR negative



Blunt versus Penetrating Injury

- Should you activate the Massive transfusion protocol?
- Use the ABC model



ABC Score

- **Transfuse 1:1:1**
- **1 unit of blood**
- **1 unit of plasma**
- **1 unit of platelets**
 - Platelets are pooled
 - Either 6 pak/10 pak
 - Varies from hospital
- **TXA 1 gram**
- **1 gram calcium every 4 units of blood**

One well-validated scoring system is the Assessment of Blood Consumption (ABC) score. The ABC score consists of four variables (pulse >120, SBP<90, + FAST, and penetrating torso injury), each assigned one point. A score of two or more warrants MTP activation. The ABC score overestimates the need for transfusion, with a positive predictive value of 50 percent to 55 percent, meaning that 45 percent to 50 percent of patients in whom MTP is activated will not need a massive transfusion. However, the ABC score is excellent at identifying who will not need massive transfusion, with a negative predictive value of less than 5 percent, meaning it identifies more than 95 percent of all patients who will need a massive transfusion. Other prediction scores have been developed and all include the presence of severe tissue injury and hemorrhagic shock as important risk factors.



Blunt
versus
Penetrating
Injury

This patient needs
MTP and OR.....

Lets change it up



Blunt versus Penetrating Injury

- 39-year-old male that presents after MVC with seat belt sign
- HR 121
- BP 89/50
- FAST equivocal
- R 18
- O2 Sat 99%



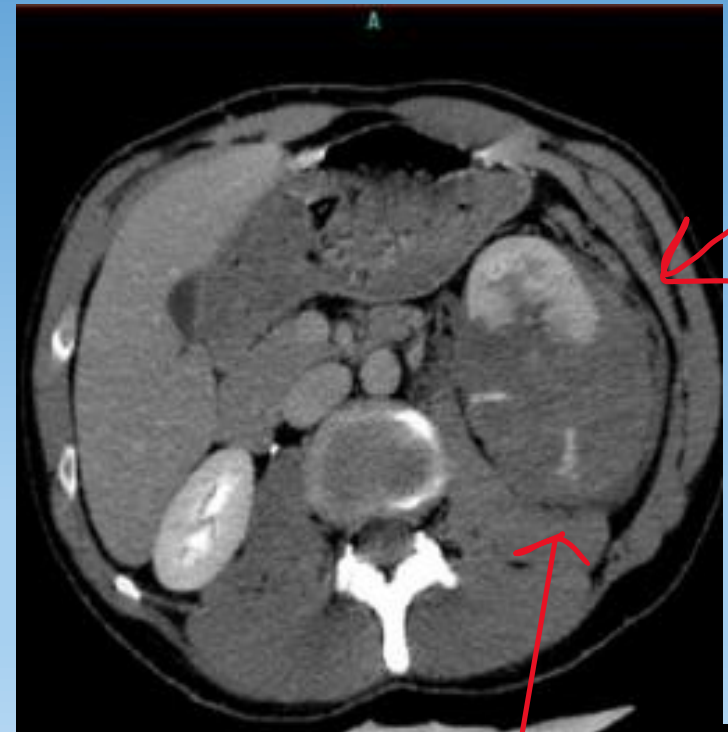
Blunt versus Penetrating Injury

- Stable or unstable?
- Does he need MTP?
- Can you transfuse 1-2 units and see what happens?
- So you transfuse 2 units BP is now 110/80 HR 105?
- Ct scanner?
- You opt for ct scanner



Solid organ injury and management

- Organ injuries are graded
 - Spleen 1-5
 - Liver 1-6
 - Kidney 1-5
- AAST grading system



Solid organ injury and management

What to do with any of these injuries?

OR?

Observation?

IR?

Transfer

- Transfer with blood or without sending blood?

