

TRAUMA OVERVIEW CHEST AND ABDOMINAL TRAUMA

Alison Ruiz, PA-C

Trauma

39% of trauma patients have injuries that are initially missed

22% of these missed injuries are clinically significant



Primary Survey

Airway

- Assess
 - maintain c-spine stabilization
 - Multi-system trauma
 - Assume a c-spine injury
 - Esp if altered mental status
 - or blunt trauma above the clavicle
 - GCS <8 intubate



Primary Survey Continued

Breathing and Ventilation

- Maintain adequate oxygenation
- Expose chest
- Auscultate

Circulation

- Control hemorrhage
 - Maintain adequate end-organ perfusion
- Level of Consciousness
 - Cerebral perfusion may be impaired
- Skin color
 - Hypovolemic patients
 - ashen, gray or have white extremities
- Pulse
 - Access central pulse
 - femoral, carotid
 - bilat for regularity, rate and quality

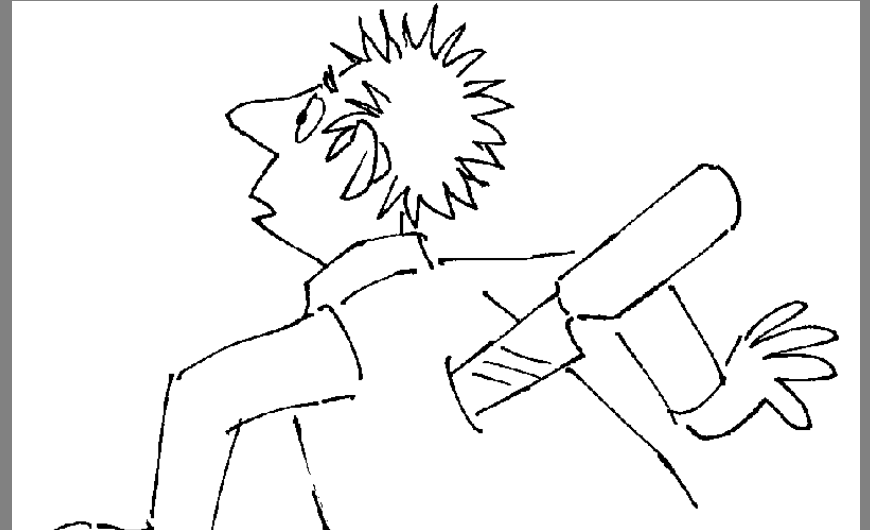
Primary Survey

Disability

- Neurologic evaluation
 - Level of consciousness, PERRL, lateralizing signs and spinal cord injury.

Exposure

- Environmental control
- Undress pt
- Look everywhere for possible injury
 - While preventing hypothermia
 - Warm IV fluids



Resuscitation

Airway

Bleeding Control

IV Replacement of intravascular volume

- Volume replacement is not a substitute for definitive control of hemorrhage.
 - *Hypovolemia is often the cause for shock in trauma*
 - OR, Angioembolization, and Pelvic Stabilization
 - Warm IV fluids 1-2 L

Adjuncts to Resuscitation

EKG

- Dysrhythmias
 - sign of cardiac injury

Urinary and gastric catheters

- Urine output
 - represents volume status and renal perfusion
 - No catheter if suspect urethral injury

Gastric catheters

- reduce the risk of aspiration
 - decompress the stomach

Ventilation rates and ABG levels

- Monitor adequacy of respiration

Adjuncts to Resuscitation

Pulse Oximetry

- Oxygen saturation of hemoglobin
- It does not measure the partial pressure of CO₂ and therefore doesn't tell you the adequacy of ventilation.

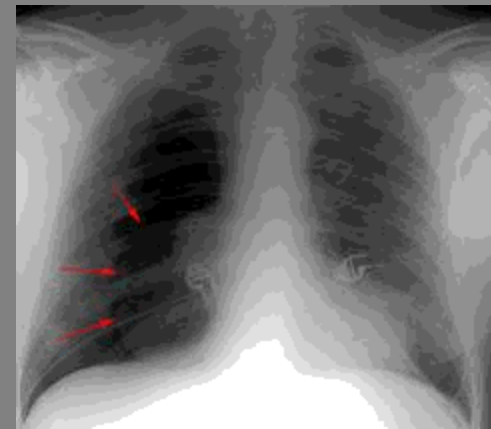
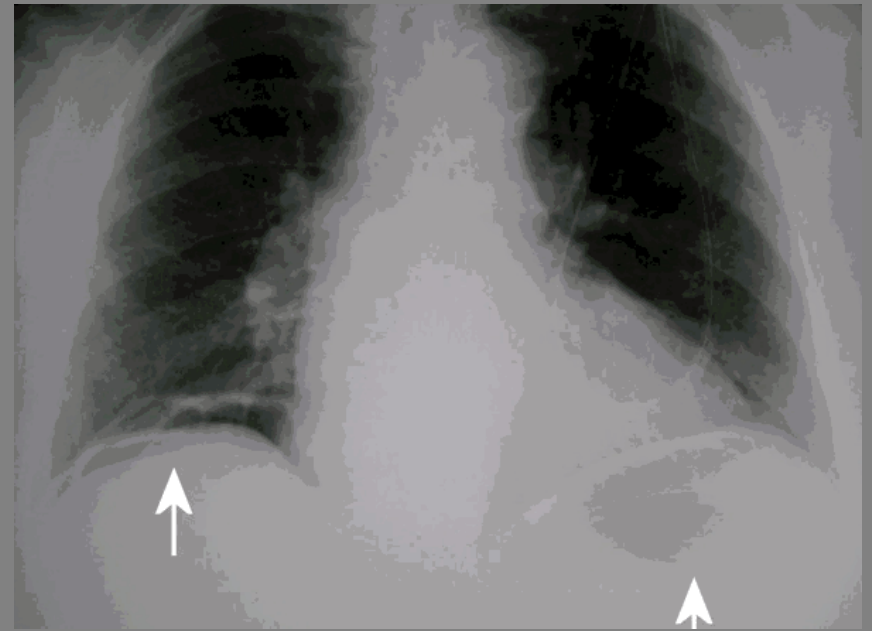
Blood Pressure

