APPROACH TO A TRAUMA

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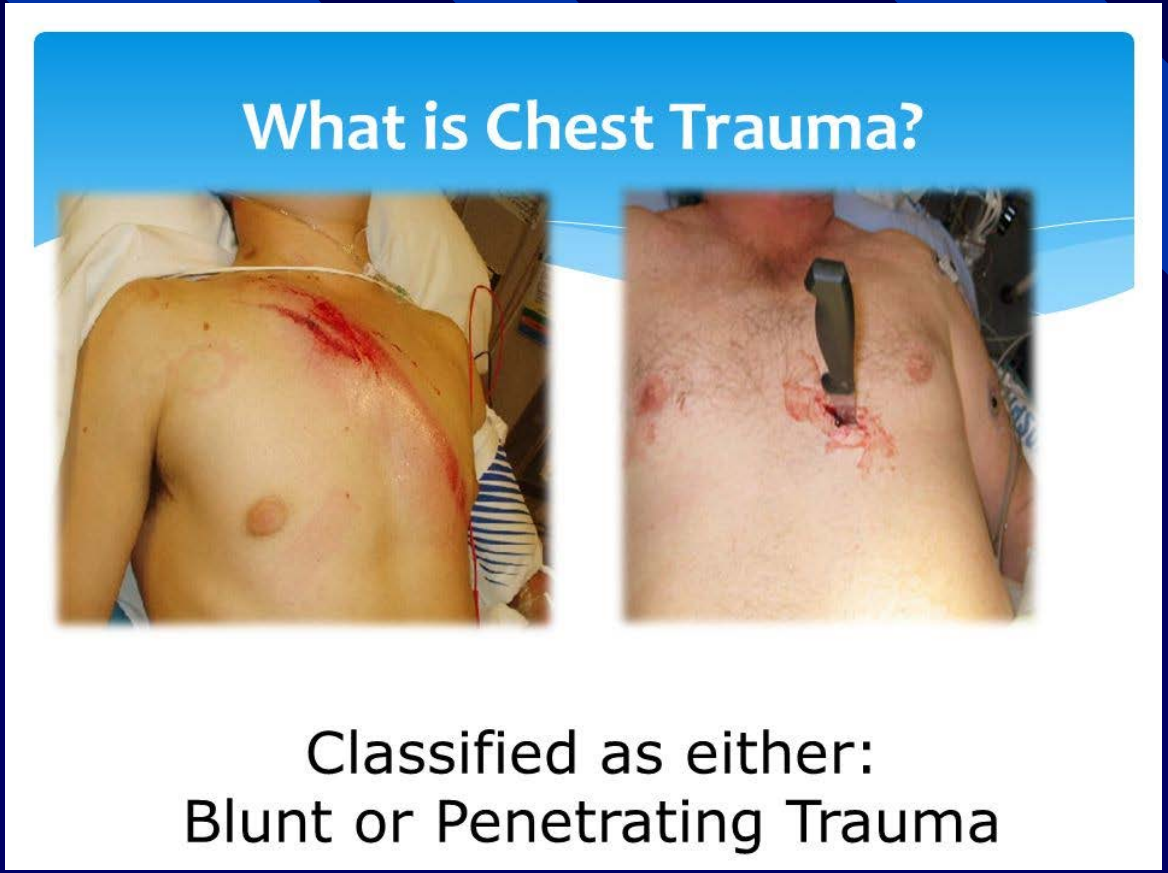
Polytrauma, multiple trauma

- A clinical syndrome with severe injuries involving two or more major organ or physiological systems which will initiate an amplified metabolic and physiological response

Mechanism of injury

- Blunt trauma
- Penetrating trauma



Trauma

- Epidemiology
  - Leading cause of death in the first 4 decades
  - 150,000 deaths annually in the US
  - Permanent disability 3 times the mortality rate
  - Trauma related dollar costs exceed $400 billion annually

Blunt trauma

- Blunt Trauma
  - Injuries caused by rapid change in velocity
  - **Deceleration or high energy injuries**
  - Body stops, tissues and organs continue to move forward

- traffic accidents, occupational accidents, violence, sports, domestic accidents

Blunt trauma

- ….causes
  - Multiple fractures
  - Large tissue damage
  - Contussion, laceration
  - Hollow viscous organ ruptures

- Approach – initial resustitation, thorough diagnostic, damage control surgery

Penetrating trauma

- Penetrating Trauma
  - Object penetrates internal tissues causing injury
  - Can be misleading: small surface,
  - Injuries depend on depth, angle, device, location
  - Stabbings, firearms

Mechanisms of Injury

- Penetrating Trauma
  - Small area
  - Bleeding

- Approach - surgery

Patophysiology of multiple trauma

6 basic mechanisms involved in trauma affecting the whole body

- soft tissue injury
- internal organs inj.
- fractures
- ischemia/reperfusion
- coagulation disorders
- infections

- Result in:
  - Blood loss
  - Tissue damage
  - Inflammatory response

Patophysiology - complex

- Blood loss
  - Drop in circulating volume – shock developement
  - Tissue hypoxia – acidosis, endothel activation, SIRS developement
  - Loss of coag. Factors
  - Heat loss

Result: coagulopahy – more blood loss

Patophysiology - complex

- Tissue damage
  - Release of free myoglobin
  - High potassium
  - Organ dysfunction
  - Oedema, compartment syn.
  - Coag. Activation
  - bleeding

Triad of Death

1. Coagulopathy
2. Acidosis
3. Hypothermia

Vicious circle rather than a triangle

Acute Traumatic Coagulopathy

Figure 1.

Resolution: **standard** / high

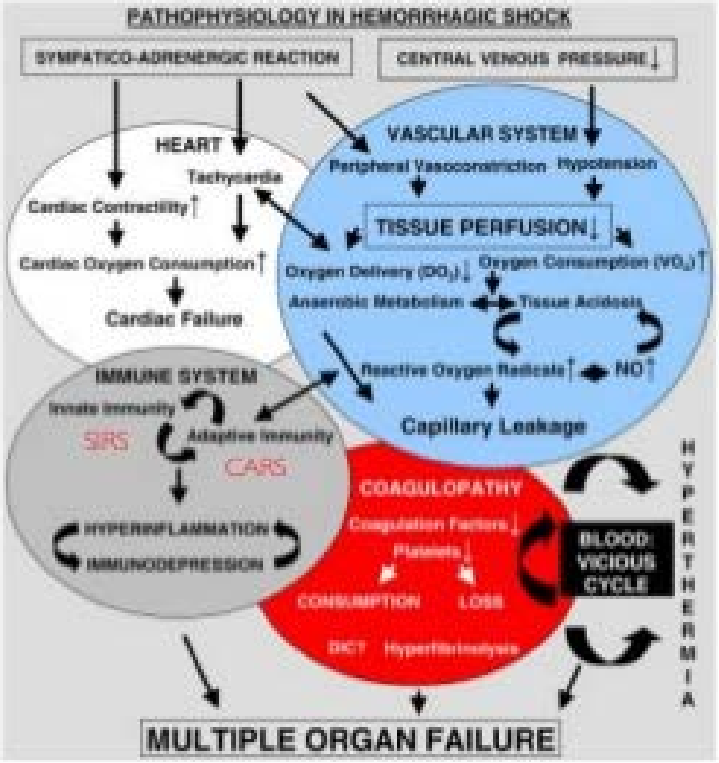


Illustration of the pathophysiological changes in hemorrhagic shock. DIC, disseminated intravascular coagulopathy; NO, nitric oxide.

