Cardiothoracic Trauma

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Thoracic Trauma: Introduction

Approximately 20% of all trauma patients sustain injury to the thorax

Guidelines promoted by the Advanced Trauma Life Support (ATLS) remain the best approach to the care of the injured patients.
Airway, Breathing, Circulation

Thoracic Trauma

Chest Wall Injuries
Pulmonary Injuries
Tracheal/Bronchial Injuries
Esophageal Injuries
Diaphragm Injuries
Cardiac/Great Vessel Injuries
Chest Wall Injuries

Rib Fractures

- Most common thoracic injury
- Underestimates severity of intrathoracic injury in children
- First rib fractures: r/o brachial plexus, arterial, venous injury
- Aggressive pain management.
  - Local Rib Blocks
  - Infusion Catheters
  - Epidural analgesia

Eastern Association of the Surgery of Trauma (EAST)
Practice management guidelines for pain management in blunt thoracic trauma

Level I: Epidural Anesthesia is effective
Level II: Thoracic epidurals should be placed for patients >65 years with four or more rib fractures (when not contraindicated), and considered in younger patients with the same injuries

Incentive spirometry is useful in predicting mortality and in determining adequate pain control. IS goal >15mL/kg

Flail Chest

- Respiratory Failure
  - Paradoxical movement of the chest
  - Severe Pain
  - Underlying Pulmonary Contusion
- May require mechanical ventilation for “pneumatic stabilization”.
- Consider early tracheostomy
- Surgical Stabilization?

Historical Flail Segment Stabilization
Open Stabilization

Absorbable Plates for Rib Fracture Repair: Preliminary Experience
J. Mayberry, J. Terhes, T. Ellis, S. Wanek, D. Walls
Department of Surgery, Oregon Health & Science University, Portland, Oregon

10 patient case series of rib fracture fixation using absorbable plates and screws

Indication included flail chest with failure to wean (5 patients), acute pain with instability (4 patients), and chest wall defect (1 patient).

All patients showed rapid vent wean and recovery.

Note: Screw fixation alone resulted in excessive loss of rib fracture reduction.

Chest Wall Defect
Case Report: 15 y/o boy struck left chest with bar during skateboarding crash.
Repaired with absorbable plates under thoracoscopic guidance.

Left chest wall defect from skateboard crash.
Penetrating Chest Wall Injuries

High velocity missiles and shotgun wounds can produce extensive open wounds requiring immediate occlusion and intubation followed by operative repair.

Sternal and Scapular Fractures

- Typically treated conservatively
- Strong indicator of severe force injury
- High incidence of associated injuries
  - blunt aortic
  - cardiac
  - pulmonary

Penetrating Chest Wall Injuries

Low velocity foreign body injuries

Initial Stabilization

Creative management of large open wounds
**Pulmonary Injuries**

**Pulmonary Contusion**

- Occurs to a varying degree in all thoracic injuries – worsens over the first 24-48 hours
- Alveolar hemorrhage and edema, causing significant hypoventilation, hypoxia and shunting

**Goals of management**

- Pain control
- Judicious fluid administration
- Careful hemodynamic monitoring
- Aggressive pulmonary toilet

**Pneumothorax**

- All traumatic pneumothoraces should be managed with prompt decompression!

- Needle Thoracostomy
- Tube Thoracostomy
**Hemothorax**

Early Tube Thoracostomy drainage to prevent clot formation and incomplete evacuation.

Surgical exploration
- Hemodynamically unstable patients who are not responsive to resuscitation
  - >1,500mL of blood initially
  - >200-300mL/hr x 4 hrs

Clotted hemothorax should be evacuated early by thoracotomy to improve pulmonary function and prevent late fibrothorax.

**Penetrating Pulmonary Injuries**

80% of penetrating wounds only require chest tube insertion

Parenchymal injuries requiring operation can usually be oversewn

A large vascular clamp placed across the lung hilum facilitates exploration and vessel repair.

**Pulmonary Tractotomy**

Diagram of lung tractotomy procedure.
Tracheal/Bronchial Injuries

Most are cervical

Urgent surgical airway indicated if unable to safely pass ET tube

Primary repair

Blunt trauma typically causes circumferential laceration of either main bronchus

Pneumomediastinum

Hamman's crunch

CXR, CT neck/chest/abd, triple endoscopy, contrast enhanced fluoroscopy

Small leaks: npo/abx/restudy in 5-7 days

OR for trach/bronch disruptions greater than 1/3 circ of airway, progressive, or PTFs.
Penetrating Base of Neck Injuries

Close proximity of major structures make injury highly probable

Surgical approaches will vary...