DIAGNOSTIC TESTING

Primary Survey

Plain films

- Portable CXR,
- C-spine
- Pelvis
 - Subdiaphragmatic free air
 - Foreign body
 - Pneumothorax/hemothorax.



Focused Assessment For Sonography For Trauma

FAST EXAM

- Pericardial and interperitoneal blood
- Less sensitive to detecting pelvic bleeding



Diagnostic Testing

Peritoneal Lavage

- Where is the pt bleeding from and what is the type of fluid?
 - i.e urine vs blood

EKG

- Potential cardiac injury

Determine If Transfer is
Necessary

SECONDARY EVALUATION

Hemodynamically unstable trauma patient

- Must not be delayed to perform a more detailed secondary evaluation.
- Directly to the OR or angiography suite or transfer trauma center.

Secondary Survey

Starts with head-to-toe exam

- *After patient is stabilized*
- HEENT
 - Maxillofacial structures
- Cervical spine and neck
- Chest
- Abdomen
- Perineum/Rectum/Vagina
- Musculoskeletal
- Neurologic

Targeted diagnostic studies

Commonly Missed Injuries

Blunt abdominal trauma

- Hollow viscus injury, pancreatoduodenal injuries, diaphragmatic rupture

Penetrating abdominal trauma

- Rectal and ureteral injuries

Thoracic trauma

- Aortic injuries, pericardial tamponade, esophageal perforation

Extremity trauma

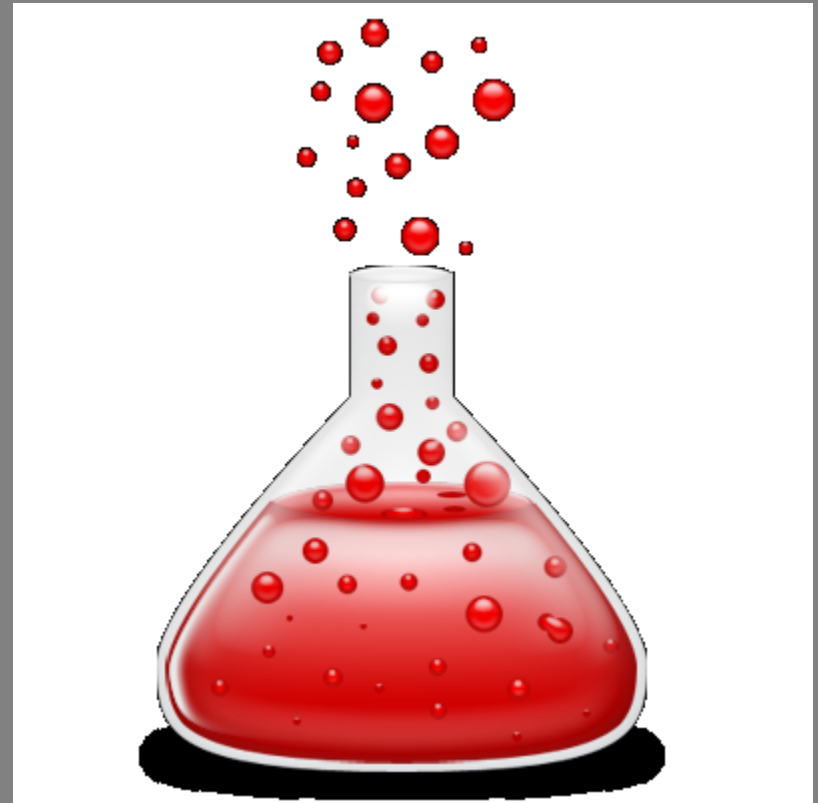
- Fractures
 - Esp in distal extremities, vascular disruption, compartment syndrome

LABS

Use clinical suspicion

Include tests that may alter management.

- i.e UCG in women of childbearing age
- INR on pt on Coumadin



ADDITIONAL IMAGING

Plain films

- xray of the spine, pelvis, extremities etc

CT scan

- “pan scanning” should be reserved for specific types of trauma

Laparoscopy

- most effective for diagnosing peritoneal trauma

ANALGESIA AND SEDATION

Short-acting agents

- Fentanyl
- Midazolam
 - 1-2.5mg IV over at least 2 minutes.
 - >60 years of age
 - 1-1.5mg IV over at least 2 minutes
 - generally preferred to avoid adverse hemodynamic effects.

