Thoracic Trauma
PFN: SOMEML1D

Hours: 3.0

Terminal Learning Objective

- Action: Communicate knowledge of thoracic trauma
- Condition: Given a lecture in a classroom environment
- Standard: Received a minimum score of 75% on the written exam IAW course standards

References

- Needle Versus Tube Thoracostomy in a Swine Model of Tension Hemopneumothorax: Prehospital Emergency Care, January/March 2009, volume 13, number 1
- Chest Wall Thickness in Military Personnel: Implications for Needle Thoracentesis in tension Pneumothorax Military Medicine, Volume 172, Dec 2007, pg. 1260
References


References

- Are needle decompressions for tension pneumothoracentesis being performed appropriately for appropriate indications? American Journal of Emergency Medicine (2008) 26, 597–602 Received 1 June 2007; revised 14 August 2007; accepted 15 August 2007
Agenda

- Identify the causes of thoracic trauma
- Identify the Pathophysiology, Pre-Hospital presentation, and Management of blast lung
- Identify the Pathophysiology, Pre-Hospital presentation, and Management of tracheobronchial injuries
- Identify the Pathophysiology, Pre-Hospital presentation, and Management of rib fractures

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Agenda

- Identify the Pathophysiology, Pre-Hospital presentation, and Management of Flail Chest
- Identify the Pathophysiology, Pre-Hospital presentation, and Management of Pulmonary Contusion
- Identify the Pathophysiology, Pre-Hospital presentation, and Management of Open Pneumothorax

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Agenda

- Identify the Pathophysiology, Pre-Hospital presentation, and Management of Closed/Tension Pneumothorax
- Identify the Pathophysiology, Pre-Hospital presentation, and Management of Hemothorax
- Identify the Pathophysiology, Pre-Hospital presentation, and Management of Myocardial Contusion
Agenda

- Identify the Pathophysiology, Pre-Hospital presentation, and Management of Pericardial Tamponade
- Identify the Pathophysiology, Pre-Hospital presentation, and Management of Aortic Rupture
- Identify the Pathophysiology, Pre-Hospital Presentation, and Management of Diaphragmatic Rupture

Agenda

- Participate in a class discussion of a Thoracic Trauma Patient Scenario

Causes of Thoracic Trauma

Motor Vehicle Accident (MVA)
Causes of Thoracic Trauma

- Falls
  - 3 times patient’s height
  - Even with minor injuries, patients are treated according to the trauma protocols
    - Airborne operations
    - Fast roping
    - Mountain climbing
    - Rappelling

Causes of Thoracic Trauma

- Blast injuries (IED)
  - Overpressure
  - Plasma forced into alveoli
- Chest compression injuries
  - Paper bag effect
- Gun shot wounds (GSW)
- Blunt trauma

Pathophysiology, Pre-Hospital Presentation, and Management of Blast Lung
Blast Lung Pathophysiology

- Primary blast injuries are caused solely by the direct effect of blast overpressure on tissue
  - Air is easily compressible, unlike water
  - Almost always affects air-filled structures such as the ears, lungs, and gastrointestinal (GI) tract

Blast Lung Pathophysiology

- Most common fatal primary blast injury among initial survivors
- Signs are usually present at the time of initial evaluation, but they have been reported as late as 48 hours after the explosion

Blast Lung Pre-Hospital Presentation

- Pulmonary injuries are the most common and serious trauma associated with injury
- Patient may show signs and symptoms of pulmonary edema
  - Caution: Pulmonary injury may not manifest itself immediately
- Blast lung should be suspected for anyone with dyspnea, associated cough, hemoptysis, or chest pain following blast exposure
Blast Lung Management

- IAPP the Chest
- Treat associated injuries
- Caution using positive pressure due to alveolar-capillary wall damage
- If lung injury is suspected, transport immediately
- Position with head lower, due to possible air emboli

