Chest & Abdomen Trauma: Understanding & Responding Appropriately

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Potentially Life Threatening Chest Injuries

- Tracheo-bronchial rupture/laceration
- open pneumothorax
- tension pneumothorax
- hemothorax
- flail chest
- cardiac tamponade
- aortic rupture
• Actual airway damage
  ◦ 80% involve mainstem bronchus
  ◦ 15% trachea,
  ◦ 5% distal bronchus
  ◦ Usually within 2.5 cm of carina
  ◦ Air escapes into the thoracic cavity
  ◦ mortality up to 30% usu. Within 1st hour
• Caused by penetrating or blunt mechanism

Tracheobronchial Injury
• #1 = Anterior (#2)
• #2 = Middle (#3)
• #3 = Posterior (#4)
• Side view: #1 = Superior
• Must be considered in all patients
  ◦ with penetrating injuries of the lower neck or upper chest
  ◦ AND any patient with evidence of violent blunt injury to the chest

Tracheobronchial Injury
Tracheobronchial Injury

- 2 groups:
  - Free communication of injury with pleural space
  - Injury confined to peribronchial connective tissue sheath (more subtle symptoms: minimal pneumo or emphysema)
• Hoarse voice
• Severe respiratory distress
• Stridor
• Cyanosis
• Subcutaneous emphysema (cervical or mediastinal)
• Decreased/unequal/absent breath sounds
• Hemoptysis
• Shock
Field Treatment

- **Airway control**
  - Maintain spinal immobilization
- **IVs en route**
- **Controlled airway**
  - Closest trauma center
- **Uncontrolled airway**
  - Closest facility/EDAP
  - Needle cricothyrotomy ...?
Pneumothorax: Open & Closed
• Caused by penetrating or blunt mechanism
• *Hole in chest wall*
• *allows air to move freely in and out of the pleural space*
• **Negative pressure is lost** in Pleural Space
  ◦ causes lungs to passively collapse
• Lung tissue usually remains intact

Open Pneumothorax “Sucking Chest Wound”
• Sucking sound or “bubbling” at wound site on inspiration
  ◦ possible bubbling on expiration
• Dyspnea/tachypnea
• Decreased breath sounds on affected side
• Unequal chest rise and fall
• Possible subcutaneous air
• Skins and vital signs reflect poor perfusion

Signs and Symptoms
• O2, monitor,
• IVs en route
• Spinal immobilization as indicated
• Three-sided occlusive dressing
• Rapid transport

• In ED: Chest tube will be placed.

Field Treatment
• Observe for signs and symptoms of tension pneumothorax (open pneumo can deteriorate)

• If tension pneumothorax develops: remove occlusive dressing &... prepare for emergent needle thoracostomy
• Blunt or penetrating mechanism
• Injury perforates chest wall and/or pleural space

• Air becomes trapped in the pleural space as it enters with each breath
  ◦ air cannot escape
  ◦ space enlarges
  ◦ lung collapses
  ◦ pressure builds
- Pressure builds pushing mediastinum to the opposite side
- Pressure is put on heart & unaffected lung and.. will eventually kink the vena cava and deviate the trachea
- Results in decreased right heart return, and thus decreased cardiac output, decreased BP

**Tension Pneumothorax**
Tension Pneumo Deterioration
Tension Pneumothorax
• Unequal lung sounds
  ◦ decreased or absent on affected side
• **Progressive** respiratory distress
• Accessory muscle use
• Dyspnea
• May note subcutaneous air in upper chest wall
• **Signs of poor perfusion**
• Possibly decreased compliance with BVM
Late Signs and Symptoms

- JVD
- Tracheal deviation
Field Treatment

- High flow oxygen/intubate prn
- Immediate Needle Thoracostomy on affected side
- Remove occlusive dressings
- Spinal immobilization
- Two large IVs en route/fluid resuscitate
- Rapid transport
- Shock position as tolerable
Needle decompresses pleural space

- Converts **tension** pneumothorax to **open** pneumothorax

Complications
- hemo/pneumothorax
- laceration of intercostal nerves/blood vessels
- infection

Needle Thoracostomy
• 2nd intercostal space  
• Mid clavicular line (2nd ICS, MCL)  
**On the affected side**  
• Large bore catheter: 14 ga. or larger  
  ○ with one-way flutter valve  
• Inserted perpendicular to chest wall  
• “Walk” the needle over the top 3rd rib
Note N. thoracostomy placement
- Listen for pop/rush of air
- May get some bubbles of blood
- Remove needle from catheter and take off syringe attach **flutter valve**
- Secure cannula with 4x4s and tape
- Immediate remove & apply pressure if punctured a spurting blood vessel