Re-evaluation

Constant re-evaluation

Watch for deteriorating pt

Monitoring vital signs, urine output

Airway Management-

Signs of Airway Obstruction

Agitation

- hypoxia

Obtunded

- hypercarbia

Cyanosis

- hypoxemia due to inadequate oxygenation

Retractions

Accessory muscle use

- Abnormal breath sounds
 - Noisy breathing, snoring, gurgling, stridor, hoarseness
 - Stridor= upper airway involvement
 - Hoarseness
 - laryngeal obstruction

Is the trachea midline?

Ventilation Management

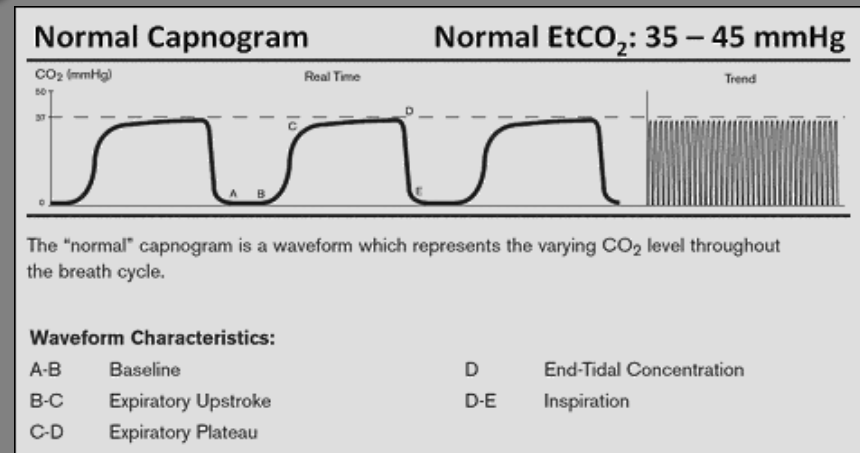
Chest Expansion

- symmetrical

End title CO₂.

Pulse Oximeter

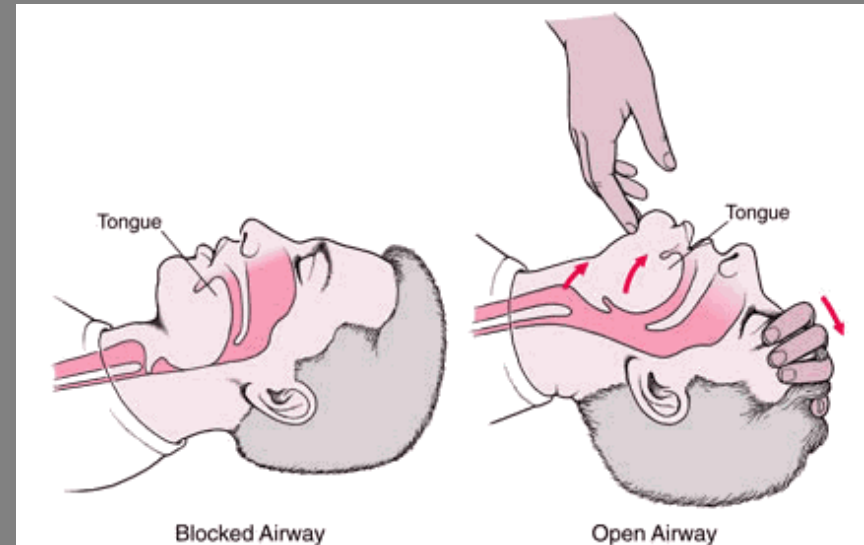
- Measures oxygen saturation and peripheral perfusion.
- does not measure the adequacy of ventilation



Airway Maintenance Techniques

Chin-lift Maneuver

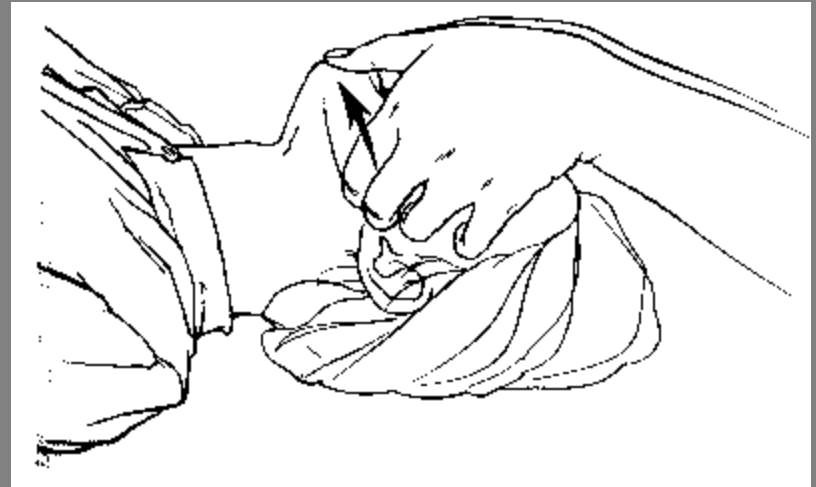
- Fingers of one hand are placed under the mandible
- Gently lifted upward to bring the chin anterior.
- The thumb on the same hand lightly depresses the lower lip to open the mouth.