Blast Lung Management

- EFAST exam to assess for lung slide bilateral
- Chest x-ray if available
  - Recommended for all exposed persons
- Prophylactic chest tube (thoracostomy)
  - Recommended before general anesthesia or air transport if blast lung is suspected

Pathophysiology, Pre-Hospital Presentation, and Management of Tracheobronchial Injury
Tracheobronchial Injury 
Pathophysiology

- Injuries to the major bronchi occur primarily due to rapid deceleration injuries.
- Forced expiration against a closed glottis and compressive forces on the pulmonary tree against the vertebral column may also cause injury to these structures.
- Most tracheobronchial injuries occur within 2 cm of the carina or at the origin of lobar bronchi.

Tracheal Tear Before and After

Tracheobronchial Injury 
Management

- Primary assessment
  - Assess for life threatening injuries first then maintain a patent airway with a full set of vitals to include pulse oximetry.
  - If necessary, an ET tube can be placed into the uninjured bronchus, and a single lung can be ventilated.
Tracheobronchial Injury Management

- Secondary Assessment
  - Monitor patient for surrounding injuries to include pulmonary and cardiac contusions (Beck's Triad) and subcutaneous emphysema
- Treatment
  - Surgical intervention

Pathophysiology, Pre-Hospital Presentation, and Management of Rib Fracture

- Fractures of the scapula, or the first and second ribs often indicate major injury to the head, neck, spinal cord, lungs, and/or the great vessels
Rib Fracture Pathophysiology

- Ribs 1-2
  - 30% die due to force required
  - 5% have aortic rupture
- Ribs 3-8
  - Fractures common on lateral aspect due to decreased musculature

Rib Fracture Pathophysiology

- Ribs 8-12
  - May cause injury to the spleen, kidney or liver

Rib Fracture Pre-Hospital Presentation

- Suspect the Mechanism Of Injury (MOI)
- Very painful with movement
- Patients can often localize the fracture by finger pointing
- Crepitus and grimace
- Associated injuries
Rib Fracture Radiograph

- Patient's Right
- Patient's Left

Rib Fracture Management
- Dyspnea must be controlled with analgesics
- Sling and swathes
- Fractured rib should not be stabilized by taping or any other firm bandaging or binding that encircles the chest
- Encourage deep breaths and coughing to prevent atelectasis

Rib Fracture Management
- Intercostal nerve blocks can be done to ease the pain and allow for full expansion of the chest wall
- A good nerve block will provide anesthesia duration between 8 to 18 hours
Intercostal Nerve Block

Pathophysiology, Pre-Hospital Presentation, and Management of Flail Chest
Flail Chest Pathophysiology

- Compromise to the structural integrity of the chest wall
- Typically defined as 2 or more adjacent ribs fractured in 2 or more places
- Can also be caused by depression of the anterior chest wall

Anterior Chest Wall Deformity

- High energy trauma
  - Road traffic accidents
    - Sternum striking the steering wheel
  - Sports related
    - Rugby, wrestling, and bench press
Flail Chest Pathophysiology

- Possible underlying pulmonary contusion could lead to hypoxia
  - Contusion develops and lung compliance falls
- Decreased ventilatory efficiency and increased work of breathing
- A vicious cycle of decreasing ventilation, increasing fatigue, and hypoxemia may develop, resulting ultimately in sudden respiratory arrest

Flail Chest Pre-Hospital Presentation

- MOI
- Area tenderness
- Bony crepitus on palpation
  - Defer palpation and percussion if obvious
- Decreased breath sounds
  - Crackles on auscultation
- Hypoxemia

Flail Chest Pre-Hospital Presentation

- Paradoxical motion
  - Inward movement of the involved portion of the chest wall during spontaneous inspiration and outward movement during expiration
  - Hypoxemia
- Significant increase in work of breathing
  - Often associated with pulmonary contusion
  - May have caused pneumothorax and/or hemothorax
Flail Chest Pre-Hospital Presentation