Tracheal/Bronchial Injuries

Treatment

Early recognition and stabilization

Immediate intubation with flexible bronchoscope assistance.

Selective right/left mainstem intubation to exclude the injury

Expedited right thoracotomy, sternotomy, or collar incision approach

Direct repair with interrupted, absorbable suture.

Tracheal/Bronchial Repair - Approaches

Right Thoracotomy approach to distal tracheal injury.
Penetrating Base of Neck Injuries Imaging
Assess with angiography, contrast swallow, endoscopy, or surgical exploration
ABC's!

Exposure of Ascending Aorta & Right Carotid Artery

Sternotomy With Extension Laterally for Right Subclavian Artery Exposure
Esophageal Injuries

Blunt Injury is Rare; endoscopic perforation, Boerhaave’s.

Mediastinitis is a lethal complication requiring early surgical intervention

Diagnosis:
- Cervical and mediastinal air
- Widened mediastinum
- Pleural Effusion

Esophageal Injury - Repair

Definitive diagnosis with contrast esophagram and endoscopy.

Management based on degree of injury
- Mild: Nonsurgical Management: NPO, TPN, PPI, Abx
- Moderate: VATS Exploration, drainage
- Severe: primary repair vs diversion

Esophagus should be closed in two layers, mediastinum widely opened, and posterior thoracic space drained into the pleural space via thoracotomy
Diaphragm Injuries

Diaphragm Injury
Most lacerations occur on the left hemidiaphragm and result from automobile accidents.

Can be repaired through the chest or abdomen.

Delayed repairs typically require both thoracic and abdominal incisions.

Diaphragm Rupture
Usually, the stomach herniates and undergoes volvulus, massively dilates, and causes left lung collapse.
Cardiac Injuries

Myocardial Contusion

ECG
- Commonly Sinus tach, Afib, BBB, ST changes
- Monitor 24-48hrs

Serial Cardiac enzymes not indicated...

Echo for patients with hemodynamic instability
- Eval for tamponade or structural injuries

Penetrating Cardiac Trauma

90% of patients do not reach the hospital, as injury to the pericardium leads to exsanguination

Hypotension unresponsive to rapid volume replacement suggests significant injury

CXR, EKG and Echo have little diagnostic value

High suspicion in injuries to the "Cardiac Box"
**Penetrating Cardiac Trauma**

Right ventricle most commonly injured, followed by left ventricle

VSD is the most common intracardiac injury, followed by valvular injury

Initial treatment usually focuses on relieving pericardial tamponade...

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**Subxiphoid Pericardial Window**

Preferred for tamponade

Should be performed in OR if possible, as patient may rapidly exsanguinate.

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**Atrial and Aortic Repairs**

4.0 prolene oversew with teflon pledgets
**Ventricular Repairs**

3.0 prolene horizontal mattress sutures tied over teflon pledgets

**Aortic Injuries**

**Aortic Injury - Diagnosis**

Aortic rupture usually fatal.

May result in formation of a false aneurysm (typically at the isthmus)

Widened mediastinum (>8cm) with appropriate mechanism prompts a CT angiogram.
Thoracic Aortic Injury
Positive CXR Findings

Aortic Injury Imaging
Aortic Angiogram
CT Angiography
TEE
MR Angiography

Positive CT for Aortic Injury #1
Direct signs: intimal flap, pseudoaneurysm
Open Aortic Injury Repair

Surgical repair should be done promptly, as fatal hemorrhage can occur at any time.

Techniques include LA-FA bypass, proximal aorta-distal aorta shunting, and cross clamping without cardiopulmonary bypass.

Endovascular Repair
Endovascular Repair

Thoracic Trauma

Chest Wall Injuries: Rib fractures, Flail chest

Pulmonary Injuries: Pneumothorax, Hemothorax

Tracheal/Bronchial Injuries

Esophageal Injuries

Diaphragm Injuries

Cardiac Injuries: Tamponade, Direct repairs

Aortic Injuries: Open and Endovascular repairs
THE END

Thank you