Airway Maintenance Techniques

Jaw-Thrust Maneuver

- Grasping angles of the lower jaw, one hand on each side and displacing the mandible forward.



Types of Airways

Oropharyngeal Airway

Nasopharyngeal Airway

Laryngeal Mask Airway

Multilumen Esophageal Airway

Laryngeal Tube Airway

Gum Elastic Bougie

Indications for Definitive Airway

Unable to maintain own airway.

Impending or potential compromise

Inability to maintain adequate oxygenation by face mask oxygen supplementation

Airway protection

- Severe maxillofacial fractures
- Risk of aspiration
 - Vomit or blood
- Unconscious
- Risk for obstruction
 - Neck hematoma, laryngeal or tracheal injury, stridor

Indications for Definitive Airway Continued

Ventilation or oxygenation:

- Apnea
- Inadequate respiratory efforts
- Severe, closed head injury
(GSC<8)
- Massive blood loss and need for
volume resuscitation

Case presentation

- 21 y/o male in MVC. Restrained driver going 80 mph on highway hits a patch of ice and rolls over in SUV. Pt c/o chest pain, SOB and back pain. Airbags deploy, Windshield cracks, Car is not drivable
- Pt was extricated from vehicle by EMS
- Boarded and collared and brought to Glenbrook ED
- No trauma team at GB so you work up patient

History

- PMH Denies
- PSH: Denies
- Meds: none
- All: none
- SH: social alcohol use. No drug use

Physical Exam- Primary Survey

- Primary Survey

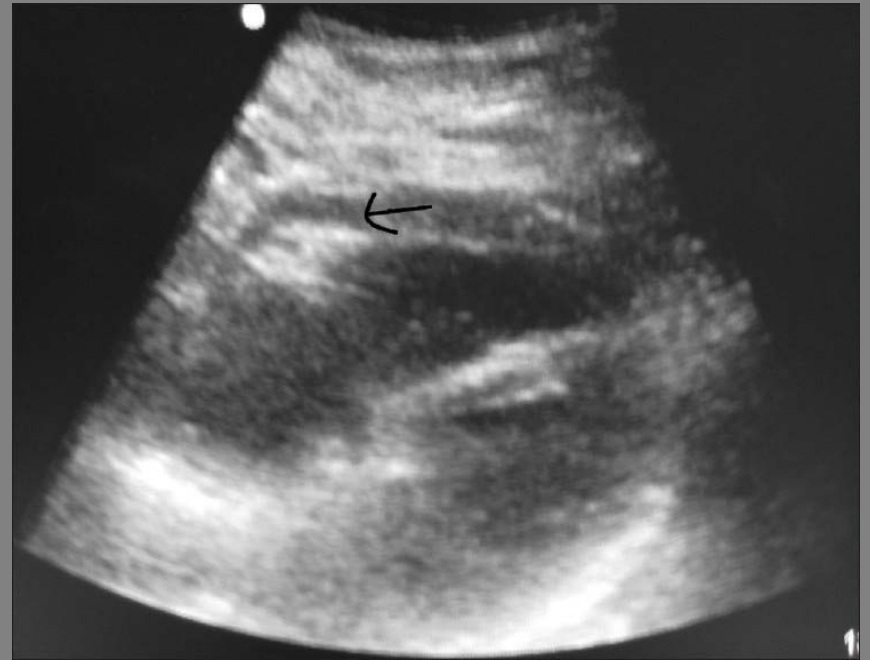
- A&Ox3 Mod Distress
- Vitals
- 98.6 PO, HR 126, BP 180/90, Pulse ox 92%, R 44

- ABCDEs

- HEENT: NCAT
- Neck supple full rom
- Chest: tenderness over sternum and left side of chest anteriorly. Friction rub
- Abd: soft NT ND NABS. No ecchymosis
- Pelvis: nontender. No ecchymosis
- Back: no ecchymosis. Tenderness T spine and L spine
- Skin: warm, pink
- Neuro: intact