- Muscle splinting may hide paradoxical movement from 15 minutes to 2 hours
- Fluid moves into pulmonary contusion
  - Lung compliance fails
  - More pressure required to inflate lungs

Paradoxical Motion

- Muscle splinting may hide paradoxical movement from 15 minutes to 2 hours
- Fluid moves into pulmonary contusion
  - Lung compliance falls
  - More pressure required to inflate lungs
**Flail Chest Pre-Hospital Presentation**

- Increasing pressure differential overcomes muscle resistance
  - Increased paradox and work of breathing
  - Decreased ventilatory efficiency
- Ventilatory fatigue may lead to respiratory failure and/or arrest

**Flail Chest Radiograph**

![Radiograph Image]

**Flail Chest Management**

- Supplemental oxygen
- Ventilatory support for falling oxygen saturation
- Restriction of IV fluids to prevent volume overload
- Pain management with analgesics or intercostal nerve blocks
- Frequent coughing, deep breathing, and incentive spiratomy
Flail Chest Management

- Pulmonary toilet or hygiene
  - Attempts to clear mucus and secretions from the trachea and bronchial tree by deep breathing, incentive spirometry, postural drainage, and percussion

Pathophysiology, Pre-Hospital Presentation, and Management of Pulmonary Contusion

- Pulmonary contusion occurs in 25% to 35% of all blunt chest trauma
  - Usually caused by rapid deceleration that results when the moving chest strikes a fixed object
- Leads to capillary damage
  - Blood and other fluids accumulate in lung tissue
  - Excess fluid interferes with gas exchange, potentially leading to inadequate oxygen levels (hypoxia)
Pulmonary Contusion
Pathophysiology
- Bruising of the lung
- Rapid deceleration forces
- Blunt force trauma

Pulmonary Contusion
Pathophysiology
- Most common potentially lethal chest injury seen
- Respiratory complications are related to the size of contused area
- Hypoxia, hypoxemia, and/or pulmonary edema may develop
- Respiratory failure can develop in the first 8 to 24 hours

Pulmonary Contusion
Pre-Hospital Presentation
- MOI
- Fractured ribs
- Flail chest
- Chest ecchymosis
- Subtle initially
- Progressive dyspnea
Pulmonary Contusion Radiograph

Pulmonary Contusion Management
- Secure airway as needed
- Support breathing
  - Oxygen
  - BVM
  - Ventilator with peep (positive end-expiratory pressure)
- Reassess regularly
  - Vital signs
- Heals spontaneously over several weeks

Pathophysiology, Pre-Hospital Presentation, and Management of Open Pneumothorax
Open Pneumothorax Pathophysiology

- Penetrating trauma to the chest wall
- Small and self-sealing
- Large and sucking
  - Sucking chest wound

Open Pneumothorax Pathophysiology

- Sucking chest wound
  - Develops when penetrating injuries to the chest create a defect large enough that air sucks in between the parietal and visceral pleura
  - During negative pressure inspiration, air is sucked in through the chest wall due to it being the path of least resistance

Open Pneumothorax Pathophysiology

- Tension pneumothorax:
  - Air enters the pleural space, compressing the lung, and shifts the mediastinum.
  - Treated with needle decompression in the midaxillary line, usually at the second intercostal space.
Open Pneumothorax Pathophysiology

- Sucking chest wound
  - Severity is directly proportional to the size of the wound
  - Path of least resistance
  - What may cause a SCW?
    - GSW
    - Stab wounds
    - Impaled objects, etc...