Angele *et al. Critical Care* 2008 **12**:218 doi:10.1186/cc6919

25% trauma pts have established coagulopathy (ATC) on presentation - 4 fold increase in mortality

Brohi K, Singh J, Heron M, Coats T. Acute traumatic coagulopathy. J Trauma 2003;54:1127-30.

MacLeod JB, Lynn M, McKenney MG, Cohn SM, Murtha M. Early coagulopathy predicts mortality in trauma. J Trauma 2003;55:39-44.

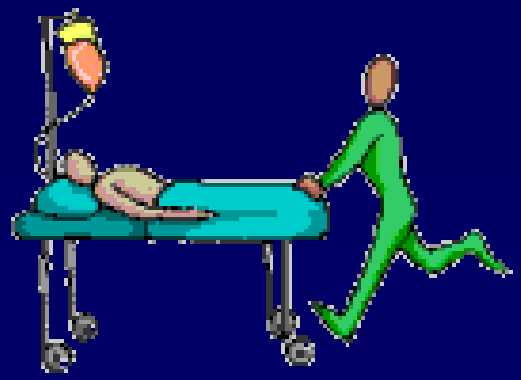
Maegele M, Lefering R, Yucel N, Tjardes T, Rixen D, Paffrath T, et al. Early coagulopathy in multiple injury: an analysis from the German Trauma Registry on 8724 patients. Injury 2007;38:298-304.

6 Actual Phases of Care...

- Prehospital
- Emergency Department
- Operative Phase
- Critical Care Phase
- Intermediate Phase
- Rehabilitation Phase

Pre Hospital Phase :-

1. Airway – C spine
2. Immobilization
3. Control of bleeding
4. IV line
5. Immediate appropriate transfer



Emergency Department Care

- ATLS, TNCC
  - Advanced Trauma Life Support
  - Trauma Nurse Core Course

A Systematic Approach

- Primary, Secondary Survey along with resuscitation and management

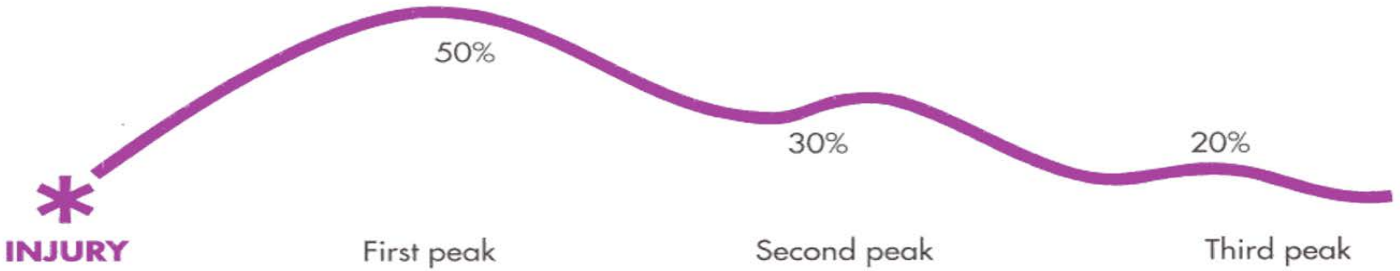
ATLS Guidelines

- Systematic approach necessary to rapidly identify injuries and stabilize the patient
- This approach is divided into:
  1. Primary Survey
  2. Resuscitative Phase
  3. Secondary Survey
  4. Definitive Care Phase

Why ATLS?

- Trimodal death distribution
  - First peak instantly (brain, heart, large vessel injury)
  - Second peak minutes to hours
  - Third peak days to weeks (sepsis, MSOF)

Distribution of trauma death



	First peak	Second peak	Third peak
Time from injury:	Minutes	Minutes to few hours	Days to weeks
Location:	At scene, en route to medical facility	Emergency department Operating room	Critical care unit
Cause of death:	Laceration of brain or brainstem, high spinal cord injury, injury to heart, aorta, or other large vessels	Subdural or epidural hematoma, hemo-pneumothorax, ruptured spleen, liver laceration, pelvic fracture, injuries associated with extensive blood loss	Sepsis, multiple organ failure

FIGURE 43-1. Trimodal distribution of trauma deaths.

Concepts of ATLS

- Treat the greatest threat to life first
- The lack of a definitive diagnosis should never impede the application of an indicated treatment
- A detailed history is not essential to begin the evaluation
- "**ABCDE**" approach

Initial Assessment and Management

- An effective trauma system needs the teamwork

Trauma Team

Trauma team

- Team Leader
- Anaesthetist + Anaesthetic Assistants
  General Surgeon + Orthopaedic Surgeon
  Emergency Room Physician
- Two Nurses. (Three if no anaesthetic assistant)
- Radiographer
- Scribe (Nurse or doctor)

Primary Survey

- Patients are assessed and treatment priorities established based on their injuries, vital signs, and injury mechanisms
- ABCDEs of trauma care
  - A Airway and c-spine protection
  - B Breathing and ventilation
  - C Circulation with hemorrhage control
  - D Disability/Neurologic status
  - E Exposure/Environmental control

Primary Survey

- ABCDE assessment, resusciation is initiated
- Adjuncts:

  BP , pulse oximetry, ABG, EKG

  Foley : urine output (avoided if suspected urethral injury)

  NG: decompression, decrease aspiration

  AP chest, AP pelvis, lateral C- spine
- Evaluate response to resusciation

Airway

How do we evaluate the airway?

A- Airway

- Airway should be assessed for patency
  - Is the patient able to communicate verbally?
  - Inspect for any foreign bodies
  - Examine for stridor, hoarseness, gurgling, pooled secrecretions or blood
- Assume c-spine injury in patients with multisystem trauma
  - C-spine clearance is both clinical and radiographic
  - C-collar should remain in place until patient can cooperate with clinical exam

Airway Interventions

- Supplemental oxygen
- Suction
- Chin lift/jaw thrust
- Oral/nasal airways
- Definitive airways
  - RSI for agitated patients with c-spine immobilization
  - ETI for comatose patients (GCS<8)

Difficult Airway

Breathing

- What can we look for clinically to assess a patient's 'breathing' status?