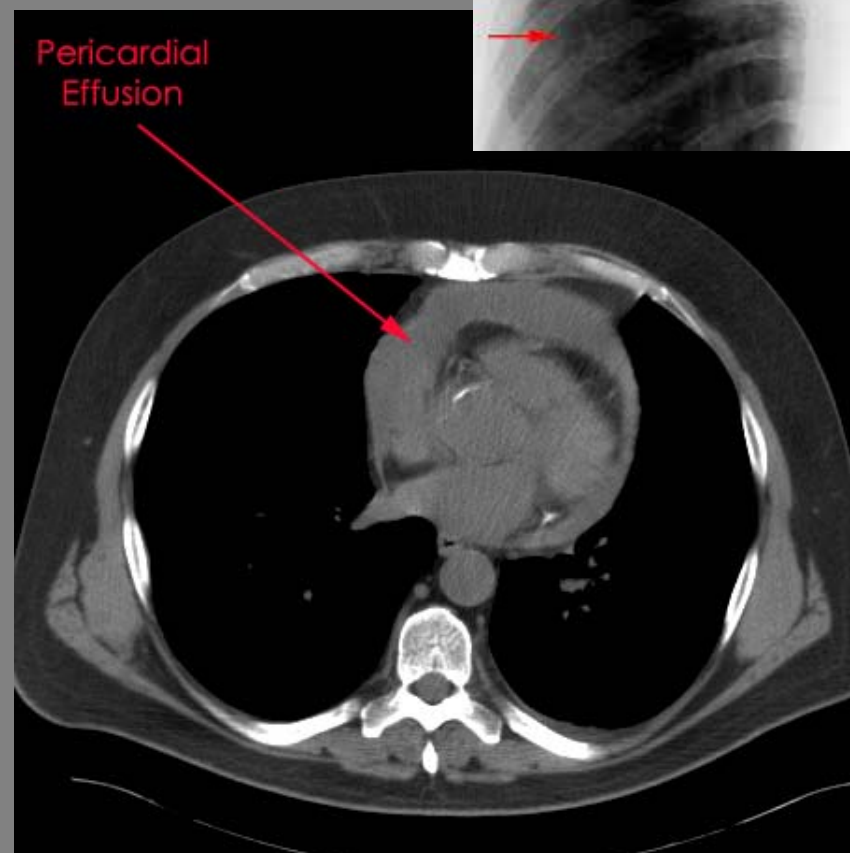
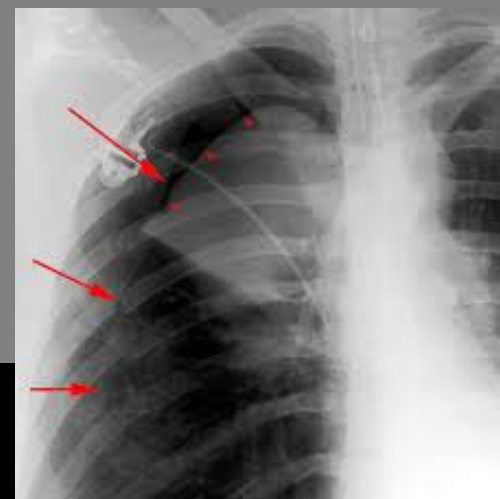
What do you do next?

- FAST EXAM



What is next

- CT
Chest/ABD/PELVIS



Other images

- Likely you would eventually image T spine and L spine in this patient with back pain
- Assess for other musculoskeletal injuries that might require imaging

Work UP

- CBC
- Type and Screen
- BMG
- LFTs
- Amylase
- Lipase
- PT
- PTT
- Urinalysis
- Cardiac Markers
- EKG

Plan of Care

Call Surgery

Chest Tube insertion

Chest Trauma Pathophysiology

Most commonly occur from MVCs

- Followed by falls, assaults and crush injuries.

Deceleration injuries

- Put traction of structures such as aorta or trachea.

Blunt trauma

- Results in penetrating trauma if ribs or clavicle fractures impale thoracic or abdominal viscera

Gun shot wounds (GSW)

Presentation and Physical Findings

Significant pain, splinting and atelectasis.

Rib fractures

- Localized tenderness and pleuritic chest pain, splinting, crepitus and ecchymosis.

Classic sternal fractures

- Present with chest pain, ecchymosis.

Pain is pleuritic.

Presentation and Physical Findings

Primary Survey:

- ABCs
- Life Threatening Emergencies
 - Airway obstruction from clavicle dislocation
 - Deformity of clavicle/stridor
 - Tension pneumothorax
 - JVD, tracheal deviation, unilateral absent breath sounds

Presentation and Physical Findings

Open Pneumothorax

- Resp distress due to sucking chest wound

Flail Chest

- Resp distress, tenderness, crepitus and paradoxical movement

Cardiac Tamponade

- Hypotension and Tachycardia, JVD and becks triad late.

Massive hemothorax

- Resp distress, chest wall injury, diminished breath sounds and dullness to percussion.

Other Diagnoses Presentation and Physical Findings

Rib, Sternum and Scapula Fractures

- 3 or more rib fractures
 - Dramatically increase chance for liver or spleen injury
- Proximal sternal fractures
 - Associated with higher incidence of spinal fractures
 - Seat belts are associated with sternal fractures.
- Fractures of the body of the sternum
 - Associated with higher incidence of pulmonary and cardiac injury
- Scapula fractures
 - High energy mechanism of injury and almost always with associated injuries.

Other Diagnoses Presentation and Physical Findings

Flail Chest

- SOB, crepitus, paradoxical movement of the chest

Pneumothorax and Hemothorax

- Chest pain, diminished bs, crepitus and hyperresonance and mild to mod resp distress

Pulmonary Contusion

- Dyspnea, tachypnea progressing to hemoptysis, cyanosis and hypotension.
- W/R/R

Other Diagnoses Presentation and Physical Findings

Tracheobronchial Injury

- Hoarseness, dysphagia, hemoptysis and dyspnea
- PE reveals: sq emphysema, hypoxia, stridor, pneumothorax or pneumomediastinum

Blunt Cardiac Trauma

- Anginal type chest pain, pleuritic pain.
- PE: listen for gallop rhythms, friction rubs
- Persistent tachycardia, hypotension or dysrhythmia

Other Diagnoses Presentation and Physical Findings

Penetrating chest injury

- GSW, stab wounds
- Becks triad
- May present stable with small wounds to the pericardium
- Will be more panic stricken, severe respiratory distress if more significant trauma

Great Vessel Injury

- Interscapular or retrosternal pain
- Decreased blood pressure in the left arm, UE hypertension with absent femoral pulses, bruit, and systolic murmur

Labs/Imaging

Rib Fractures

- AP chest and rib x-rays.