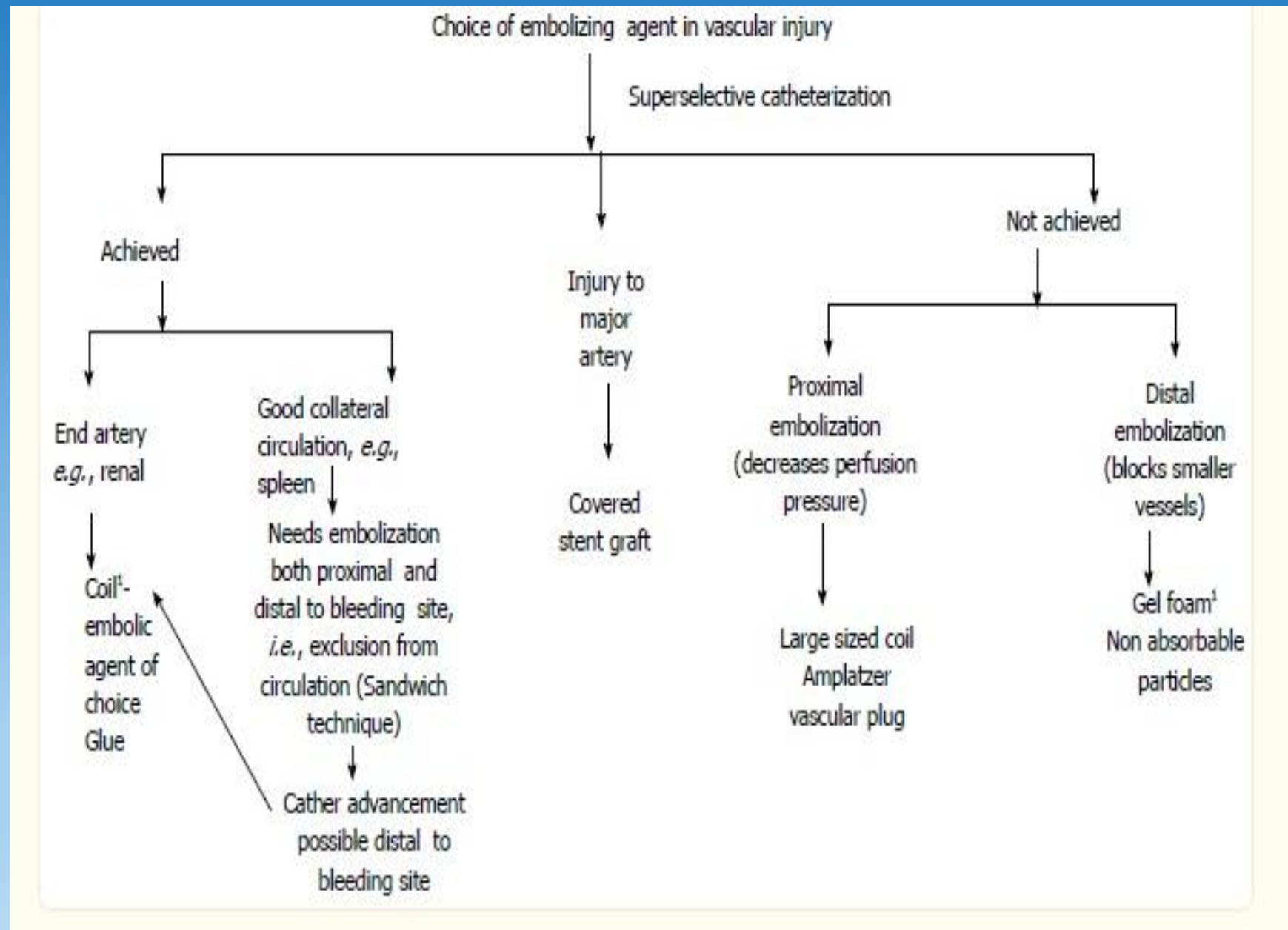


Interventional Radiology

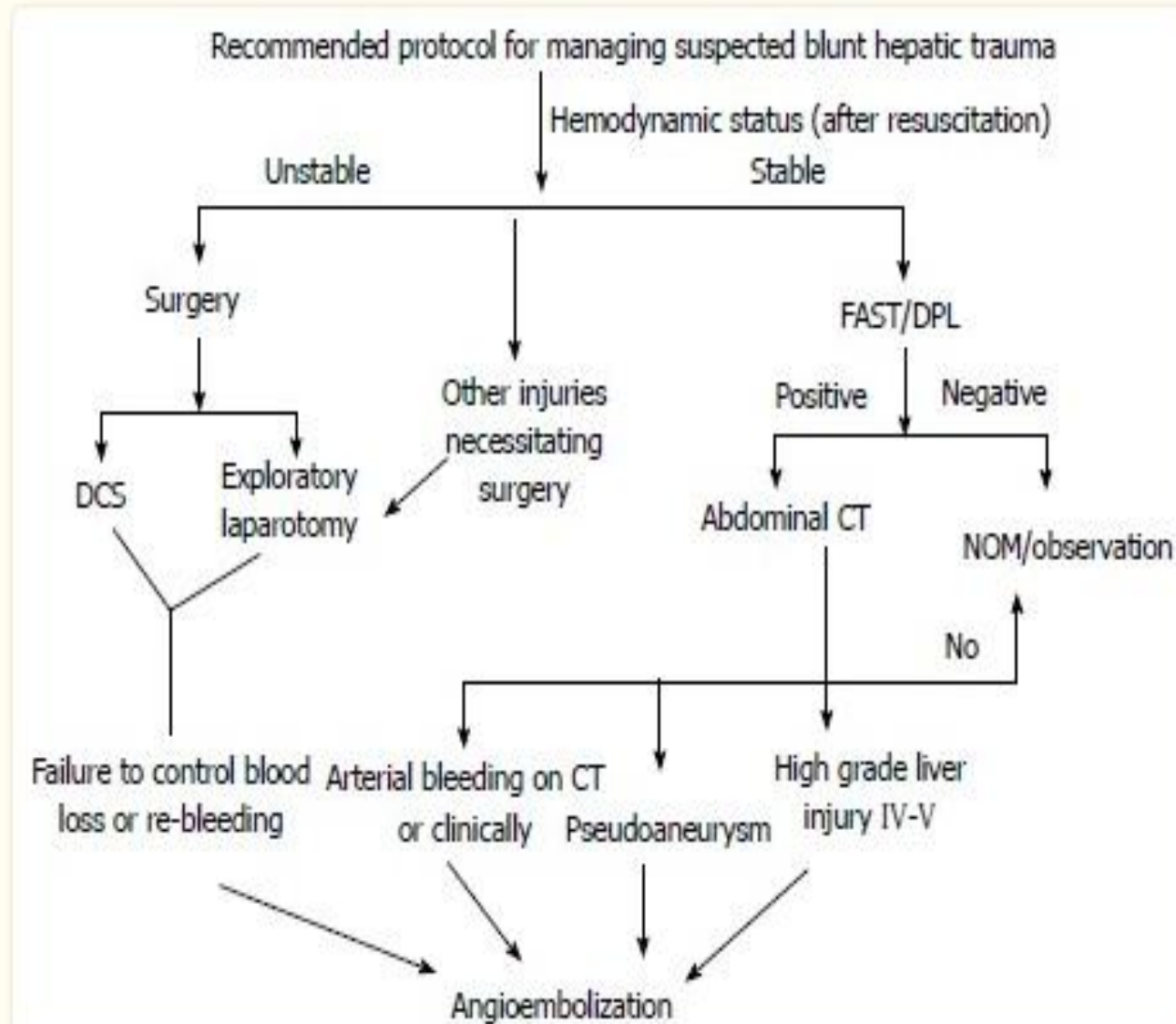
- There is an ever-increasing role of IR in traumatic injuries of solid abdominal organs, pelvic and peripheral arteries to control active bleeding by therapeutic embolization or vascular reconstruction using stent grafts. Traditionally, these endovascular treatments have been offered to hemodynamically stable patients