B- Breathing

- Airway patency alone does not ensure adequate ventilation
- Inspect, palpate, and auscultate
  - Deviated trachea, crepitus, flail chest, sucking chest wound, absence of breath sounds
- CXR to evaluate lung fields ????

Flail Chest

Subcutaneous Emphysema

Breathing Interventions

- Ventilate with 100% oxygen
- Needle decompression if tension pneumothorax suspected
- Chest tubes for pneumothorax / hemothorax
- Occlusive dressing to sucking chest wound
- If intubated, evaluate ETT position

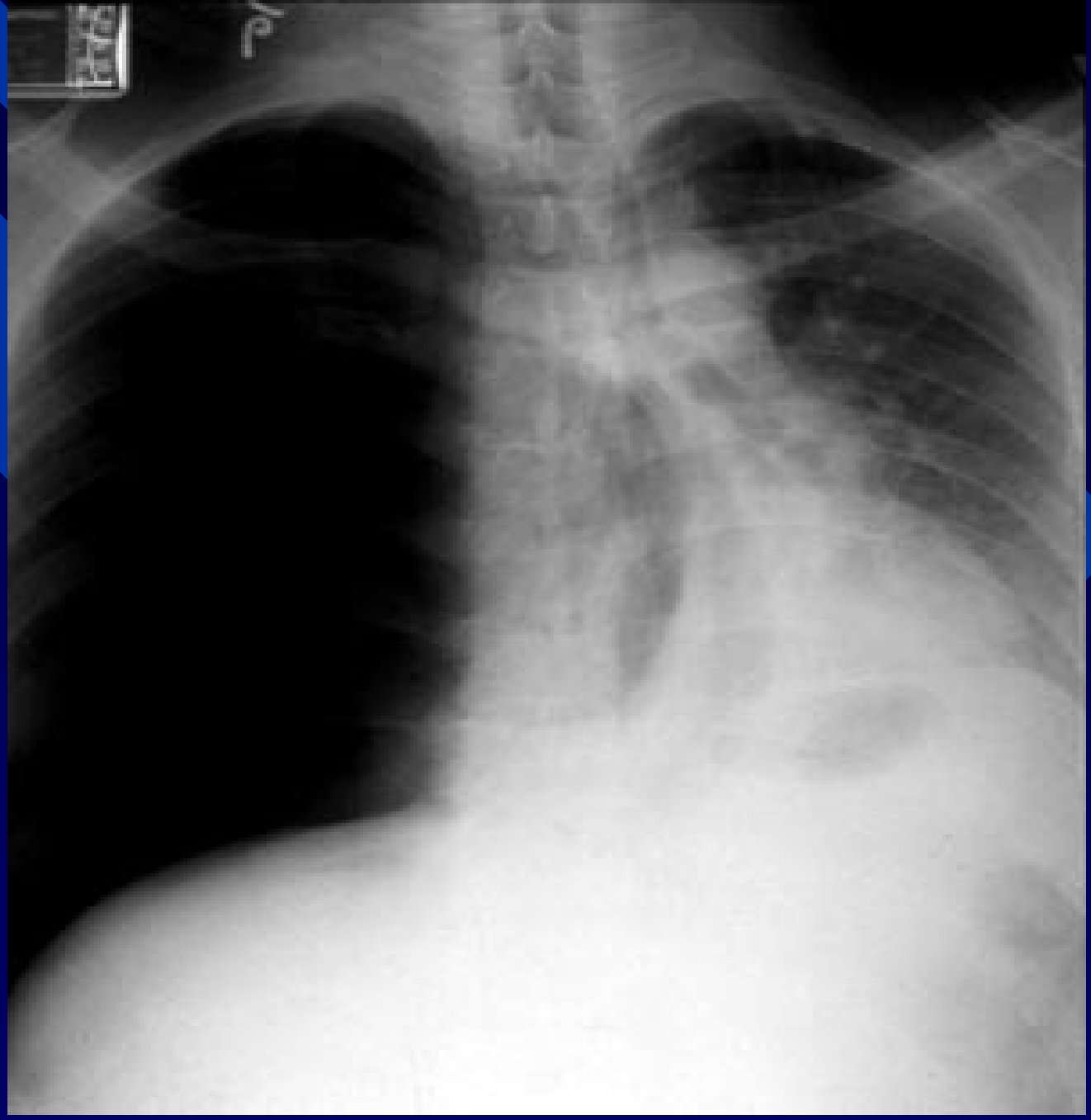
- Casualty: man, car crash in 100km/h, arousable, complain of difficult breathing and chest pain ?

- Puls 130/min,
- BP 95/50
- SpO2 85%

Diminished beathing sound right

OTI –

P 150/min, BP 70/30 SpO2 66% Your action????



Chest Tube placement

C- Circulation

- Hemorrhagic shock should be assumed in any hypotensive trauma patient
- Rapid assessment of hemodynamic status
  - Level of consciousness
  - Skin color
  - Pulses in four extremities
  - Blood pressure and pulse pressure

Circulation Interventions

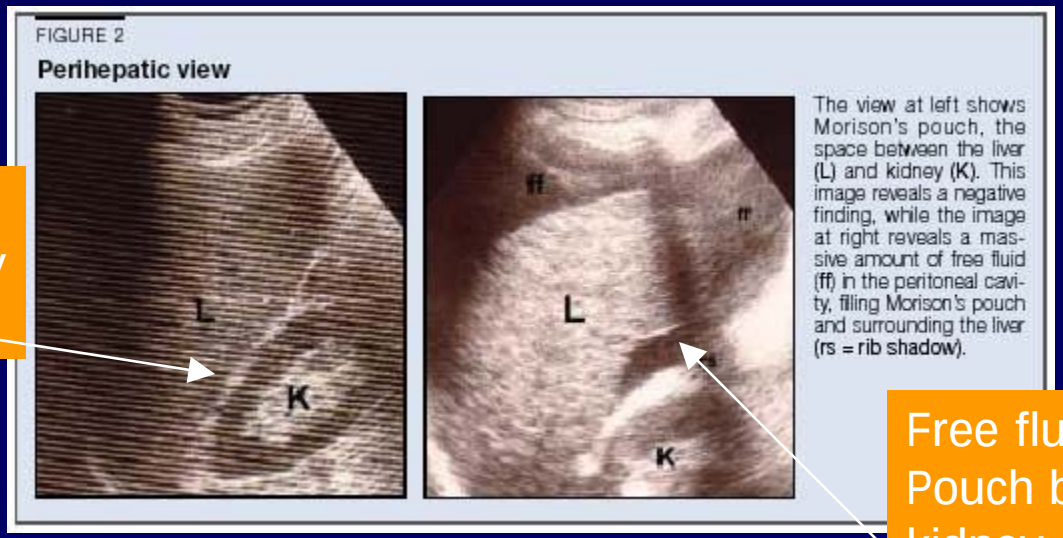
- Cardiac monitor
- Establish IV access
  - 2 large bore IVs
  - Central lines if indicated
- Treat hypovolemia!!
  - Crystalloids, colloids, blood
  - Draw blood samples: BC, Lcytes, coags, Type and X, ABG's , PG test, Tox. & ETOH levels

Resuscitation Process

- Volume resuscitation
  - Have blood ready if needed
  - Level One infusers available -WARMING
- urinary catheter
- On the scene – FAST scans (USG)
- Cardiac tamponade decompression if indicated

(e) FAST Exam

- Focused Abdominal Scanning in Trauma
- 4 views: Cardiac, RUQ, LUQ, suprapubic (+ chest cavities)
- Goal: evaluate for free fluid



See normal Liver and kidney

Free fluid in Morrison's Pouch between liver and kidney

FIGURE 3

Perisplenic view

Perisplenic free fluid (ff) can be seen to the left of the spleen (S), or it can appear in the subdiaphragmatic space.