Scapula Fractures

- CXR and shoulder x-ra

Sternum Fractures

- sternal x-ray

+/- CT Chest

Labs/Imaging

Flail Chest

- CT chest

Pneumothorax and Hemothorax

- CXR
- Chest CT if necessary

Pulmonary Contusion

- CXR/CT chest
- EKG

Treacheobronchial Injury

- CXR/CT chest
- EKG

Labs/Imaging

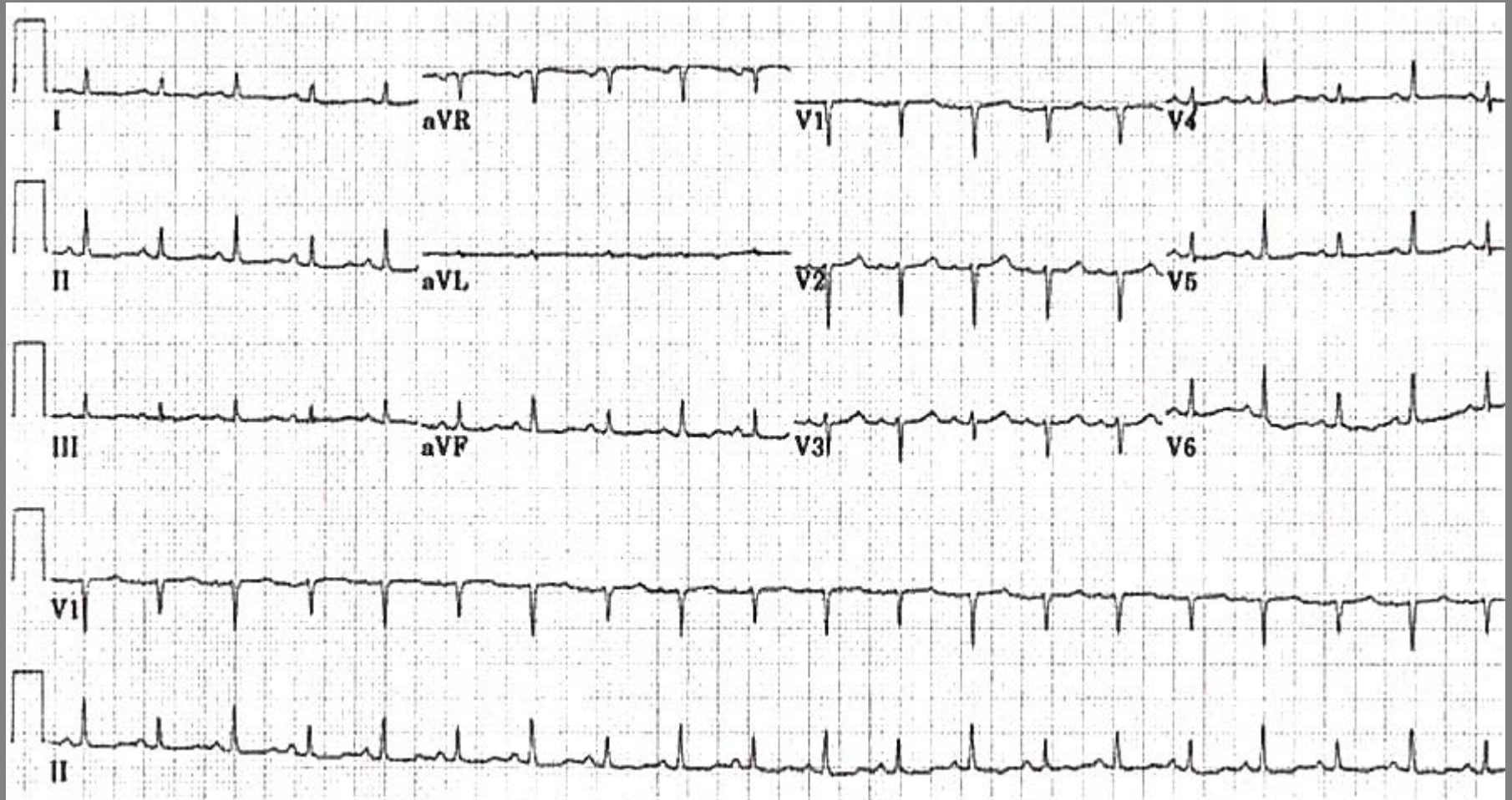
Blunt Cardiac Trauma

- EKG
- CT chest
- Cardiac Markers
 - Only if there is an ischemic pattern on EKG.
- Emergent Echocardiogram in the unstable patient.