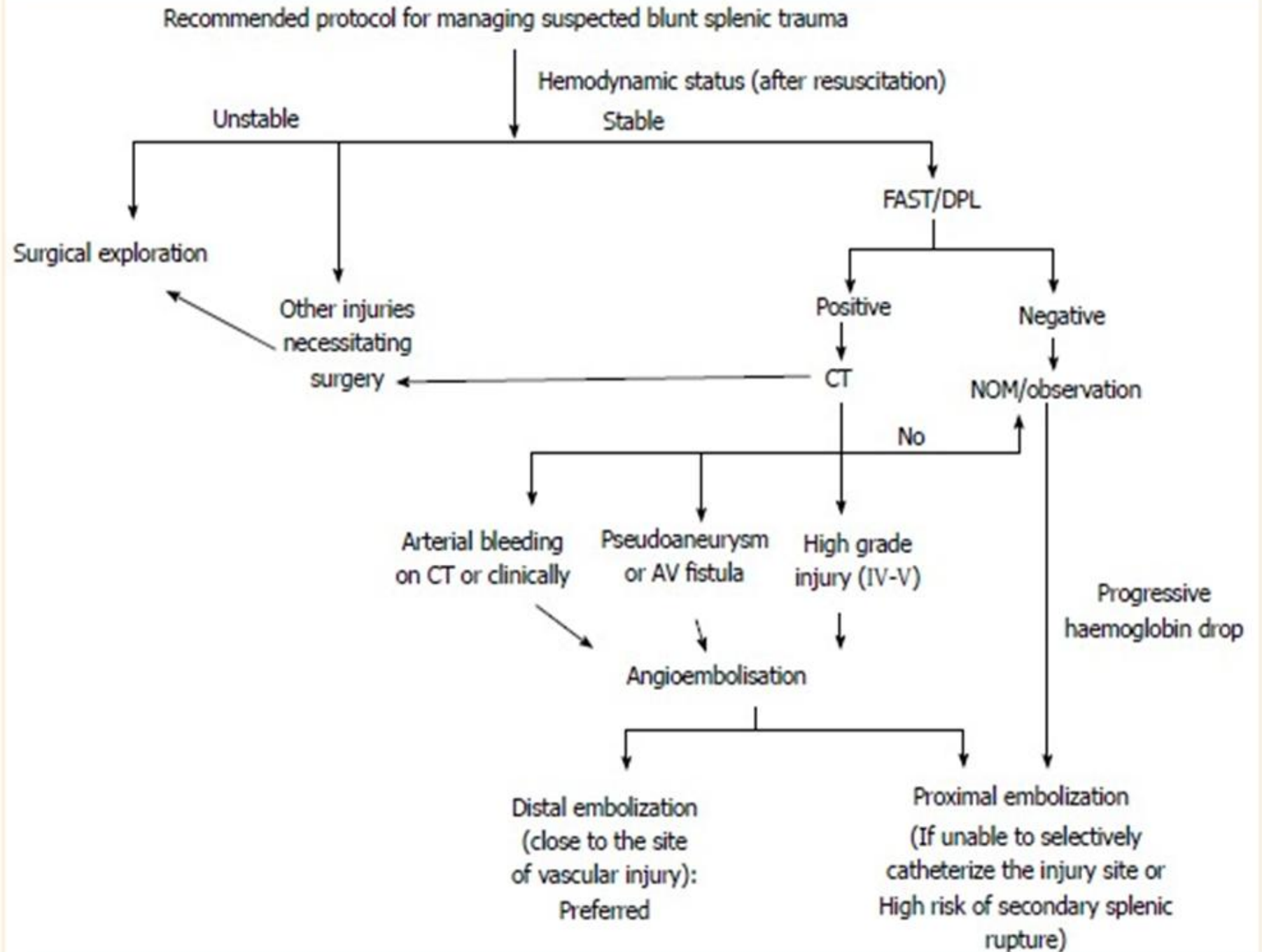
Interventional Radiology



• Interventional Radiology



Splenic Management



What about the pelvis you say?