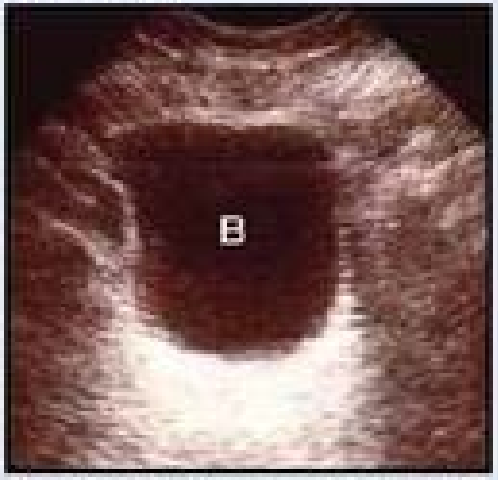
FIGURE 1

Pericardial view

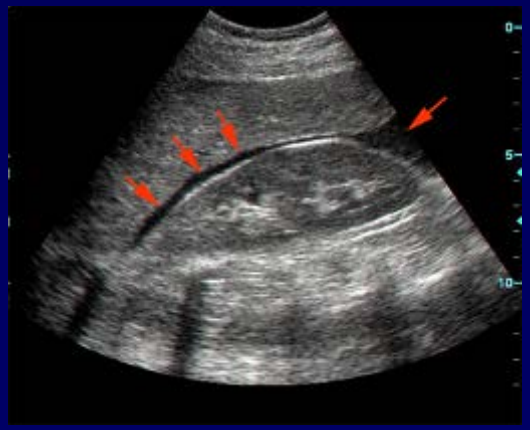
Fluid in the pericardial sac is seen as a black stripe (f) that separates the visceral and parietal pericardial layers.

FIGURE 4

Pelvic view



The bladder (B) is seen clearly in this normal pelvic image. No free fluid is seen.



Morrison's pouch

D- Disability

- Abbreviated neurological exam
  - Level of consciousness
  - Pupil size and reactivity
  - Motor function
  - GCS
    - » Utilized to determine severity of injury
    - » Guide for urgency of head CT and ICP monitoring

GCS

EYE		VERBAL		MOTOR	
Spontaneous	4	Oriented	5	Obeys	6
Verbal	3	Confused	4	Localizes	5
Pain	2	Words	3	Flexion	4
None	1	Sounds	2	Decorticate	3
		None	1	Decerebrate	2
				None	1

Disability Interventions

- Spinal cord injury
  - High dose steroids if within 8 hours ????
- ICP monitor- Neurosurgical consultation
- Elevated ICP
  - Head of bed elevated
  - Mannitol
  - Hyperventilation
  - Emergent decompression

E- Exposure

- Complete disrobing of patient
- Logroll to inspect back
- Rectal temperature
- Warm blankets/external warming device to prevent hypothermia