**Needle Thoracostomy Stabilization**
Heimlich valve & its function
Needle Thoracostomy Kit example
Questions...?
- Blood accumulates in pleural cavity
- Caused from injury to heart, great vessels, or intercostal arteries
- Will get Thoracotomy (cracked chest) in ED if blood loss through chest tube is greater than 2 to 4 ml / kg / hour

**Hemothorax**
from blunt or penetrating trauma
Hemothorax
- May be difficult to distinguish if significant hemothorax
- Both present with...
  - signs of poor perfusion and unequal breath sounds
- More common to see hypotension before respiratory distress
- Usually pleural space fills with air and blood

**Tension Pneumothorax vs. Hemothorax**
• Accumulation of blood **into pericardial sac** that surrounds heart
• Blood in sac **reduces chamber filling**
• Pressure backs up and results in decreased right heart return and thus decreased stroke volume and decreased cardiac output

Cardiac Tamponade
*Caused by blunt or penetrating mechanism*
Becks Triad

Characteristic of Cardiac Tamponade

- Hypotension (narrowed pulse pressure)
- JVD
- Muffled, distant heart sounds
- Patient will also display...
- Tachycardia
- Dyspnea
- Poor skin vitals
- Trauma field treatment
- Pericardiocentesis
- to be performed in ED
Both present with
- signs of poor perfusion
Both have chest trauma
Difference is breath sounds
- tension pnemo=unequal BS
- C. tamponade=equal BS

Tension Pnemothorax vs. Cardiac Tamponade
Questions...?
• Usually from a rapid deceleration mechanism
  ◦ Motor Vehicle Accidents
  ◦ falls
  ◦ crush injury
• Usual site: the distal aortic arch just beyond left subclavian artery takeoff where it is firmly tethered

Aortic Rupture
• **Massive hemorrhage within few minutes**
  ◦ severe injury; Rapid Deceleration Shearing
  ◦ 80-90% fatality rate within 1st hour

• Most common cause of Sudden Death post MVC

• Estimated that 1:6 who die in MVA’s sustain an aortic rupture

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**Aortic Rupture**
Abb. 5.67

Aus: B. N. Tillmann, Atlas der Anatomie des Menschen
Kapitel 5: Situs – Brustsitus

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• Chest pain
• Dyspnea
• May have...
• no obvious signs of chest trauma

(\textit{up to 50\%})

Signs/Symptoms
• Hi-flow O2
• Support airway as needed
• cardiac monitoring
• spinal precautions
• shock position
• IVs (x2) en route
• fluid resuscitate (500 cc) with s/o shock
• Keep Warm (maintain body temperature)

Trauma Field Treatment
2 or more rib fractures in at least 2 places

- **Paradoxical motion** of flail segment

- Segment moves:
  - **in** on **inspiration**
  - (Normal is **out** on **Insp.**)

- **out** on **expiration**
  - (Normal is **in** on **Exp.**)

**Flail Chest**
• Risk for pneumothorax from fractured rib

• Signs and Symptoms:
  ◦ dyspnea/tachypnea
  ◦ localized chest pain
  ◦ may have palpable crepitus
  ◦ s/o poor perfusion from poor oxygen exchange

• Massive force needed to cause injury
  ◦ think about other injuries

• (4-10) (8-12) (1-2)

Flail chest
Treatment for flail chest

- High flow oxygen/IVs en route/monitor
- Stabilize flail segment with bulky taped dressing
- IVs en route
Diaphragmatic Rupture

- Diaphragm separates abdominal and thoracic cavity
- Abdominal contents rupture through thin diaphragm wall and enter chest cavity
  - from sharp increase in intra-abdominal pressure
- L>R side from liver protection
Signs and Symptoms of Diaphragmatic Rupture

- Restricted lung ventilation
- Decreased venous return
- Dyspnea & hypotension ensues
- May c/o abdominal pain
- Bowel sounds heard in chest
- Multiple injuries usually involved
- Historically < 5% of blunt trauma
• 80 – 90% occur from MVC’s

• Lateral Impact 3x more likely to cause rupture. “T-Boned”

• **Postero-lateral aspect** of Diaphragm is its embryologic weak point.

• (L)>(R) rupture likely from (R) liver protection (80-90% occur on (L) side)

• Preoperatively Dx’d in only 40-50% for (L)
• Results from severe crushing injury to chest and abdomen

• Rapid increased intra-thoracic pressure

• Blood forced into veins of upper thorax, neck and face

• Results in reddish-purple discoloration of face and neck, JVD, conjunctival hemorrhage

Traumatic Asphyxia
Traumatic Asphyxia
Pulmonary Contusion

- Rapid deceleration forces most common
- Hemoptysis from hemorrhaging alveoli
- Pulmonary edema ensues
- Injury to actual Lung Parenchyma.
Among the **most common** result of Blunt Force Trauma along with rib fractures & pneumothorax (Think: Airbags!)