- Management of severe pelvic injuries continue to remain an enigma for trauma surgeons. Mortality in pelvic injury ranges from 2%-23% and nearly 54% of the early deaths are attributed to the ongoing hemorrhage.





What about the pelvis you say?

- Same patient
- 39-year-old male that presents after MVC with seat belt sign
- HR 121
- BP 89/50
- FAST equivocal
- R 18
- O2 Sat 99%
- You get pelvic x-ray
 - What do you see?
 - Who gets pelvic x-ray in trauma?



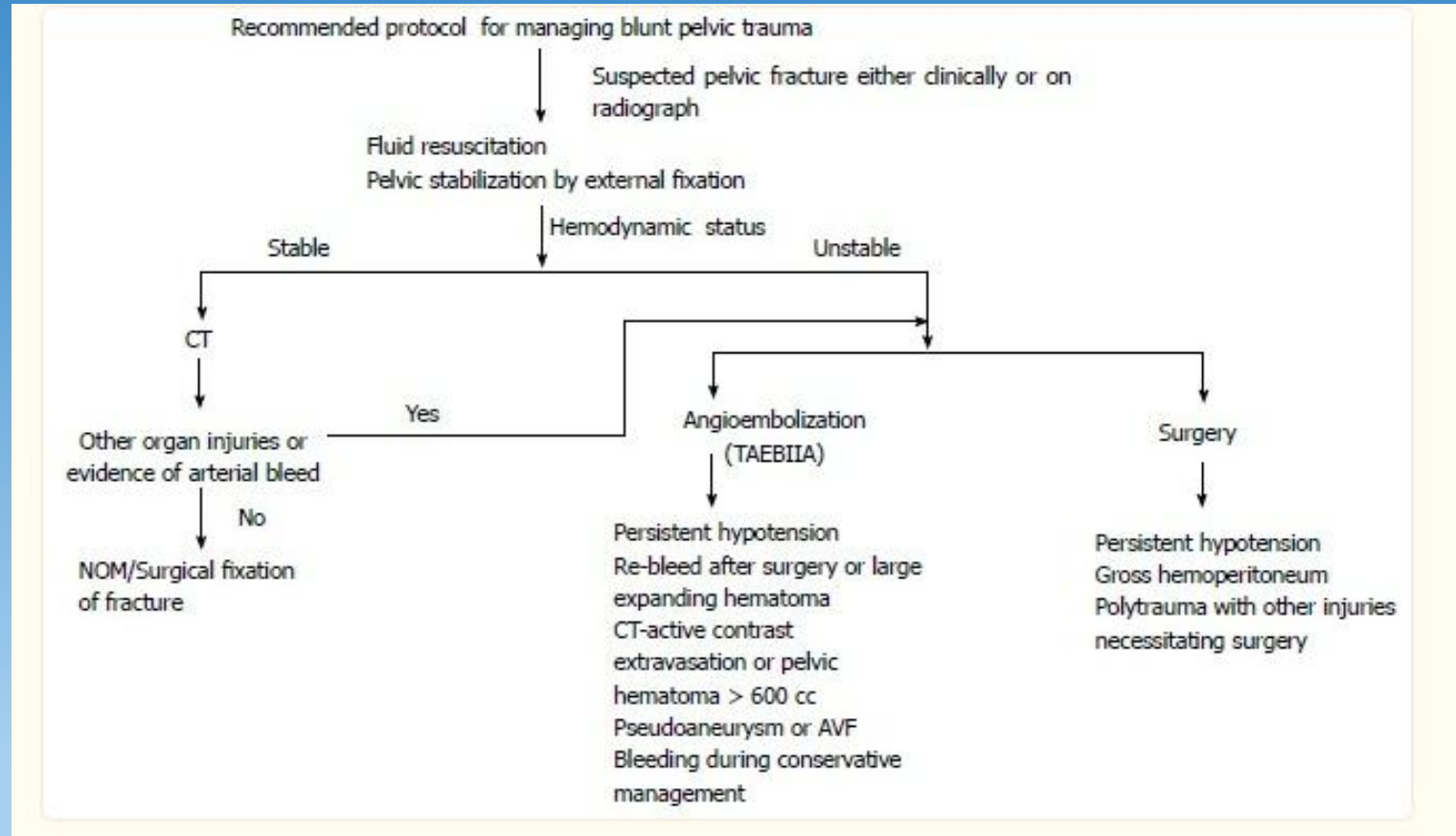


What about the pelvis you say?