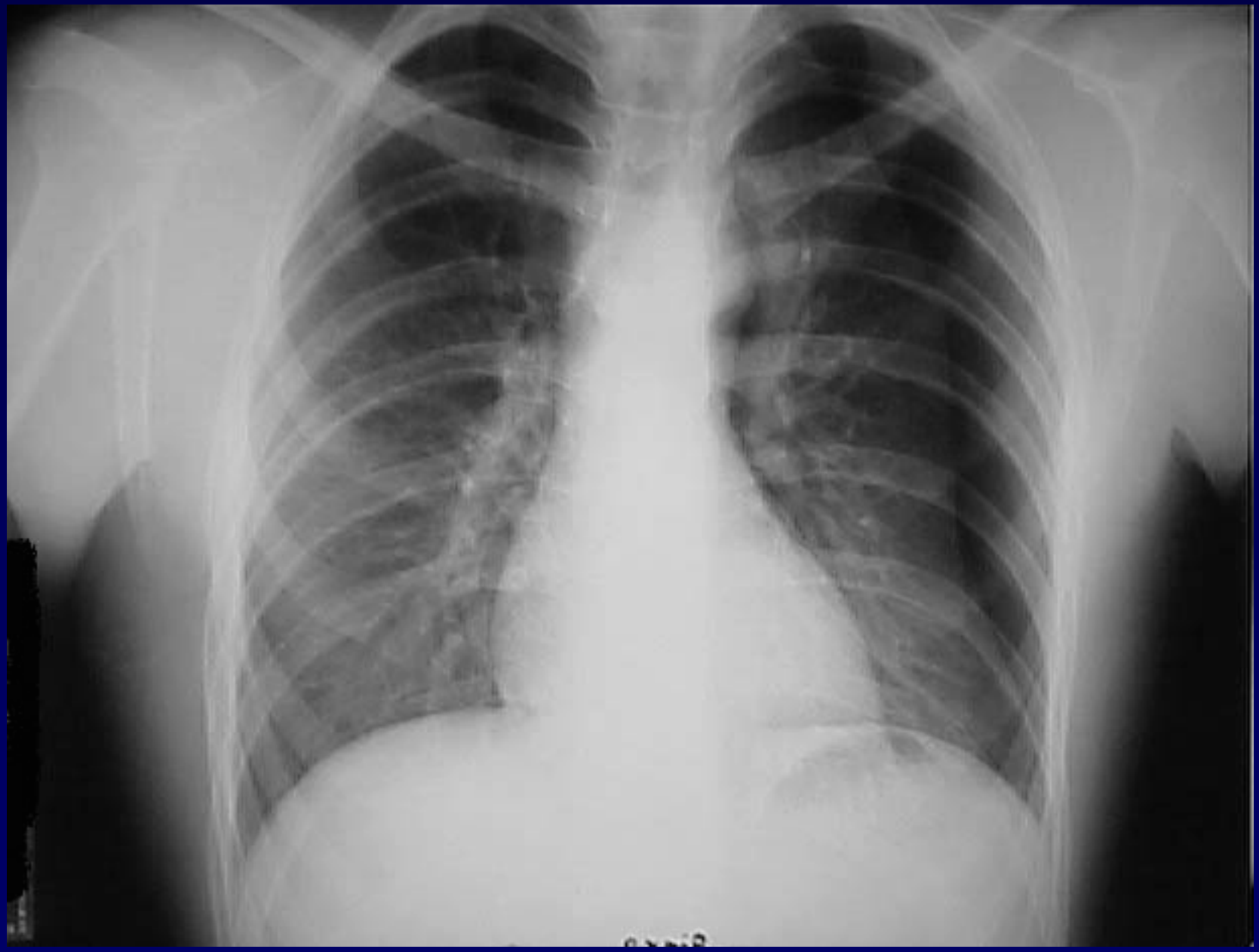
Always Inspect the Back

Secondary Survey

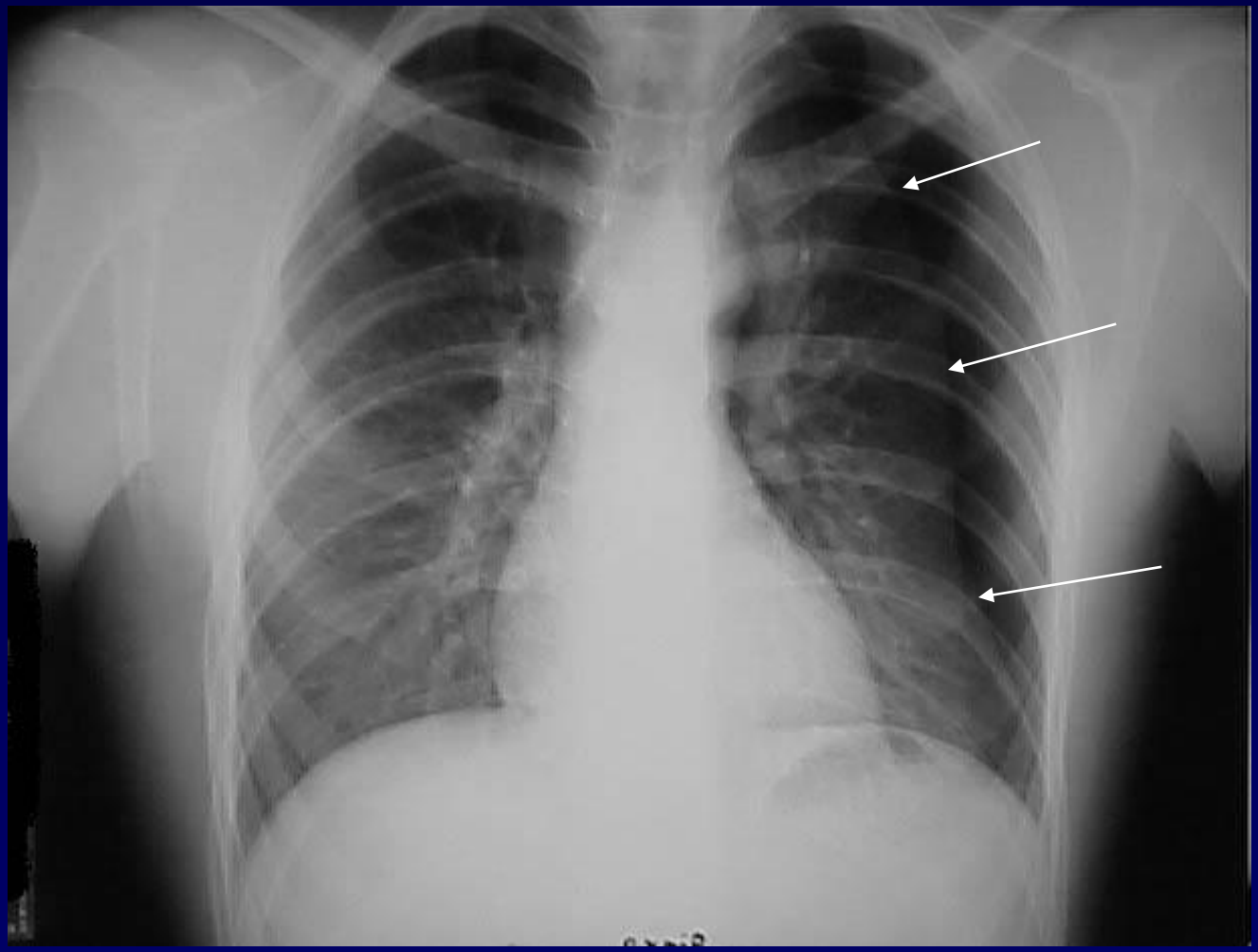
- AMPLE history
  - Allergies, Medications, PastMedicaHistory, Last meal, Events
- Physical exam from head to toe, including rectal exam
- Frequent reassessment of vitals
- Diagnostic studies at this time simultaneously
  - X-rays, lab work, **CT – scan trauma protocol**

