CHEST TRAUMA

AN APPROACH TO MANAGEMENT

2013
THORACIC TRAUMA

• 25 % of trauma deaths
• 80% of thoracic trauma may be managed without operative management
• 66 % of deaths occur in hospital

• May be penetrating or blunt
PENETRATING INJURIES

- Knives, spears, guns, swords...
- During initial assessment, note the location of the penetrating wound:
  - If below the 5th rib
    - Evaluate the abdomen for possible diaphragmatic or intra-abdominal injury
PENETRATING INJURIES

- Stab wounds and low velocity gun shot wounds:
  - Lead to minimal chest wall trauma unless associated with injury to major vessels
  - May need thoracotomy to control bleeding
  - Most often only need insertion of chest drain
PENETRATING INJURIES

- High velocity gunshot wounds however lead to devastating chest wall injuries as well as significant injuries to underlying structures
  - The management of such injuries frequently requires operation
BLUNT TRAUMA
BLUNT TRAUMA

• Can induce injury by 3 distinct mechanisms
  • Direct blow to chest
    • Rib fractures
  • Deceleration injury
    • Pulmonary contusion
    • Aortic tear
    • Cardiac contusion
  • Compression injury
    • Cardiac rupture
    • Diaphragm rupture
APPROACH TO MANAGEMENT

- INITIAL RESUSCITATION
  - PRIMARY SURVEY

- SUBSEQUENT
  - SECONDARY SURVEY
INITIAL RESUSCITATION

• Focuses mainly on ABC’s
  • Airway
  • Breathing
  • Circulation
    As applies to all major trauma resuscitation cases

• Aim
  • Stabilize
  • Assess for major life-threatening injuries
  • Treat above
PRIMARY SURVEY – CHEST INJURIES

- Airway obstruction
- Tension pneumothorax
- Massive haemothorax
- Cardiac tamponade
- Flail chest
AIRWAY OBSTRUCTION

• Patency assessed by
  • Chest excursion
  • Air movement
  • Stridor

• Secure airway
  • E.T. intubation
  • Cricothyroidotomy
PNEUMOTHORAX

- Simple
- Tension
PNEUMOTHORAX

Defined: accumulation of air within pleural space.
Injury to – trachea
           bronchi
           visceral surface of lung

PATHOPHYSIOLOGY – increased intrapleural pressure – lung collapse.
- Functional R – L shunt
- increased pulmonary vascular resistance with decreased blood flow thru lung – hypoxia.
Simple Pneumothorax

• Management
  • Large: >1.5cm in size
    - measurement taken from inside of third rib to margin of the lung
    - minimum 28f drain needed
  • Small: < 1.5 cm in size
    - may be managed without an intercostal drain provided it is:
      - unilateral
      - pt not on ventilator
      - pt does not require GA
TENSION PNEUMOTHORAX

• Clinical not radiological diagnosis
• Patient
  • Panicky
  • Dyspnoeic
  • cyanosed
• Hallmarks of diagnosis
  • Decreased B.S. on affected side
  • Hyper-resonant percussion note
  • Tracheal deviation
  • Distended neck veins
  • Marked hypotension
TENSION PNEUMOTHORAX

• Pathophysiology
  • Rapid accumulation of air within pleural space
  • Increased intrapleural pressure → compression of mediastinal structures
  • End result is depression of venous return to heart, resulting in hypotension
MASSIVE HAEMOTHORAX

• Pleural cavity can hold up to 3 litres of blood
• Sources of bleeding
  • IMA or intercostal vessels – 90 % cases
  • Lung parenchyma
  • Great vessels
• Presentation
  • Massive haemothorax (> 1.5 litres)
  • Hypovolaemic shock
  • Tracheal elevation
  • Absent breath sounds
• Management
  • Evacuation via tube thoracostomy
FLAIL CHEST

• Associated with multiple rib fractures on same side
• Results in flail segment losing continuity with remainder of thoracic cage

• Pathophysiology
  • Has 3 components
    • Alteration of chest wall mechanics
      • Inadequate tidal volume
      • Inadequate cough
    • Underlying pulmonary contusion
    • Pain
      • inadequate tidal volume
      • Inadequate cough
FLAIL CHEST

• Management
  • Recognize injury not static but evolving process
  • Therefore frequent re-evaluation necessary

• Initial management
  • Confirm and maintain airway patency
  • Early intubation: rarely needed
    • If needed, for associated injuries, usually CNS

• Pain management – essential
  • Anti-inflammatory
  • Parenteral opioid narcotics:
    • Morphine
    • Omnopon
    • Thoracic Epidural
FLAIL CHEST

• Consider intubation and ventilation if
  • Significant other injuries (ISS > 50)
  • Respiratory rate more than 35 per min
  • Partial pressure oxygen less than 8.0 kPa
  • Partial pressure carbon dioxide greater than 6.6 kPa
  • Vital capacity less than 12 ml/kg
  • Right to left shunt of more than 15 %
• Operative fixation is not normally required
SUBSEQUENT EVALUATION

• Involves:
  • Thorough physical examination
  • Multiple studies
SECONDARY SURVEY

- Tracheo-bronchial disruption
- Pulmonary contusion
- Myocardial contusion
- Traumatic aortic rupture
- Diaphragmatic injury
TRACHEOBRONCHIAL INJURY