- Occurs in 17% of multiple trauma patients
- **A form of hematoma to lung tissue.**
- Mortality 6 – 25% due to superimposed pneumonia, ARDS, embolic blood clots

**Pulmonary Contusion**
Myocardial Contusion

- Common steering wheel injury (now Airbags)
- Heart compresses b/w sternum and vertebra
- Edema can result from ruptured capillaries and damaged heart muscle
• Can range from minor to MI
• May be asymptomatic up to 8 hrs
• Can present in cardiogenic shock
• May occur with cardiac tamponade
• Need to assume contusion with significant blunt chest trauma

• Adequate paramedic report of mechanism essential

Myocardial Contusion Presentations
• Can present similar to angina/MI
• Dyspnea: Ronchi, Wheezes, Hemoptysis
• Palpitations
• Possible dysrhythmias
• Obvious chest trauma, or NOT!
• Treatment may include Amiodarone for Ventricular Tachydysrhythmias

S/S Myocardial Contusion
Abdominal Trauma
Understanding Injury of Solid versus Hollow organs
Solid Organs

- Very vascular
- Bleed out rapidly
- Can be punctured, lacerated, ruptured
Hollow Organs

- Usually contain fluids
- Fluids can spill into abdominal cavity after injury
- Causes peritonitis and sepsis
- Can rupture if full
  - water balloon effect
• Rigid abdomen
• Distended abdomen
• Abdominal guarding
• Kerr’s sign
  ◦ pain referred to left shoulder from splenic injury
• Or, soft, round, with minimal tenderness!!

Signs/Symptoms of BAT
Abdomen regions: What’s Involved
Intrathoracic Abdomen:
- upper abdomen that lies beneath the rib cage
  (the ribcage makes complete abdomen exam difficult)
  - Diaphragm
  - Liver
  - Spleen
  - Stomach

The “4” Abdomens
• Contains the intestines, Small & Large
• (with highly omentum!)
• The Uterus when gravid
• The bladder when distended, full
• Perforation in this area is associated with significant physical findings, pain & tenderness from peritonitis

The “True” Abdomen
• This area is “behind the guts”
• Problems here are difficult to diagnose by physical exam alone
  ◦ Kidneys
  ◦ Adrenal glands
  ◦ Ureters
  ◦ Pancreas
  ◦ Aorta
  ◦ Vena Cava

The “Retroperitoneal” Abdomen
The bony pelvis
- Urinary bladder
- Urethra
- Rectum
- Some small intestine
- Ovaries, Fallopian tubes
- Uterus

You can lose 50% of blood volume here!

The “Pelvic” Abdomen
Female Pelvis

Male Pelvis

“Pelvic” Abdomen
- Cover with moist, sterile dressing
- Place patient supine with knees slightly flexed
- Placing contents back inside Abdominal Cavity is contra-indicated.

**Evisceration**
• Collisions by the injured person & the external environment results in sudden, massive increased intra-abdominal pressure. (external compression)

• Next, acceleration & deceleration forces directly affect the organs ... and the bony body (create shear forces at fixed points of organ attachment)

Be guided by mechanisms & associated forces
• Also, a crushing effect on intra-abdominal organs lying between the vertebral column & abdominal wall (solid viscera particularly vulnerable)

And Thirdly....
Don’t let the findings fool you
Although exam appears normal
  ◦ Soft, nontender, nondistended

**Bleeding still may occur within the abdomen despite a normal exam**
Also distracting injuries, abdominal Wall spasms, AMS, Intoxication all confuse the exam.

Physical exam can be... notoriously unreliable!
• Remember: Trauma patients with complaints of diffuse abdominal trauma go to a trauma center
• Diffuse abdominal trauma is defined as pain in two or more of the four abdominal quadrants
• The four quadrants of the abdomen are:
  ◦ RUQ, LUQ, RLQ, LLQ
Consider Pain Management
• Patients who have an isolated traumatic extremity injury, burn, fractured hip, or chief complaint of pain.

• Caution with:
  - Head injuries
  - Multi-system trauma
  - Labor
  - Abdominal pain
  - Elderly

Who Should Receive Pain Medication
Adults:
- IV Dosage : 2-10 mg slow IVP titrated to pain relief. May repeat to a max dose of 20mg.
- IM Dosage : 10mg IM one time dose.

IV is the recommended route.

**If unable to start an IV or patient does not require IV, IM is an option.**
Any Questions?
Thanks for Listening