Open Pneumothorax Pathophysiology

Open Pneumothorax Pathophysiology

Open Pneumothorax Pathophysiology
Open Pneumothorax
Pre-Hospital Presentation

- Shortness of breath (SOB)
- Pain
- Sucking or gurgling sound as air moves in and out of the pleural space through the wound (SCW)

Open Pneumothorax
Pre-Hospital Presentation

Open Pneumothorax
Management

- Close the defect quickly
  - Stop gap
  - Apply a vented chest seal
    - If a vented chest seal is not available, a non-vented chest seal is acceptable
    - If a tension pneumothorax is suspected, immediately perform needle decompression
Open Pneumothorax Management

- Oxygen, intubation and/or BVM as needed
- Treat for shock with fluid resuscitation
- Reassess for tension pneumothorax!
- Definitive treatment is closed tube thoracostomy
  - Chest tube 5th ICS MAL

Pathophysiology, Pre-Hospital Presentation, and Management of Closed/Tension Pneumothorax
Closed/Tension Pneumothorax
Pathophysiology

- Progressive build up of air within the pleural space
  - Usually due to a lung laceration which allows air to escape into the pleural space but not to return
  - Air enters thoracic cavity via “one way valve” type defect and cannot exit the pleural space

Closed/Tension Pneumothorax Pre-Hospital Presentation

- Initial signs and symptoms
  - Unilateral decreased or absent breath sounds on the affected side
  - Increased dyspnea and tachypnea
  - Anxiety
Closed/Tension Pneumothorax Pre-Hospital Presentation

- Progressive signs and symptoms
  - Increasing dyspnea and tachypnea
  - Tachycardia
  - Subcutaneous emphysema
  - Increased difficulty bagging an intubated patient
  - Cyanosis

- Late signs and symptoms
  - Jugular vein distension (JVD) and tracheal deviation
  - Patient may also have lost a considerable amount of blood, so that JVD may not be present
  - Tympany (hyper-resonance)
  - Narrowing pulse pressure
  - Unilateral rise and fall of the chest

JVD and Tracheal Shift

- Increased pressure moves mediastinum and compresses the lung on the uninjured side
- Decreased cardiac input/output of the heart with kinking of the great vessels
- 35 to 40 lbs of pressure
Closed/Tension Pneumothorax

Radiograph

Closed/Tension Pneumothorax
Management

- Chest decompression
  - Needle thoracentesis
- A casualty with torso trauma or polytrauma with no pulse or respirations will receive a bilateral needle decompression
- Flutter valve
- High flow oxygen
- BVM
- Intubation

Closed/Tension Pneumothorax
Management

- Chest tube
  - Up for air
  - A pneumothorax associated with persistent large air leak after tube thoracostomy suggests a bronchi injury

Closed/Tension Pneumothorax
Management

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Closed/Tension Pneumothorax
Management

- Chest tube
  - Up for air
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Needle Thoracentesis Steps

- Take and maintain BSI precautions
- Open/remove patient's IBA and shirt to expose chest
- Assess casualty for indications for needle decompression
- Inspect for bilateral rise and fall of the chest, Auscultate for bilateral breath sounds, Palpates for crepitus and grimace, Percuss for hyper or hyporesonance

Needle Thoracentesis Steps

- Assemble necessary equipment
- Identify second intercostal space (ICS) on anterior chest wall Mid-clavicular line (MCL) on same side as injury; approximately two-finger widths below the clavicle

  *Or*

Needle Thoracentesis Steps

- Identifies fourth or fifth intercostal space (ICS) on the anterior axillary line (AAL) on the same side as the injury
- Ask patient about allergies
- Prep site with alcohol and betadine
- Selects and inspects 3.25 inch 14 gauge or 10 gauge needle
- Removes plastic cap and flash chamber cover from needle
Needle Thoracentesis Steps

- Insert needle into skin over superior border of the third rib, MCL, (*lateral to the nipple line*) or 5th rib on the Anterior Axillary Line and direct the needle into the appropriate ICS at 90 degree angle.
- Advance needle and catheter together all the way to the hub and leave in place for 5-10 seconds to allow for full decompression

Needle Thoracentesis Steps

- Remove the needle to decrease the likelihood of injury. Leave the catheter in place to provide continued decompression
- Reassess breathing and conduct secondary IAPP (may defer percussion over an injury)
- Document procedure on appropriate medical form

