

PRACTICE GUIDELINE

Effective Date: 5-21-04

Manual Reference: **Deaconess Trauma Services**

TITLE: BLUNT CHEST INJURIES

PURPOSE: To define protocols for the diagnosis and management of specific chest injuries that is commonly seen after blunt trauma.

DEFINITION: A chest injury is any injury to the thoracic cage and its contents, including the lungs, heart, great vessels, tracheobronchial tree and the esophagus.

GUIDELINES:

1. Blunt chest injuries are characterized by:
 - a. Mechanism:
 - i. Severe blunt force applied to the chest.
 - ii. Rapid deceleration injury.
 - b. Signs:
 - i. Chest wall deformity
 - ii. Chest wall contusion
 - iii. Chest wall laceration
 - iv. Severe trauma above the chest (e.g., head injury) and below the chest (e.g., abdominal or pelvic injury)
 - c. Symptoms:
 - i. Tachypnea
 - ii. Pain
 - iii. Absent breath sounds
 - iv. Crepitus or subcutaneous emphysema
 - v. Hemoptysis
 - vi. Discordant breathing pattern
 - vii. Hypotension
 - viii. Distended neck veins

2. With any of the above findings, consider the possibility of the following chest injuries:
 - a. Tension pneumothorax
 - b. Open pneumothorax
 - c. Flail chest
 - d. Pulmonary contusion
 - e. Massive hemothorax
 - f. Cardiac tamponade
 - g. Cardiac contusion
 - h. Ruptured diaphragm
 - i. Ruptured tracheobronchial tree
 - j. Ruptured thoracic aorta
 - k. Ruptured esophagus
 - l. Myocardial tear

- m. Simple pneumothorax
- n. Fractured ribs

3. Maintain airway:
 - a. Intubate for respiratory distress or airway obstruction.
 - b. Beware of worsening pneumothorax as pressure is applied to the airway.
 - c. Consider needle decompression for tension pneumothorax
4. Obtain portable AP chest x-ray on all CAT I patients before going to CT scanner to assess for:
 - a. Possible chest injury
 - b. Confirm tube placement
 - c. All transfers who have had a chest x-ray at another facility should have a repeat chest x-ray after arrival.
 - d. Chest tubes should be placed prior to the chest x-ray and/or CT scan if there is hemodynamic compromise or any clinical evidence of a pneumothorax.
5. For severe anterior chest trauma, obtain an emergent EKG.
6. Treat injury according to the diagnostic findings:
 - a. Tension pneumothorax
 - i. Physiology
 - a) air enters the pleural space and cannot exit (“flap valve” phenomenon)
 - b) Respiratory compromise due to increased pleural pressure.
 - c) Hemodynamic compromise due to impaired venous return.
 - d) Good lung is affected by mediastinal shift.
 - ii. Diagnosis:
 - a) Respiratory distress
 - b) Absent unilateral breath sounds
 - c) Asymmetric chest wall motion
 - d) Hypotension with distended neck veins
 - e) Shift of the trachea and the PMI
 - iii. Treatment:
 - a) With hemodynamic compromise: needle decompression followed by chest tube.
 - b) Chest tube insertion must occur prior to CT Scan.
 - c) Without hemodynamic compromise: place large bore chest tube.
 - d) Obtain chest x-ray or CT scan of chest after the chest tube has been placed.

b. Open pneumothorax:

i. Physiology:

- a) Open defect in chest wall allows air to enter the pleural space through the defect rather than through the trachea.
- b) Mediastinum shifts as pressure gradients change across the midline.

ii. Diagnosis: “sucking chest wound”

iii. Treatment:

- a) Intubate the patient and place on positive pressure ventilation.
- b) Insert large bore chest tube.
- c) Cover with a vasoline gauze.
- d) Consider surgical closure of the defect.

c. Flail chest

i. Physiology:

- a) Blunt force to the chest.
- b) Ribs fractured in multiple places lead to unstable segment of chest wall.
- c) Severe pain.

ii. Diagnosis:

- a) Paradoxical chest wall movement.
- b) Severe pain with breathing or with palpation in the affected area.
- c) Respiratory distress.
- d) Hemoptysis.

iii. Treatment:

- a) Pain control: epidural, PCA, morphine drip.
- b) Pulmonary toilet, monitor vital capacity.
- c) Intubate for worsening compliance and respiratory distress due to the underlying contusion or increasing pCO₂

d. Pulmonary contusion:

i. Physiology:

- a) Underlying area of lung with alveolar hemorrhage and edema resulting in focal compliance reduction and interference with gas exchange

ii. Diagnosis:

- a) Chest x-ray demonstrates contusion, but it may not show for several hours
- b) Seen on chest CT sooner

iii. Treatment:

- a) Pulmonary toilet, monitor vital capacity.
- b) Intubate for worsening compliance, respiratory
- c) Maintain normovolemia, do not dehydrate but utilize fluids judiciously.

e. Massive hemothorax:

i. Physiology:

- a) Massive bleeding into the pleural space results in hemorrhagic shock.
- b) After blunt trauma, source is usually bleeding from the chest wall.

ii. Diagnosis:

- a) Hemorrhagic shock and hemothorax on chest x-ray.
- b) Absent breath sounds on the affected side.
- c) Dull to percussion on the affected side.

iii. Treatment:

- a) Fluid resuscitation to correct hemorrhagic shock.
- b) Place large bore chest tube.
- c) If initial drainage > 1500 ml or drainage continues at >200 ml/hr for more than two hours, then consider operative intervention.
- d) If drainage is high, may consider intubation and application of PEEP (10-20 cmH₂O) to tamponade chest wall bleeding.
- e) Consider autotransfusion.