Diagnostic Aids

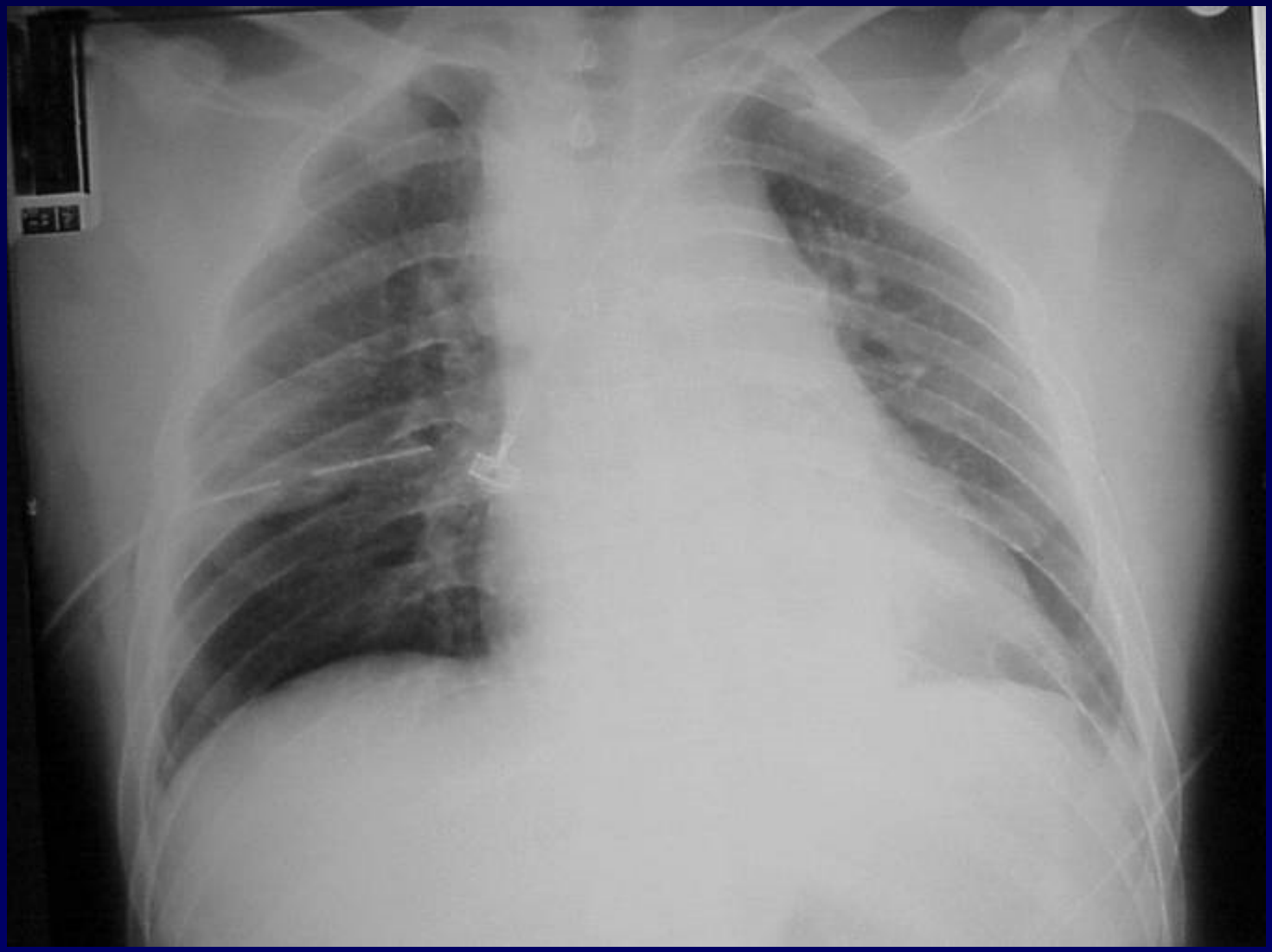
- Standard trauma labs
  - BC, ions, U, crea, glu, myoglobin, TnI, EtOH, ABG, INR, APTT, fibri
- CT – head to pelvis
- Pt should only go to radiology if stable
- http://www.trauma.org/archive/radiology/FASTluq.html



Simple Pneumothorax



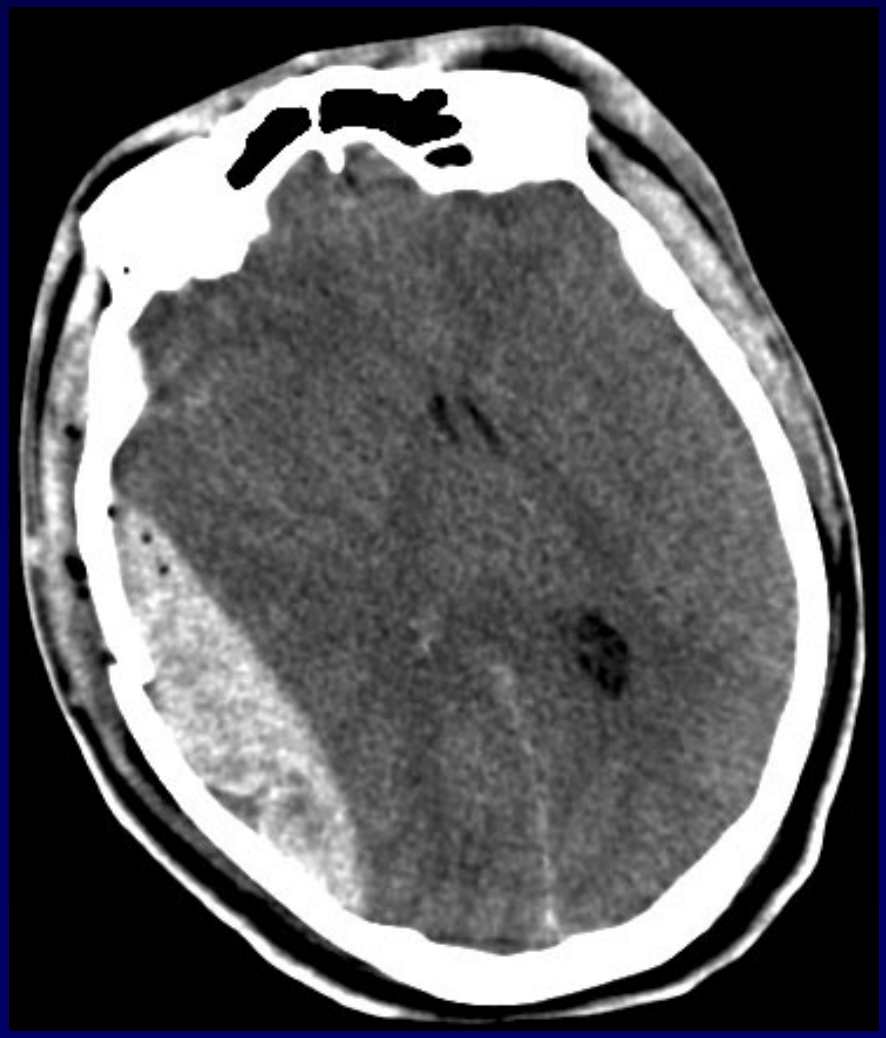
What does this indicate?