Needle Thoracentesis Landmarks
Needle Thoracentesis Procedure

- Patients with thoracic trauma or polytrauma who have sustained a traumatic cardiac arrest should receive bilateral decompression to ensure arrest is not due to an unrecognized tension pneumothorax on either side of the chest.
Hemothorax Pathophysiology
- Blood pooling in the pleural space
- Pleural space can hold 30% to 40% of patient’s blood volume
- Blood may collapse the lung on the injured side

Hemothorax Pre-Hospital Presentation
- MOI
- Tachypnea and dyspnea
- Diminished or absent breath sounds
  - Affected lung
- Tracheal deviation to the unaffected lung
  - Rare
- Hypovolemia
- Cyanosis

Hemothorax Management
- High flow oxygen
  - Possible intubation and BVM
- Fluid resuscitation
- Definitive care requires tubal thoracostomy
  - Posterior and superior for blood
Tubal Thoracostomy

- Indications
  - Definitive care for pneumothorax, hemothorax, and tension pneumothorax

- Insertion
  - 5th ICS MAL
  - REMEMBER with maximum expiration the diaphragm can reach the 4th ICS anteriorly, the 6th laterally, and the 8th posteriorly
  - Multiple tubes may be necessary or position patient to desired angle for best relief

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Tubal Thoracostomy Procedure

- With a hemothorax, if the chest tube only evacuates a small amount of blood and the patient remains in shock, you should suspect an abdominal injury
Pathophysiology, Pre-Hospital Presentation, and Management of Myocardial Contusion

Myocardial Contusion Pathophysiology

- Most common cardiac injury due to blunt trauma
- Deformed steering wheel, column, or dashboard, alerts to cardiac contusion
- Blast injury
- Reported in approximately 20% of patients with severe blunt chest trauma
  - Rarely fatal
Myocardial Contusion
Pre-Hospital Presentation
- Chest pain and dyspnea
- Abnormal chest wall movement
  - Flail segment
- Contusions or abrasions of the chest wall
- Tenderness to the touch
- Subcutaneous emphysema

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Myocardial Contusion
Pre-Hospital Presentation
- Tachycardia out of proportion to other findings
- Tachypnea
- Dysrhythmias
  - PVCs, atrial fibrillation, and/or conduction abnormalities
- Decrease cardiac output
  - Heart failure

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Myocardial Contusion
Management
- Supplemental oxygen
- Pain control
- 12 lead EKG
- Drug therapy for dysrhythmias
- Cardiac ultrasound
Pericardial Tamponade
Pathophysiology

- Blunt or penetrating trauma disrupts heart wall(s) and/or vessels causing blood to leak into pericardial space
- Up to 300 ml of blood enters the pericardial space causing the tamponade to develop

Pericardial Tamponade
Pathophysiology

- Fluid in the pericardial space increases pericardial pressure and does not allow heart to expand fully
- Decrease in stroke volume and cardiac output
Pericardial Tamponade
Pre-Hospital Presentation (Beck’s Triad)

- Hypotension
  - Narrowing pulse pressure
- Muffled heart sounds
  - Due to pericardial sac being filled with blood
- Jugular vein distention (JVD)
  - Due to a decrease ventricular filling

Pulse Pressure

- Pulsus paradoxus
  - Systolic blood pressure that drops more than 10 mm Hg upon inspiration compared with expiration

Echocardiography of a Pericardial Effusion
Large Pericardial Effusion  
Echocardiogram (Parasternal Long Axis)

Large Pericardial Effusion  
Same Patient in Short Axis Views

Pericardial Tamponade  
Pre-Hospital Presentation

- Electrical alternans on EKG
  - Alternating high and low-voltage QRS complexes as the hearts swings toward and then away from the EKG leads on the chest wall with each contraction
Pericardial Tamponade
Pre-Hospital Presentation

- Question
  - How does the Pre-Hospital presentation of pericardial tamponade differ from a tension pneumothorax?