f. Cardiac tamponade:

i. Physiology:

- a) Hole in the atrium, ventricle, or intrapericardial vena cava results in blood loss into the pericardial sac.
- b) As blood accumulates in pericardial sac, then end-diastolic volume and ventricular wall movement is reduced, resulting in a decrease of the cardiac output.

ii. Diagnosis:

- a) Hypotension and distended neck veins without a tension pneumothorax.
- b) Distant or muffled heart sounds.
- c) Cyanosis.
- d) Pulsus Paradoxus.
- e) Narrowed pulse pressure.

iii. Treatment:

- a) IV fluid bolus.
- b) Pericardiocentesis
- c) Pericardial window.
- d) If positive, immediately go to OR for median sternotomy or thoracotomy.

g. Cardiac Contusion:

i. Physiology:

- a) Results in conduction defects.
- b) Contusion may result in reduced contractility.

ii. Diagnosis:

- a) History of severe anterior chest trauma and abnormality in EKG.
- b) Unexplained tachycardia
- c) Right bundle branch block
- d) Unexplained nonspecific ST-T wave changes.
- e) New Q-waves
- f) New arrhythmia (atrial fib/flutter, PVC's, multifocal PAC's).
- g) Unexplained myocardial pump failure (rule out valve injury).

iii. Treatment:

- a) With high suspicion, obtain echocardiogram (preferably TEE).
- b) Monitor telemetry for 24 hours in the hospital.
- c) Treat arrhythmias.
- d) Treat cardiac dysfunction
- e) Obtain cardiology consult.
- f) Treat any cardiac failure with inotropes and consider concurrent placement of a pulmonary artery catheter.

h. Ruptured diaphragm:

i. Physiology: tear in diaphragm allows abdominal contents to enter chest, resulting in respiratory distress. The process is more rapid with spontaneous ventilation.

ii. Diagnosis:

a) Left:

- i) Chest x-ray shows abdominal visceral in the chest, therefore will assess bowel sounds in the chest.
- ii) Place NG tube to see if it goes up into the chest.
- iii) If necessary, obtain barium swallow to document the location of the stomach.

b) Right:

- i) An abnormal "hump" in the lateral diaphragm suggests laceration and protrusion of the liver.
- ii) Confirm with CT.

iii. Treatment:

- a) Consider early intubation to prevent further migration of abdominal viscera into chest.
- b) Operative repair through the abdomen.
- c) If diagnosis is delayed, may need a thoracotomy.

i. Ruptured tracheobronchial tree:

i. Physiology: massive air leak into the pleural space after tear of the bronchial tree, usually near a point of fixation.

ii. Diagnosis:

- a) Massive pneumothorax.
- b) Continued massive air leak after placement of chest tube.
- c) Bronchoscopy diagnosis of tear.

- iii. Treatment:
 - a) If massive, can try balloon occlusion of the affected bronchus.
 - b) To the operating room for thoracotomy and operative closure.
 - c) Avoid high pressures on the lung.
- j. Ruptured thoracic aorta:
 - i. Physiology:
 - a) Aorta ruptures at point of fixation after severe deceleration event. The point of rupture is usually just distal to the left subclavian artery or in the ascending arch.
 - b) Resulting hematoma is contained by adventitia or pleura.
 - c) 85% are dead at the scene.
 - d) One half of the survivors will die in 24 hours.
 - ii. Diagnosis:
 - a) History of severe deceleration impact.
 - b) Widened mediastinum.
 - iii. Treatment:
 - a) Avoid hypertension, using beta-blocker with vasodilator if necessary.
 - b) Consult cardiothoracic surgery and prepare for surgery.
- k. Ruptured esophagus:
 - i. Physiology: chest crush or penetrating injury results in rupture of the esophagus.
 - ii. Diagnosis:
 - a) Air in the mediastinum.
 - b) Sputum or intestinal contents out of the chest tube.
 - c) Confirm with esophagoscopy or gastrograffin swallow (preferred).
 - iii. Treatment:
 - a) Thoracotomy
 - b) Surgical repair.
- l. Simple pneumothorax:
 - i. Physiology: puncture of the lung with air leak into the pleural space. The air in the space is not under excessive pressure.
 - ii. Diagnosis:
 - a) Absent unilateral breath sounds.
 - b) Subcutaneous emphysema
 - c) Pneumothorax on chest X-ray
 - iii. Treatment:
 - a) Large bore chest tube should be inserted in patients with traumatic pneumothorax seen on plain chest X-ray.
 - b) Occult pneumothorax seen on CT scan without plain findings can be treated without chest tube. If patient goes to the operating room, is intubated or is transferred by air ambulance, then a chest tube should be in place.

m. Fractured ribs:

i. Physiology: ribs fractured from direct force.

ii. Diagnosis:

a) Chest wall pain.

b) Bony crepitus.

c) Fractured ribs on chest X-ray.

d) Anterior costochondral cartilages can be fractured and not show up on chest X-ray.

iii. Treatment:

a) Pain control by epidural or PCA.

b) Pulmonary toilet.

c) Drain intrapleural fluid accumulation.

REFERENCES:

- ❖ Deaconess Trauma Guideline Manual, PATIENT IN EXTREMIS FLOWCHART; TRAUMATIC ARREST; EVALUATION OF THE WIDENED MEDIASTINUM; EMERGENCY RESUSCITATIVE THORACOTOMY.
- ❖ Deaconess Critical Care Department Policy & Procedure Manual, AUTO TRANSFUSION A-13.

REVIEWED DATE	REVISED DATE
JAN 05	JAN 08
JAN 06	
JAN 07	