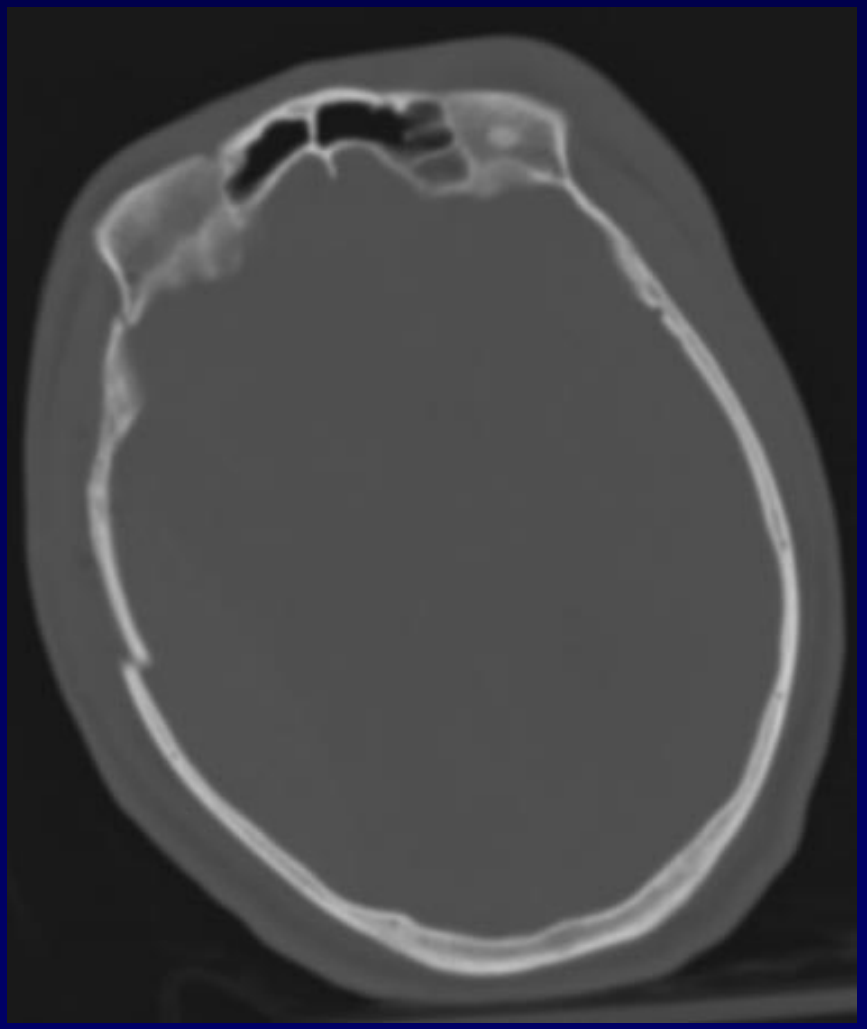


Bilateral Pubic Ramus Fractures and Sacroiliac Joint Disruption

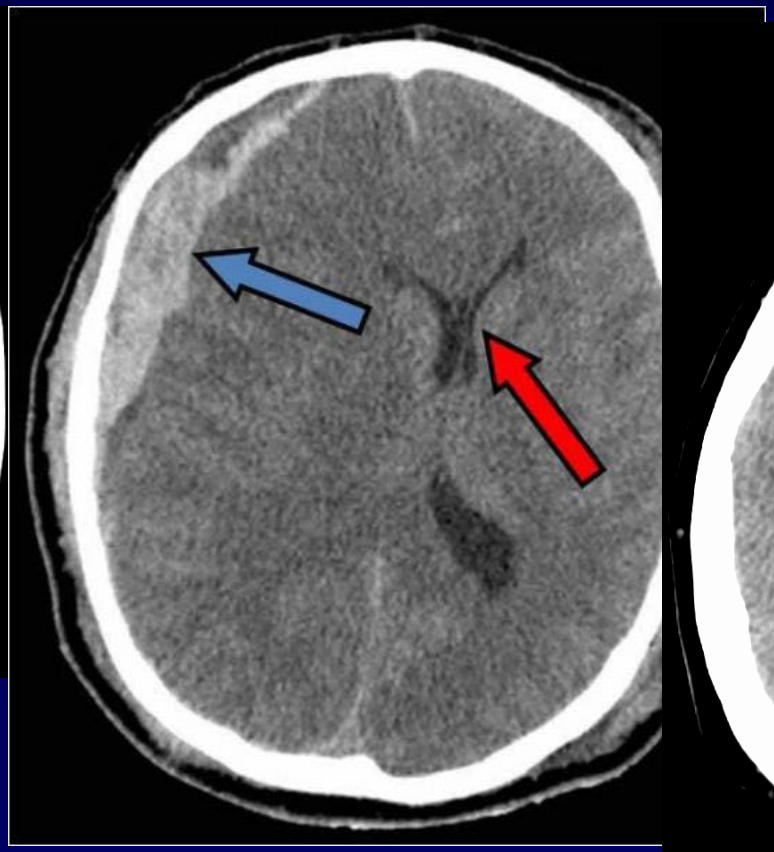
What should this injury make you worry about?

Epidural Hematoma





Subdural Hematoma SDH



CT Scan in Trauma

- Abdominal CT scan visualizes solid organs and vessels well
- CT does NOT see hollow viscus, duodenum, diaphram, or omentum well
- Some recent surgery literature advocates whole body scans on all trauma

Disposition of Trauma Patients

- Dictated by the patient's condition and available resources i.e. trauma team available
  - OR, admit, or transfer
- Transfers should be coordinated efforts
  - Stabilization begun prior to transfer
  - Decompensation should be anticipated

Whats next

- According to the clinical and other data the patient will be taken to **OR, ICU/CCU**
- Trauma is almost always a *Surgical Event*
- Need to go in and mechanically repair
- Damage control surgery ???

“two hit “ hypothesis

- Initial trauma + surgical intervention: 2 hits
- Surgery in posttraumatic period may increase inflammation response
- MODS developement, MOF in 40%

- multiple trauma patients are more likely to die from their intra-operative metabolic failure that from a failure to complete operative repairs

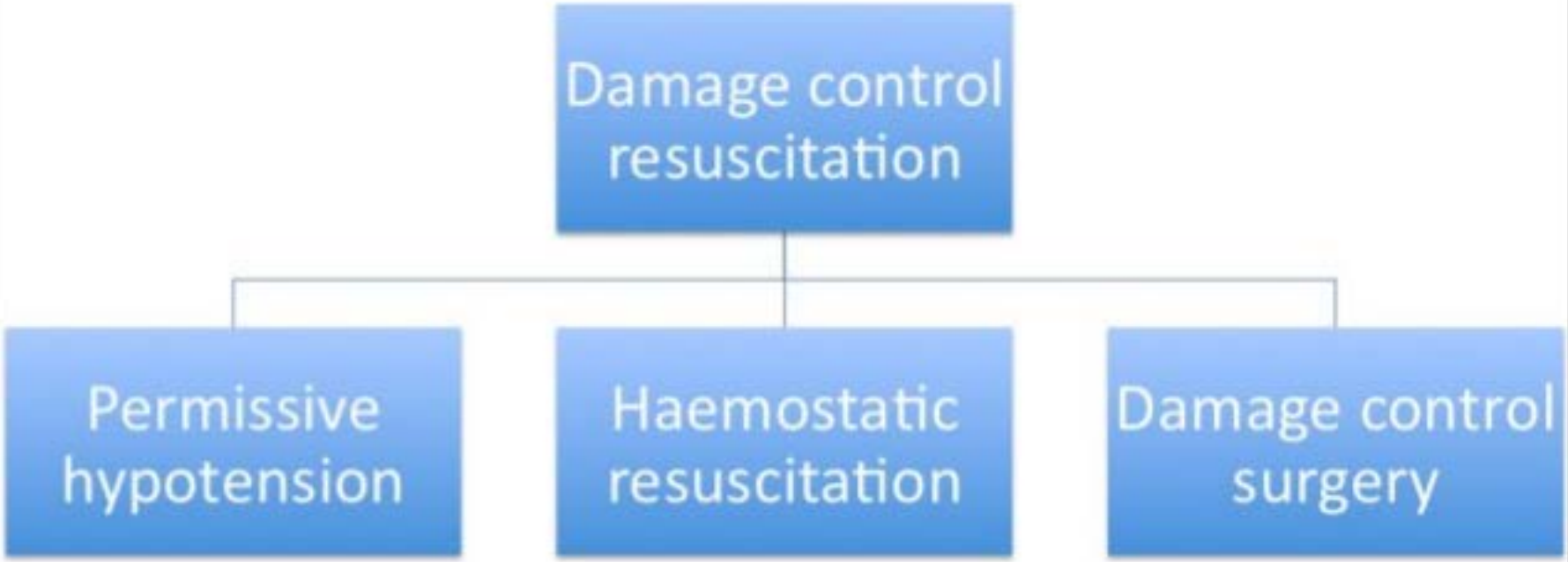
- Traditional approach

Damage control

- patients die from a triad of
- ***coagulopathy,***
- ***hypothermia***
- ***and metabolic acidosis.***
- If so – no control of haemorrhage