Penetrating chest injury

- EKG
 - Pericardial tamponade, electrical alternans
- CXR

Electrical Alternans



Labs/Imaging

Great Vessel Injury

- CXR
 - Mediastinal widening, obscured aortic knob, loss of the AP window, displaced NG tube, widened paratracheal stripe, widened paraspinal interface, depression of the left mainstem bronchus, left hemothorax, left apical pleural cap, deviation of the trachea to the rt, and multiple rib fractures
- CT Chest can r/o traumatic aortic injury

Treatment

Ortho Consult

Fractures

- RICE

Rib Fractures

- Pain control.
- No binding devices
- 10 deep breaths per hour/incentive spirometer

Scapular Fracture

- sling

Displaced fractures require ortho consult with possible surgical repair

Treatment

Flail Chest

- Oxygenate

Pneumothorax and Hemothorax

- Chest tube placed in the 4th or 5th intercostal space, just anterior to the midaxillary line.
- Observation and aspiration of an asymptomatic pneumothorax may be appropriate

Pulmonary Contusion

- Admission to ICU
- Require observation because respiratory failure can be subtle and develop over time

Treatment

Treacheobronchial Injury

- May require surgical repair
- Most die on the scene of accident

Blunt Cardiac Trauma

- Unstable require airway control, IJ insertion for fluid resuscitation and admit to ICU
- Admit if have any form of cardiac contusion

Treatment

Penetrating chest injury

- Trauma team
- Possible thoracotomy in ED
- Immediate operative repair

Great Vessel Injury

- Early orotracheal intubation is required because of possibility of expanding hematoma making intubation impossible later
- Operative repair

Case Presentation

- 28 y/o M boating on Lake Michigan and fell out of the boat. Sustained blunt force trauma to the chest and abdomen from sail boat passing by.
 - c/o abdominal pain RUQ more than LUQ, back pain
- What else would you like to know about this patient?
- Call a trauma based on history
 - if you are at a level 1 trauma center

History

- PMH: denies
- PSH: Appendectomy
- Meds: Prilosec
- All: NKDA
- SH: 5-7 drinks per week, no drug use, nonsmoker
- FH: not significant

Physical Exam- Primary Survey

- Primary Survey

- A&Ox3 Mod Distress
- Vitals
- 98.6 PO, HR 115, BP 103/60, Pulse ox 97%, R 40

- ABCDEs

- Airway intact- speaking in full sentences
- HEENT: NCAT
- Neck supple full rom
- Chest: nontender. No ecchymosis
- Abd: ecchymosis to the mid abdomen. Tenderness RUQ and LUQ
- Pelvis: nontender
- Back: no ecchymosis
- Skin: warm, pink
- Neuro: intact

Physical Exam- Primary Survey

- HEENT
 - PERRL EOMi, NCAT
 - TMs: no hemotympanum
- Neck
 - Supple full rom, nontender
- Lungs
 - CTA bilat. No W/R/R
- Chest
 - No ecchymosis, sts, tenderness, symmetrical chest expansion
 - RRR S1s2
- Abd
 - Soft tenderness diffusely in the upper abdomen
 - Positive ecchymosis to the mid abdomen
- Back
 - tenderness over the paraspinal lumbar region
 - No CVAT
- Ext/Neuro
 - NT full rom of all 4 extremities
 - Nvi
 - Sensation intact bilat UE and LE
- Skin
 - Warm and pink

What is next?

- FAST EXAM



Other Imaging

- CT chest and abdomen/pelvis with IV contrast



Figure 1 - Image from CT scan showing a grossly abnormal spleen with a large amount of free fluid in the abdominal cavity

Labs

- CBC
- Type and Screen
- BMG
- LFTs
- Amylase
- Lipase
- PT
- PTT
- Urinalysis
- Cardiac markers
- EKG

What do you do next?

- OR

Abdominal Trauma

Pathophysiology

Blunt force to the abdomen

- Solid organs are particularly susceptible
- Elderly and Alcoholic patients have lax abdominal walls and are more susceptible to injury
- Deceleration forces can shear/lacerate solid and hollow organs. There may be tears at the vascular pedicles causing organ infarct.

Fractured ribs and pelvic bones can lead to lacerations of organs.

Historical Questions to Ask in Blunt Abdominal Trauma

Fatality at the scene

Vehicle type and velocity

Whether the vehicle rolled over

Patient's location within the vehicle

Extent of intrusion into the passenger compartment

Extent of damage to the vehicle

Steering wheel deformity

Restrained? Lab belt/shoulder harness

Presentation/Physical Exam

Accuracy of the PE in blunt abdominal trauma (BAT) is only 55% to 65%

- The absence of physical findings does NOT preclude serious pathology
- Up to 10% of patients with apparently isolated head injury may have concomitant intra-abdominal injuries.
- 7% of blunt trauma patients with distracting extraabdominal injuries have an abdominal injury despite the absence of abdominal pain or tenderness.

Presentation and Physical Exam

Alert patients without distracting injuries

- pain, tenderness and peritoneal symptoms.

Absence of tenderness in an awake, stable patient indicates injury is highly unlikely.