- Rare, but can be life-threatening (1.5% major chest trauma)
- 30% missed
- Tear/rupture usually within 2.5 cm carina, mostly on right
- Diagnosis starts with high index of suspicion
- Manifest by:
  - Extensive subcutaneous emphysema
  - Persistent pneumothorax and air leak
  - Minor haemoptysis
  - Atelectasis
  - Incomplete expansion of lung despite insertion of drain
  - CXR – pneumothorax with downward displacement of lung hilum
    - so-called fallen lung
Bronchial Tear

P's

Persistent or Progressive Pneumothorax or Pneumomediastinum
N.B. Since several signs may occur simultaneously, the percentages given are not cumulative.
PULMONARY CONTUSION

• Associated with 1 or more fractures of bony chest wall
• Is the consequence of a severe blow to chest
• Contusion may not readily be apparent on initial evaluation
• However, resultant
  • Haemorrhage
  • Oedema
  • Inflammation of affected lung
• May later result in decreased oxygenation and impaired ventilation
TREATMENT OF PULMONARY CONTUSION

• Usually individualized depending on the respiratory need of patient
• If contusion noted during initial resuscitation, mechanical ventilation will normally be necessary

• Therapy involves
  • Limitation of fluid administration
  • Regional pain control
  • Aggressive pulmonary toilet
CARDIAC TAMPONADE

• Can be the sequel to penetrating or blunt trauma to chest
• Compression of cardiac structures
  • Vena cava
  • Atria
  • hypotension
• Beck’s triad
  • Increased jugular venous distention
  • Muffled heart sounds
  • Systemic hypotension
• Cardiac echo
• Management
  • Pericardiocentesis
  • Pericardial window
Heart Injury

Myocardial contusion 50%
Less common
pericardial laceration
myocardial rupture
aortic valve rupture
laceration coronary artery
TRAUMATIC AORTIC RUPTURE (TAR)

- 80 – 90 % of patients T.A.R. die before reaching hospital
- 30 % of survivors will die within 6 hours
- 50 % will die within 24 hours if diagnosis is delayed
- 72 % die within 8 days
- 90 % die within 4 months
CLINICAL (TAR)

- Pulse and B.P. discrepancy between upper and lower limbs
- Paresis or paralysis
- Pressure of steering wheel imprint on anterior chest wall
Displacement of trachea (see 925, 942, 969h, 975c, 1050c)

Displacement of oesophagus (see 951, 1050c)

Apical extrapleural cap sign (see 925, 949, 950, 967c, 984)

Enlargement and blurring of aortic knob (see 927, 928, 941, 966, 969f, 1050a)

Dissociation of intimal and adventitial layers (see 952, 970c, 975e)

Haemothorax (see 953, 965, 966b)

Depression of left main-stem bronchus (see 969f, 1050c)
DIAPHRAGMATIC INJURY

• Incidence - 1-3 % of blunt chest trauma

• Herniation
  • Immediate
  • Occur within period of weeks to months
  • 90 % left-sided
  • 70 % initially missed

• Diagnosis
  • Injury overshadowed by multiplicity of injuries
  • Signs ruptured diaphragm
  • Chest x-ray
  • NG tube insertion
  • Barium studies

• Treatment
  • Surgery
Signs Ruptured Diaphragm

- Mediastinal shift
- Elevated diaphragm
- Bowel gas
- Hemothorax
- NG tube course
MYOCARDIAL CONTUSION

• Imp. Cause of death after blunt chest trauma
• Problem – no standard diagnosis
• Triage in casualty should determine whether myocardial contusion likely
• Suspect:
  • Head-on-crash → violent deceleration force
  • Sudden post-traumatic angina
  • Precordial ecchymosis
  • Sternal fracture
  • Numerous rib fractures
  • Abnormal vital signs
    • Hypotension
    • Tachycardia
    • arrhythmias
  • High ISS good indicator for possible myocardial contusion
MYOCARDIAL CONTUSION

• Can take many forms
  • Simple contusion
  • Contusion complicated by
    • Arrhythmia
    • Traumatic coronary artery rupture with infarction
    • Injury to the septum (ASD, VSD)
    • Rupture
    • Valvular damage
ECG

- Sustained dysrrhythmia
- Q-waves
- S.T. segment and T-wave abnormalities
- Presence of ectopic beats
MANAGEMENT OF MYOCARDIAL CONTUSION

- Monitor for signs of
  - Cardiogenic shock
  - arrhythmias

- Treatment
  - Fluid replacement
  - Inotropic support
  - Intra aortic balloon pump

- Continuous ECG monitoring
  - Monitor arrhythmias as they occur
FRACTURED STERNUM

- 8 – 10% admissions to trauma centre
- Serve as a benchmark for cardiac concomitant injuries
- Sternal fractures associated with low morbidity and mortality
- Assess heart
  - ECG
  - Cardiac enzymes
  - Cardiology consult
SUMMARY

- Trauma worldwide is the leading cause of death in people under 40 years.
- Chest trauma is a relatively common but potentially fatal injury.
- Management requires:
  - A high level of suspicion
  - Rapid diagnosis
  - Appropriate therapy