Injuries to the Chest

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Initial Evaluation and Management
Primary Survey

- Organized and rapid

- Aimed at recognizing and treating immediately life-threatening problems

- Airway
  - Clear oropharynx
  - Naso- or oro-tracheal, cricothyroidotomy, trach

- Ensure adequate ventilation
Primary Survey

- Control external hemorrhage
- Restore circulation
- Inadequate perfusion
  - tension PTX
  - pericardial tamponade
  - cardiac contusion
Good News

• In most blunt trauma patients, urgent treatment of thoracic injury is accomplished during primary survey

• Most common blunt chest injuries can be controlled with endotracheal intubation or tube thoracostomy
Tube Thoracostomy
Indications

• PTX

• HTX

• Can be both diagnostic and therapeutic
Tension PTX

• Most common and easily treated life-threatening thoracic injury

• Pathophysiology – air escapes into the pleural space increasing intrathoracic pressure – decreases venous return

• Classic signs
  – decreased BS
  – tympany on the ipsilateral side
  – tracheal shift
  – distended neck veins
Occult PTX

- PTX seen only on CT
- Hypotensive patients, those with respiratory distress and those with associated HTX
- Stable with no respiratory compromise – should be observed for at least 24 hours with repeat CXR
HTX

• Complete evacuation of the blood from the pleural space

• Complete re-expansion of the lung
Complications

- Atelectasis
- Empyema
- Related to the presence of residual blood, fluid and air
  - improper positioning
  - obstruction of the tube
Retained HTX

• Suggested by the presence of a persistent opacification in the pleural space
  – plain CXR can be misleading
  – chest CT

• Retained blood serves as a nidus for infection and empyema

• Placement of additional tube is rarely effective in removing clotted blood and may increase risk of infection
Retained HTX

• Operative approach is best
  – VATS effective when used early
  – thoracotomy

• Use caution for those patients where on-going bleeding is a concern
Empyema

- Occurs in 5 to 10% of patients after chest trauma
  - retained HTX
  - PN with parapneumonic effusion
  - persistent FB
  - ruptured pulmonary abscess
  - BP fistula
  - esophageal leak
  - tracking from abdominal source
Diagnosis

• Chest CT with fluid collection with loculations or enhancing rim

• Analysis and culture of fluid typically confirm diagnosis

• Fluid may be sterile if patient is already receiving ABx
Treatment

• Antibiotic therapy is important

• Primary goal is removal of the infection while the fluid is still thin

• Decortication = cornerstone of effective therapy for post-traumatic empyema
Resuscitative Thoracotomy

- Reserved for those who arrive and deteriorate rapidly or undergo cardiac arrest just PTA
- Overall survival for blunt trauma is 1%
- Survival rates are better after penetrating trauma
  - 16 to 57%
  - 57 to 72% for cardiac wounds
Technique
Operative Considerations
Indications

• Hemorrhage
• Major airway disruption
• Cardiac and vascular injuries
• Esophageal disruption
• Diaphragmatic disruption
Magic Number

• Indication for thoracotomy?
  – 1500 cc of blood or more is evacuated
  – *ongoing bleeding at a rate of 300 cc/hr or more for 3 hours*

• Use caution with delayed presentations and presence of coagulopathy

• Use caution with significant chest wall injury
Choice of Incision

• Factors
  – indication for operation
  – urgency of the situation
  – presence of associated injuries
  – mechanism of injury
  – results of pre-op studies
Damage Control
Role for Thoracic Trauma

- Most common injury locations necessitating DC = lung and chest wall
- Avoid formal anatomic resections
- Wedge resection, tractotomy, suture repair
- Persistent chest wall bleeding usually stops with lung re-expansion and correction of coagulopathy
Chest Wall Injuries
Simple Rib Fractures

• Most common chest wall injuries following blunt trauma

• Pain, splinting and prevention of adequate cough

• Pain control is mainstay of treatment

• Mortality is twice as high in patients older than 65
Sternal Fractures

- Almost invariably transverse
- Occur either at sternomanubrial joint or in midbody of sternum
- Simple = two fragments; comminuted = multiple fragments
- Displaced or aligned
- Stable or unstable
- Beware associated underlying visceral injuries
Diagnosis and Management

• Pain associated with instability
• Rule out other life-threatening injuries
• Displaced fractures can be reduced manually
• Vast majority heal with non-op management
Operative Management