- For surviving the operation pacients must be transferred from ICU/CC to OR warmed, filled …, Bc +coag. corrected

Damage Control Surgery


Damage control resuscitation
Permissive hypotension
Haemostatic resuscitation
Damage control surgery

Critical Care Phase

- Initial assessment:
  - Primary, Secondary survey methods
- Continue stabilization
- Complete cleaning (hair, wounds, etc.)
- Complication Prevention
    - » Infection, ARDS, DIC, embolisms, renal failure, compartment syndrome, MSOF, SIRS
- O2 Supply/ Demand balance
- Pain Management
- Communication: Patient and family

Summary

- Trauma is best managed by a team approach (there's no "I" in trauma)
- A thorough primary and secondary survey is key to identify life threatening injuries
- Once a life threatening injury is discovered, intervention should not be delayed
- Disposition is determined by the patient's condition as well as available resources.

Sources

- ATLS Student Course Manuel, 9th edition.
- www.med.unc.edu/emergmed/files/Trauma.ppt
  - http://faculty.ksu.edu.sa/19985/Lectures/Essam11.ppt
- Emergency Medicine A Comprehensive Study Guide, 5th edition.
- www.trauma.org/

Thank you

Abdominal Trauma

- Common source of traumatic injury
- Mechanism is important
  - Bike accident over the handlebars
  - MVC with steering wheel trauma
- High suspicion with tachycardia, hypotension, and abdominal tenderness
- Can be asymptomatic early on
- FAST exam can be early screening tool

Abdominal Trauma

- Look for distension, tenderness, seatbelt marks, penetrating trauma, retroperitoneal ecchymosis
- Be suspicious of free fluid without evidence of solid organ injury

Splenic Injury

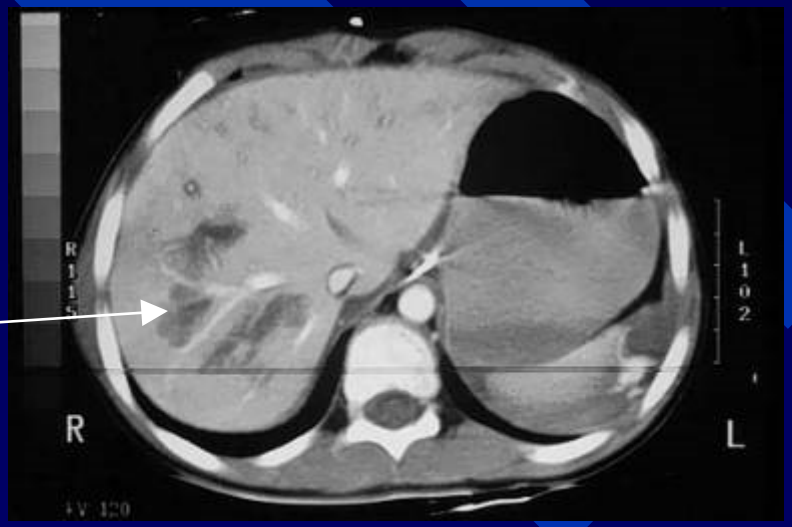
- Most commonly injured organ in blunt trauma
- Often associated with other injuries
- Left lower rib pain may be indicative
- Often can be managed non-operatively

Blood from spleen Tracking around liver

Spleen with surrounding blood

Liver injury

- Second most common solid organ injury
- Can be difficult to manage surgically
- Often associated with other abdominal injuries



What's wrong with this picture?

Trace the Diaphragm Outline. Where is the Diaphragm on the left?

Abdominal contents Up in the chest on the left

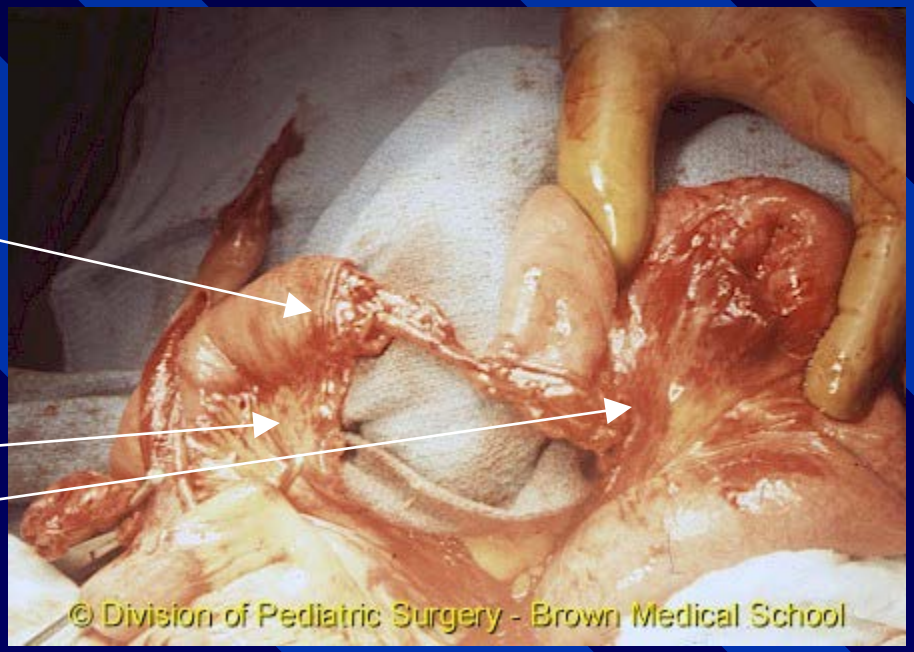
- May only see the nasogastric tube appear to be coiled in the lung.
- Left > right due to liver protection of the diaphragm.

Hollow Viscous Injury

- Injury can involve stomach, bowel, or mesentery
- Symptoms are a result of a combination of blood loss and peritoneal contamination
- Small bowel and colon injuries result most often from penetrating trauma
- Deceleration injuries can result in bucket-handle tears of mesentery
- Free fluid without solid organ injury is a hollow viscus injury until proven otherwise

bowel

mesentery



Mesenteric and bowel injury from blunt abdominal trauma. Notice the bowel and mesenteric disruption.