- Answer
  - Tension pneumothorax should have no breath sounds on one side, hyperresonance and maybe tracheal deviation
Pericardial Tamponade Management

- Oxygen administration
- EKG monitoring
- Fluid resuscitation
- Pericardiocentesis
  - Better be right!
  - May need to be done repeatedly
- Thoracotomy
  - Surgical exploration and repair

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Pericardiocentesis Sites

- Ultrasound is extremely useful in the diagnosis and management of pericardial tamponade
- If ultrasound is available, use it to guide your pericardiocentesis
- If ultrasound is not available and the patient has cardiac or hemodynamic compromise, the blind approach for pericardiocentesis can be used
Pericardiocentesis Procedure

- Insert 3 to 10 inch 16 gauge needle attached to a 20 to 50 ml syringe below xiphoid process at 45 degrees towards the left MCL
- Aspirate every 1 to 2 mm as needle is advanced
- Advance the needle carefully until
  - Ultrasound shows correct placement
  - Blood is obtained
  - Cardiac pulsations are felt
  - EKG changes

Pericardiocentesis Procedure (cont)

- Aspirate blood from pericardial sac
  - Pericardial blood is often clotted
  - May only be able to aspirate a few milliliters without manipulating the needle
  - If 20 ml can be easily and rapidly aspirated you are probably in the right ventricle
Pathophysiology, Pre-Hospital Presentation, and Management of Aortic Rupture

Aortic Rupture Pathophysiology

- Result of shear force injury
- Descending aorta
  - Tightly fixed to the thoracic vertebrae
    - Ligamentum arteriosum
- Heart and aortic arch suddenly move anteriorly or laterally
- 80% to 90% exsanguinate into left pleural space within first hour

Aortic Rupture Pre-Hospital Presentation

- Difficult to diagnose
- MOI and scene survey of the magnitude of trauma
- Unexplained shock from a frontal or lateral impact
- Blood pressure and pulse variations
  - Marked variation in BP from right to left arm
  - Decreased femoral and pedal pulses
Aortic Rupture Radiograph

Aortic Rupture Management

- High flow oxygen
- Airway support as needed
- Immediate transport
  - Requires surgical repair
- Careful fluid resuscitation
  - May increase tearing of remaining aortic wall

Pathophysiology, Pre-Hospital Presentation, and Management of Diaphragmatic Rupture

Thoracoscopic repair of Rt. diaphragmatic injury

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Diaphragmatic Rupture
Pathophysiology

- Can occur in both high pressure blunt thoracoabdominal trauma as well as in penetrating trauma
- Equally common on the left and right side
  - Some right sided injuries may be undiagnosed due to the liver preventing the herniation of abdominal contents into the chest

Diaphragmatic Rupture
Pre-Hospital Presentation

- Similar to a tension pneumothorax or hemothorax
- Patient will present with history of blunt or penetrating trauma
- Upon IAPP of chest you hear bowel sounds
- Abdomen may appear to be hollow
- CXR may reveal the nasogastric tube going into the abdomen then back into the chest
Diaphragmatic Rupture Radiograph

Diaphragmatic Rupture Management

- Prompt surgical repair
  - Laparotomy is necessary to repair the diaphragm
- Treat associated injuries
  - Check lung fields
  - Listen for bowel sounds in the chest

Class Discussion of a Thoracic Trauma Patient Scenario

Terrorist Sniper Footage
RT 3:00
Case Scenario Objectives

- By eliciting feedback from your facilitator
  - Assess your patient (10 minutes)
  - Obtain your findings
  - Come to a diagnosis and develop a treatment plan (10 minutes)

In 20 minutes each small group will present their case to the class.