- Wisniewski Rules of Pelvic Trauma
 - 1. Close down the pelvis ring
 - 2 Transfuse these patients
 - They can lose their entire blood volume in the pelvis
 - Do not underestimate the ability of this injury to kill the patient in front of you
 - 3. Unstable patients need intervention
 - IR if transient responder
 - OR for pre-peritoneal packing
 - Possible internal iliac artery ligation
 - Transfer ASAP
 - 4 These patients have a 28 % chance of having other abdominal injuries. Low threshold to operate



What about
the pelvis
you say?

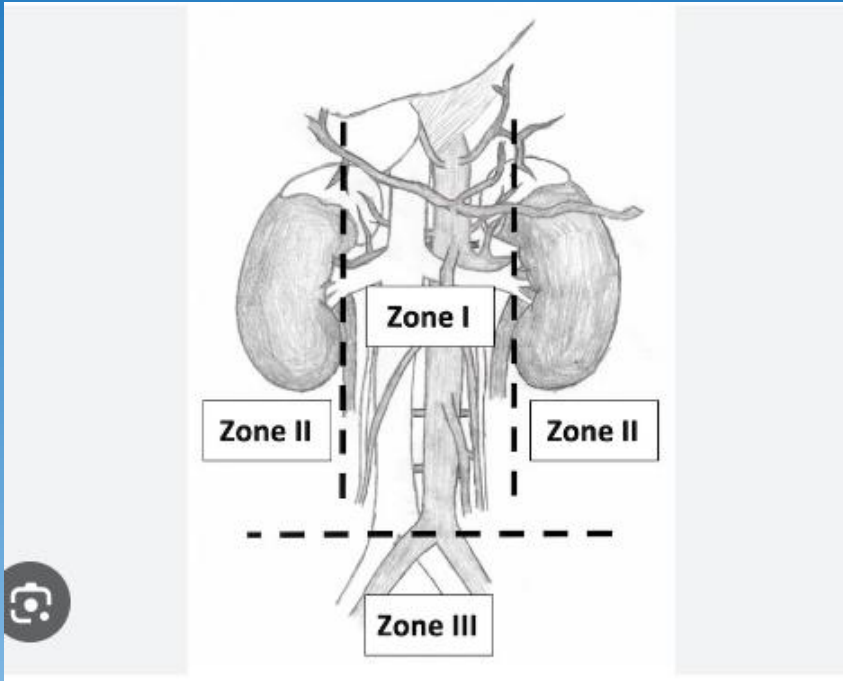


Pelvic Fractures and Associated Injuries in Patients Admitted to and Treated at Emergency Department of Tibebe Ghion Specialized Hospital, Bahir Dar University, Ethiopia

[Biruk Ferede](#),¹ [Asteray Ayenew](#),² and [Worku Belay](#)¹

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We studied 64 cases of pelvic fracture during the study period. Pelvic was common among males with a ratio of 7:1 and young population (15–35 years). The most common associated injuries were lower extremity 23 (35.9%), abdominal injuries 16 (25.0%), and urethral injury in 13 (20.3%). Moreover, most patients with pelvic fracture have Tile A fracture 56.3%, Tile C in 20 (31.3%), and Tile B in 8 (12.5%) patients. The road traffic accident was the most common cause of pelvic fracture in 56.3%, followed by fall down accident (28.1%), and bullet injury (12.5%).



Retroperitoneum

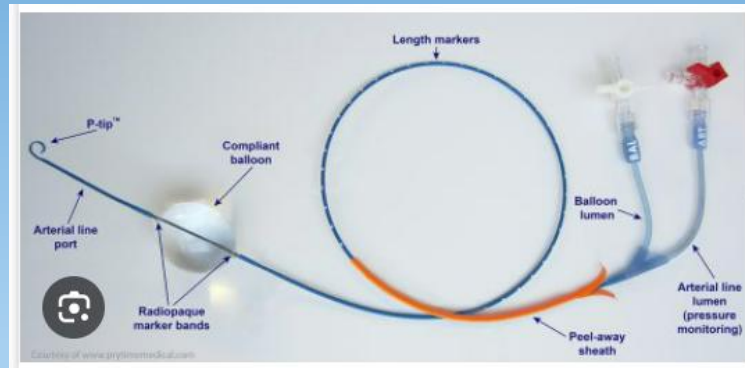
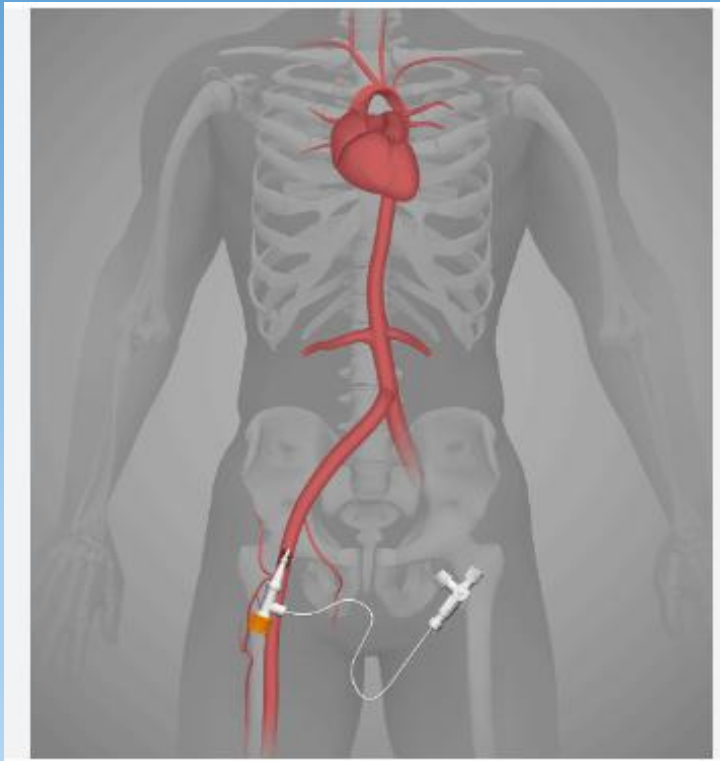
- One reason the fast will be equivocal to negative
 - Bleeding in retroperitoneum
 - Bleeding in the pelvis