- ORIF reserved for unstable fractures or those displaced by > 1 cm of overlap

- Special circumstances – may be necessary to allow ambulation

- Approach is via vertical or sweeping transverse inframammary incision

- Plates or wires
Flail Chest

- Most serious of blunt chest wall injuries
- Represents a disruption of the stability and normal respiratory mechanics of the rib cage
- Clinical diagnosis
- Paradoxical chest motion, underlying pulmonary contusion and pain
Management

- In virtually all awake and alert patients, management without intubation should be attempted

- **EARLY** and **AGGRESSIVE** pain control

- PCA, thoracic epidural, OnQ pump, rib plating

- Maintain effective cough
Penetrating
Hemorrhage

- Most common cause of persistent hemorrhage = lacerated internal mammary or intercostal artery
- Attempts to control non-operatively usually fail
- Angio delays definitive care
Open Chest Wounds

- Diagnosis is usually obvious
- Most small open PTX can be managed with CT and operative closure
- For larger wounds, initial management is directed at restoration of respiratory mechanics
Open Chest Wounds

• Address any underlying intrathoracic injuries

• Attempt to preserve blood supply and muscle mass to the chest wall adjacent to the defect

• Most can be closed with viable autogenous tissue
Pulmonary Injuries
Lacerations

- Treated with oversewing, resection or tractotomy
- Most pulmonary resections for trauma should be stapled, non-anatomic resections
- Mortality is proportional to the amount of lung tissue resected
Mortality

• Suture repair = 9%
• Tractotomy = 13%
• Wedge resection = 30%
• Lobectomy = 43%
• Pneumonectomy = 50%
Tractotomy Technique
Pulmonary Contusions

- Bruises that can be secondary to both blunt and penetrating injuries
  - contused segment has profound V/Q mismatch – shunt and hypoxia
- Presentation can vary from SOB to respiratory failure
- Supportive care
Tracheobronchial Injuries

- Rare – 0.2 to 8%
- High index of suspicion, timely diagnosis and appropriate intervention can improve chance of successful outcome
- Concomitant injury is the rule
Tracheobronchial Injuries

- > 80% occur within 2.5 cm of the carina
- Mainstem bronchi in 80%
- Distal bronchi in 9.3%
- Complex injuries in 8%
Tracheobronchial Injuries

- Clinical presentation varies
- Severe respiratory distress, stridor, hemoptysis, hoarseness, subq empysema
- In only 30% of cases is a definitive Dx made within 24 hours
- Bronchoscopy is the most reliable means of establishing the Dx and determining the site, nature and extent of injury
Management

• Non-op reserved for lesions that involve < one third of the circumference, lung must be fully re-expanded, air leak should resolve promptly, no associated injuries and no need for PPV

• For operative repairs, the ETT should be removed ASAP

• Optimal repair includes adequate debridement of devitalized tissue and primary end to end anastomosis – preserves lateral blood supply
Esophageal Injuries

- Most result from penetrating trauma – 12% for cervical; 0.7% for thoracic
- Between 60 to 80% give rise to clinical signs and Sx depending on the location, size of the perforation, degree of contamination, length of time after injury and associated injuries
- Contrast studies, esophagoscopy
Management

- Surgical repair entails debridement, wide drainage, primary repair and buttressing of the repair with muscle flap
- Two layer repair
- Primary repair with autologous tissue coverage should be attempted
Cardiac Injuries
Penetrating

- In 20% the injury is clinically silent
- 50% will have signs of tamponade
- 30% will present in hemorrhagic shock
- Proximity wounds – cardiac box – 15 to 20% of patients
Diagnosis

• PE is unreliable

• Ultrasound – unreliable in the presence of a HTX

• Subxiphoid pericardial window is gold standard

• Operative management
Blunt Cardiac Injury

- Cardiac contusion
- Usually associated with rib or sternal fractures
- Sequellae involve dysrhythmias and pump failure
- Dx is elusive – should be suspected in correct clinical setting
What You Need to Know …

- A well-placed CT will fix majority of issues
- How to manage large HTX
- Early VATS
- Resuscitative thoracotomy technique
- Technique for pulmonary hemorrhage
What You Need to Know …

• When to rule out cardiac injury
• How to repair cardiac injury
• How to approach unstable thoracic injuries
• Know your options