Group 1 Assessment

- Airway Inspection
  - Coughing (hemoptysis)
  - Audible wheezing
- Chest Inspection
  - No visible external trauma
- Chest Auscultation
  - Abnormal cracking sound in chest (rales)
- Chest Palpation
  - No crepitos or grimace
- Chest Percussion
  - Normal resonance
- Skin Inspection
  - Cyanosis
- Capillary Refill
  - Delayed
- Pulse
  - Tachycardia
- Head Inspection
  - Tympanic membrane perforation
- Pulse Oximetry
  - <90%
- Arterial Blood Gas
  - PaO2 59 mm Hg (hypoxemia)
  - PCO2 50 mm Hg
- Chest X-ray
  - All explosion victims should get one!
- Ultrasound
- CT

Group 1 Assessment

- Airway Inspection
  - Coughing (hemoptysis)
- Chest Inspection
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  - PCO2 50 mm Hg
- Chest X-ray
  - All explosion victims should get one!
- Ultrasound
- CT
Group 1 Assessment Continued

Group 1

Diagnosis

Group 1 Diagnosis

Blast Lung

- Blast lung should be suspected for anyone with dyspnea, cough, hemoptysis, or chest pain following blast exposure
- Most common fatal primary blast injury among initial survivors
  - Almost always affects air-filled structures such as the lungs, ears, and gastrointestinal (GI) tract
- Signs are usually present at the time of initial evaluation, but they have been reported as late as 48 hours after the explosion
Group 1 Diagnosis
Blast Lung

Group 1
Blast Lung
Management

- Supplemental high flow oxygen to prevent hypoxemia
- Monitor closely for respiratory deterioration for at least 6 hours post-blast
- If ventilatory failure is imminent or occurs, patients should be intubated;
  - however, caution should be used as mechanical ventilation and positive end pressure may increase the risk of alveolar rupture and air embolism
- If air embolism is suspected, the patient should be placed in prone, semi-left lateral, or left lateral positions
Group 2 Assessment

- Airway Inspection
  - Dyspnea
  - Tachypnea
- Chest Inspection
  - Penetrating sucking wound
  - Unilateral chest rise
- Chest Auscultation
  - Diminished breath sounds on the affected side
  - Displaced apex beat (heart)
- Chest Palpation
  - Subcutaneous Emphysema
- Chest Percussion
  - Hyperresonance
- Skin Inspection
  - Cyanosis
- Capillary Refill
  - Delayed
- Pulse
  - Tachycardia
- Neck Inspection
  - JVD
  - Tracheal Deviation
- Pulse Oximetry
  - <90%
- Chest X-ray
  - All explosion victims should get one!
- Arterial Blood Gas
  - PaO2 59 mm Hg (hypoxemia)
  - PaCO2 50 mm Hg
- Ultrasound
- CT

Group 2 Assessment Continued

Sucking Entrance Wound  Exit Wound
Group 2 Assessment Continued

Normal CXR  
Group 2 CXR

Group 2 Diagnosis

Tension Pneumothorax

- Tension Pneumothorax should be suspected for anyone with dyspnea and penetrating wounds from the mandible to the umbilicus
  - During negative pressure inspiration, air is sucked in between the parietal and visceral pleura
  - Air enters thoracic cavity via "one way valve" type defect and cannot exit the pleural space

Group 2 Diagnosis

Diagnosis

Tension Pneumothorax

- Tension Pneumothorax should be suspected for anyone with dyspnea and penetrating wounds from the mandible to the umbilicus
  - During negative pressure inspiration, air is sucked in between the parietal and visceral pleura
  - Air enters thoracic cavity via "one way valve" type defect and cannot exit the pleural space
Group 2 Tension Pneumothorax
Management

- Close the defect quickly
  - every hole between the chin and the navel gets an occlusive dressing (chest seal)
  - Apply a vented chest seal preferably
  - If not available use a non-vented chest seal