The retroperitoneum is divided into three main zones of injury: zone I is the central/midline retroperitoneum, zone II encompasses the perinephric space, and zone III comprises the pelvic retroperitoneum. Treatment of retroperitoneal hematomas varies depending on the anatomical location and mechanism of injury.

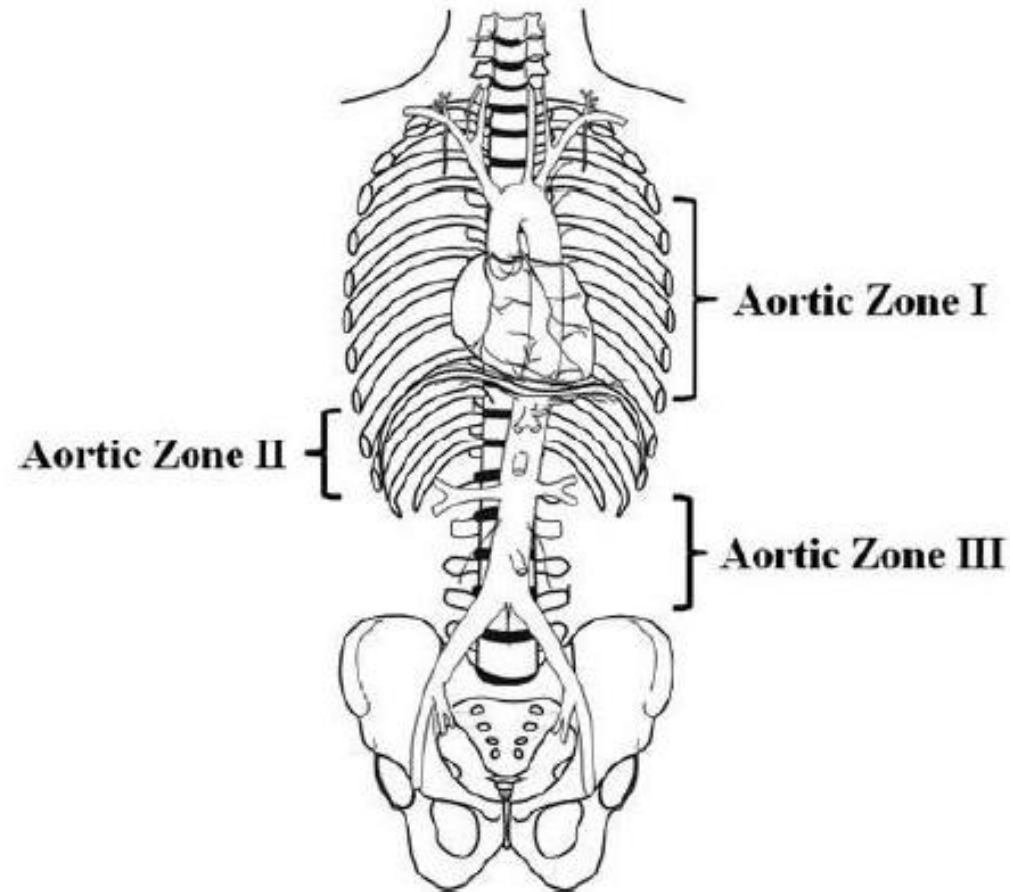


Reboa

- What is REBOA?
- Resuscitative endovascular balloon occlusion of the aorta (REBOA)



Reboa Zones



Zone 1: left subclavian artery to celiac axis

- landing zone for most cases of shock and impending cardiovascular collapse

Zone 2: celiac axis to renal artery

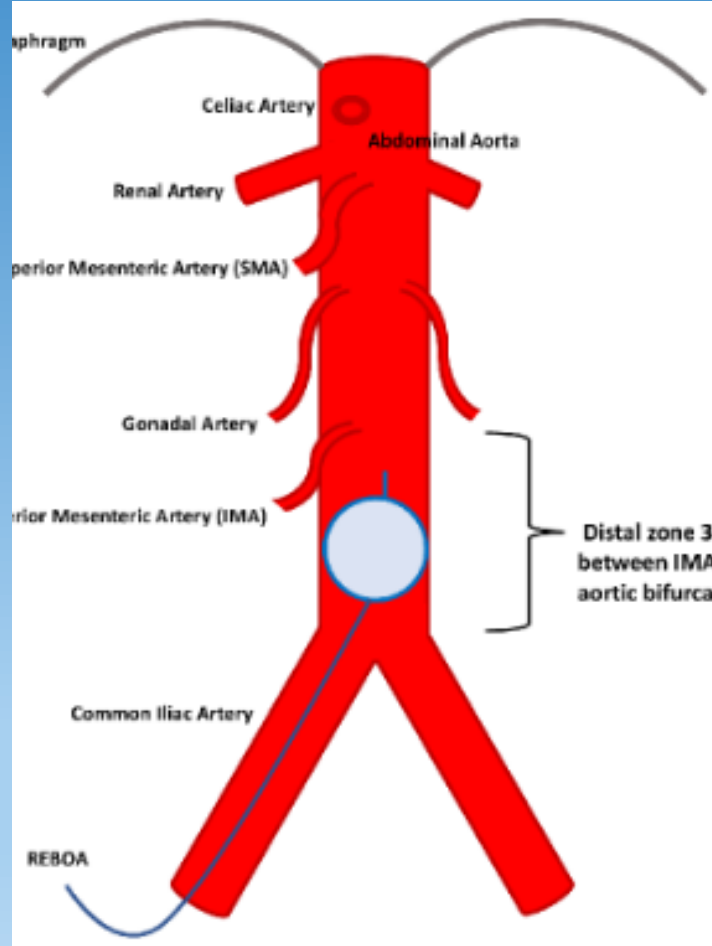
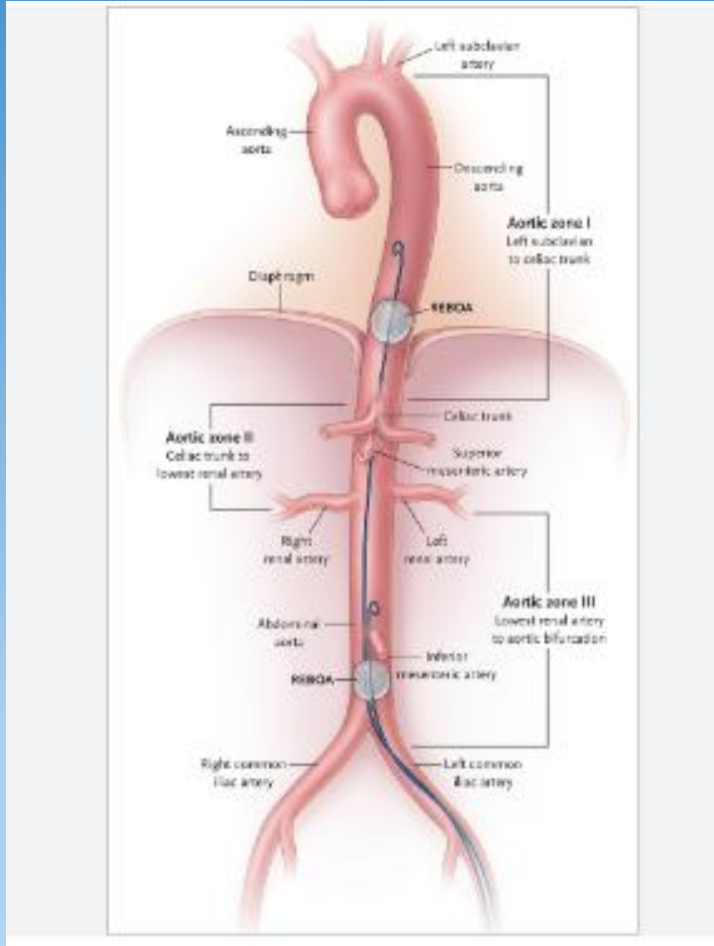
- no-occlusion zone

Zone 3: renal artery to aortic bifurcation

- useful for isolated pelvic hemorrhage



Reboa is an option for hemorrhage control in the pelvis or abdomen



- Never place the REBOA in Zone 2
- Inflate until blood flow stops
- Bridge to other surgical intervention
- When the sheath port no longer bleeds the balloon has achieved occlusion
- Place 1 ml of contrast in balloon and take x ray to confirm placement. May use ultrasound if available



Take Home Points

Recognize patients that need transfusion. Stable versus unstable

Recognize that patients who are unstable need surgical intervention early to minimize blood loss

ABC score is good tool for objectively activating MTP

Close down the pelvic ring most of the time the bleeding is venous in nature

Do not put binders on non open book fractures may make bleeding worse

Confirm placement of REBOA prior to inflating balloon all the way

Open book pelvic fractures think urethral injury especially in males



Hepatic Injuries

Grade	Description of injury
I	Hematoma: subcapsular, <10% surface area Laceration: capsular tear, <1cm depth
II	Hematoma: subcapsular, 10-50% surface area; intraparenchymal <10cm diameter Laceration: capsular tear, 1-3cm depth, <10cm length
III	Hematoma: subcapsular, >50% surface area of ruptured subcapsular or parenchymal hematoma; intraparenchymal hematoma >10cm or expanding Laceration: >3cm parenchymal depth
IV	Laceration: parenchymal disruption involving 25-75% hepatic lobe or 1-3 Couinaud segments
V	Laceration: parenchymal disruption >75% hepatic lobe or >3 Couinaud segments within single lobe Vascular: juxtahepatic venous injuries (retrohepatic vena cava / central major hepatic veins)
VI	Vascular: hepatic avulsion



Hepatic Injuries

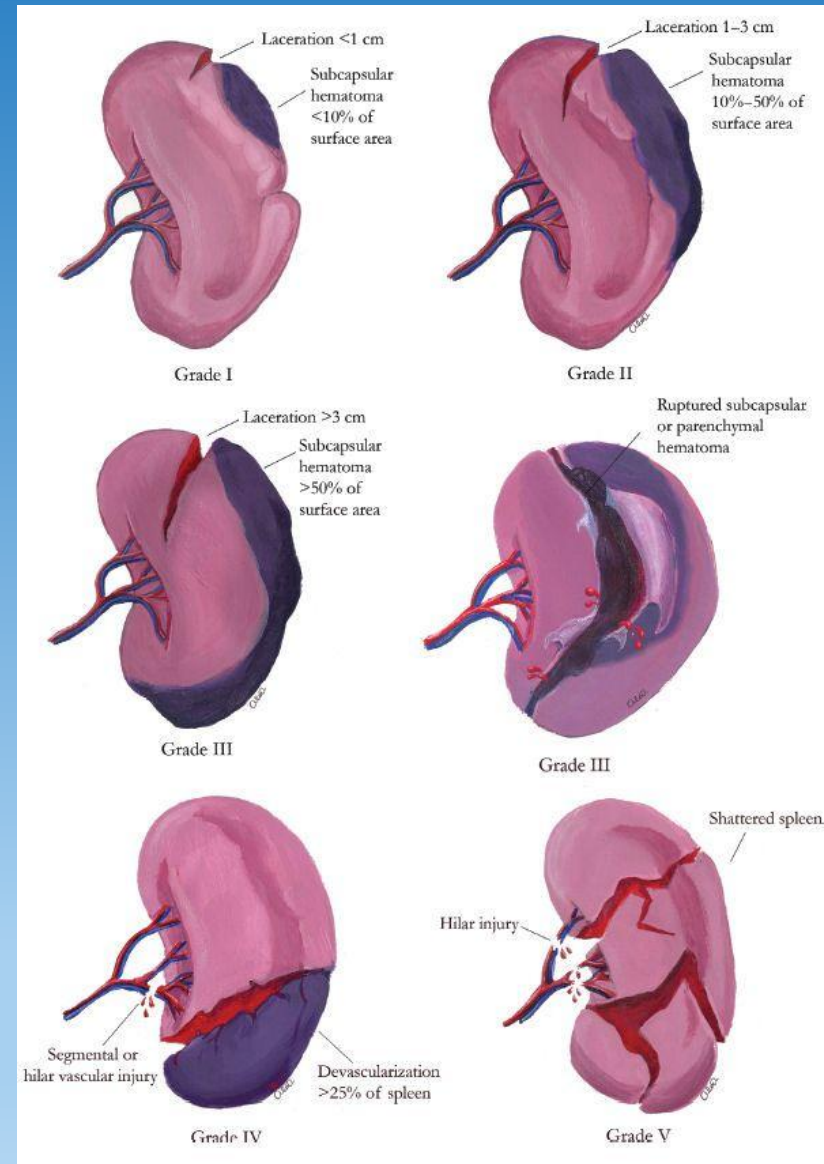
Grade	Laceration	Hematoma	Vascular
I	Capsular tear < 1 cm deep	Subcapsular hematoma < 10% surface area	None
II	1-3 cm deep <10 cm long	Subcapsular hematoma: 10%-50% surface area Intraparenchymal hematoma < 10 cm	None
III	Parenchymal laceration more than 3 cm deep	Subcapsular hematoma > 50% surface area, expanding or ruptured (regardless of size) Parenchymal hematoma > 10 cm or expanding	None

Splenic injuries

- The grading of splenic laceration is classified using the American Association for the Surgery of Trauma (AAST) splenic injury scale, which includes the following grades:
- Grade I: Superficial laceration < 1 cm deep.
- Grade II: Laceration 1-3 cm deep or involving < 10% of the splenic surface.
- Grade III: Laceration > 3 cm deep or involving 10-25% of the splenic surface.
- Grade IV: Laceration involving segmental or hilar vessels and that devascularizes > 25% of the spleen.
- Grade V: Completely shattered spleen or hilar vascular injury that devascularizes the spleen.



Splenic injuries



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