Hypotension

- think solid organ hemorrhage

Presentation and PE Continued

+/-Signs

- Abdominal wall ecchymosis, Abdominal distention, and decreased bowel sounds

Seat belt sign

- Indicates abdominal injury in 1/3 of patients

Rectal exam

- Blood or subq emphysema which correlate with abdominal injury

Vaginal exam

- Lacerations may occur because of bony pelvic fragments

Specific Diagnoses

Diaphragm Injuries

- Typically involves the left hemidiaphragm
- May see blurring of the hemidiaphragm, hemothorax or abnormal gas shadow

Duodenal Injuries

Pancreatic Injuries

GU injuries (see below)

Small Bowel Injuries

Solid Organ Injuries

Pelvic Fractures and assoc Injuries (see below)

Labs

Type and Screen

Hematocrit

- Serial is best to make comparison

LFTS

- Elevated transaminase levels
- Doesn't distinguish contusions from severe injury

Amylase and Lipase

- Elevation may suggest pancreatic injury, but normal levels do not exclude injury

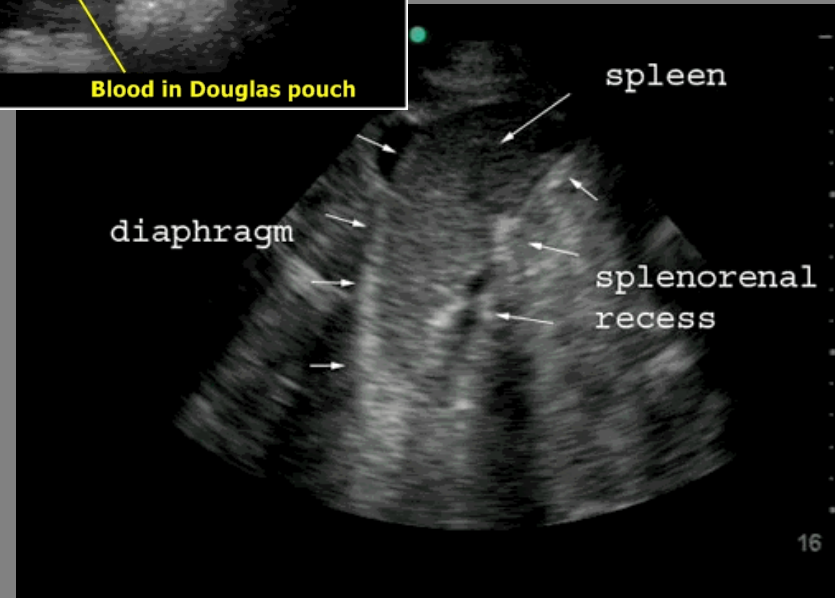
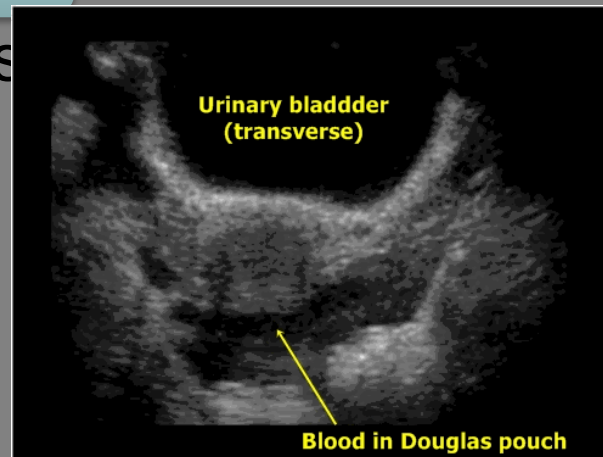
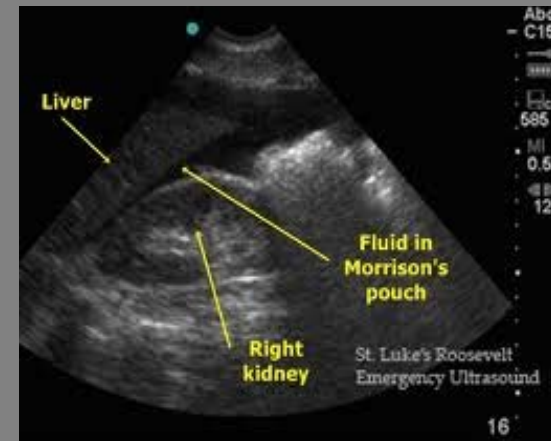
Urinalysis

- Look for microscopic hematuria indicating renal injury

Imaging

Fast Scan

- Look for blood in spaces where it is likely to accumulate
 - Hepatorenal space (Morrison's pouch),
 - Splenorenal recess
 - Inferior portion of the intraperitoneal cavity (including pouch of Douglas).



Imaging Continued

CT is used in the hemodynamically stable patient.

- IV contrast only
- Suboptimal sensitivity for pancreatic, diaphragmatic, bowel, and mesentery injury

Imaging Continued

Angiography

- Beneficial for pts with unstable pelvic fractures
- Can be used to embolize bleeding vessels, manage bleeding from solid organs or assess pedicle injuries of the kidney

Peritoneal Lavage is used less since the advancements of US

Treatment

Laparotomy

- If unexplained signs of blood loss, hypotension
- Pneumoperitoneum
 - Signs of viscus rupture
- Diaphragmatic Rupture
- Significant GI bleeding persisting

Transfer to trauma center if necessary