Group 2 Tension Pneumothorax
Management Continued

- Supplemental high flow oxygen to maintain an oxygen saturation >90%
- Burp the chest seal
- Needle thoracentesis (decompression)
- Continuously monitor for redeveloping tension pneumothorax
- Definitive treatment is a tubal thoracostomy (chest tube)
Group 3 Assessment

- Airway Inspection
  - Dyspnea
  - Tachypnea
- Chest Inspection
  - No visible external trauma
  - Diminished breath sounds left side
- Chest Auscultation
  - Bowel sounds left side
- Chest Palpation
  - No crepitus or grimace
- Chest Percussion
  - Normal resonance
- Skin Inspection
  - Cyanosis
- Capillary Refill
  - Delayed
- Pulse
  - Tachycardia
  - Head Inspection
  - Tympanic membrane perforation
- Abdomen Inspection
  - Hollow appearance
- Pulse Oximetry
  - <90%
- Chest X-ray
  - All explosion victims should get one!
- Arterial Blood Gas
  - PaO2 59 mm Hg (hypoxemia)
  - PACO2 50 mm Hg
- Ultrasound
- CT

Group 3 Assessment Continued

Normal CXR

Group 3 CXR
Diaphragmatic Rupture

- Diaphragmatic injuries are caused most frequently by penetrating trauma of the lower chest or upper abdomen. Rupture due to blunt trauma is much less frequent and occurs in <5% of patients.
  - Right-sided injuries may be undiagnosed, owing to the liver preventing the herniation of abdominal contents into the chest.

Group 3 Diagnosis
Diaphragmatic Rupture

Management
Group 3 Diaphragmatic Rupture Management

- Treat associated injuries
  - >80% of diaphragmatic ruptures are associated with other severe injuries
- Evacuation for prompt surgical repair
  - Laparotomy is necessary to repair the diaphragm

Agenda

- Identify the causes of thoracic trauma
- Identify the Pathophysiology, Pre-Hospital presentation, and Management of blast lung
- Identify the Pathophysiology, Pre-Hospital presentation, and Management of tracheobronchial injuries
- Identify the Pathophysiology, Pre-Hospital presentation, and Management of rib fractures

Agenda

- Identify the Pathophysiology, Pre-Hospital presentation, and Management of Flail Chest
- Identify the Pathophysiology, Pre-Hospital presentation, and Management of Pulmonary Contusion
- Identify the Pathophysiology, Pre-Hospital presentation, and Management of Open Pneumothorax
Agenda

- Identify the Pathophysiology, Pre-Hospital presentation, and Management of Closed/Tension Pneumothorax
- Identify the Pathophysiology, Pre-Hospital presentation, and Management of Hemothorax
- Identify the Pathophysiology, Pre-Hospital presentation, and Management of Myocardial Contusion

Agenda

- Identify the Pathophysiology, Pre-Hospital presentation, and Management of Pericardial Tamponade
- Identify the Pathophysiology, Pre-Hospital presentation, and Management of Aortic Rupture
- Identify the Pathophysiology, Pre-Hospital Presentation, and Management of Diaphragmatic Rupture

Agenda

- Participate in a class discussion of a Thoracic Trauma Patient Scenario
References

- Needle Versus Tube Thoracostomy in a Swine Model of Tension Hemopneumothorax: Prehospital Emergency Care, January/March 2009, volume 13, number 1
- Chest Wall Thickness in Military Personnel: Implications for Needle Thoracentesis in tension Pneumothorax Military Medicine, Volume 172, Dec 2007, pg. 1260

References


References

- Are needle decompressions for tension pneumothoracentesis being performed appropriately for appropriate indications? American Journal of Emergency Medicine (2008) 26, 597–602 Received 1 June 2007; revised 14 August 2007; accepted 15 August 2007
Terminal Learning Objective

- Action: Communicate knowledge of thoracic trauma
- Condition: Given a lecture in a classroom environment
- Standard: Received a minimum score of 75% on the written exam IAW course standards

Thoracic Trauma
PFN: SOMEML1D

Hours: 3.0
Instructor: