THORACIC TRAUMA I

Thoracic trauma accounts for 25% of all trauma deaths, representing approximately 160,000 deaths annually around the world. Over 70% of thoracic injuries result from blunt trauma, most of which are caused by automobile accidents. One in four cases with cardiothoracic trauma, regardless of etiology, requires hospital admission.

TYPES:
I. Blunt chest trauma
II. Penetrating trauma

Penetrating injuries are uncommon in either elderly or pediatric patients, but they remain one of the most common causes of death from trauma in persons up to 40 years of age. Low-velocity handguns, seen primarily in the civilian population, transmit very little damage to surrounding tissues. Conversely, much more damage and energy is conducted along the path of high-velocity missiles, usually associated with the military, but now often seen in violent assaults as well.

Blunt trauma accounts for 70% of chest injuries and more than 70% of these injuries result from Motor Vehicle Accidents. For penetrating injuries 60 to 70% are due to stab wounds. Less than 10% of blunt injuries and only 15 to 30% of penetrating injuries require thoracotomy.

THE PRIMARY SURVEY

Rapid and thorough performance of the “ABCs” is the standard. This begins with traditional resuscitation as outlined by the American College of Surgeons in the Advanced Trauma Life Support guidelines. The airway must be controlled and breathing assessed and established immediately if necessary. Circulation must be supported through rapid establishment of reliable, large-bore venous access and the initiation of fluid resuscitation. The primary survey is performed to search for immediate life-threatening injuries that could account for ventilation or hemodynamic instabilities, which, if left uncorrected, could cause the acute demise of the patient. These life-threatening injuries are listed in the table below:

<table>
<thead>
<tr>
<th>Injuries</th>
<th>Management</th>
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<tbody>
<tr>
<td>Tension pneumothorax</td>
<td>Tube thoracostomy</td>
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<tr>
<td>Massive haemothorax</td>
<td>Tube thoracostomy ± operative repair</td>
</tr>
<tr>
<td>Cardiac tamponade</td>
<td>Pericardiocentesis ± operative repair</td>
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<tr>
<td>Deceleration aortic injury</td>
<td>Operative repair</td>
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<tr>
<td>Massive flail chest with pulmonary contusion</td>
<td>Intubation, pain control, fluid restriction</td>
</tr>
</tbody>
</table>
Injuries | Management
---|---
Upper and lower airway obstruction | Intubation, airway, bronchoscopy
Tracheobronchial rupture | Bronchoscopy, operative repair
Diaphragmatic rupture with visceral herniation | Operative repair
Esophageal perforation | Operative repair

**DIAGNOSTIC TESTS**

History and physical examination: details involving the mechanism and pattern of injury, medical history and review of systems should be obtained.

For any wound below nipples in front and inferior to the scapular angles dorsally should be considered to have an abdominal injury (Liver, Spleen…etc.) until prove otherwise.

**I. Chest Radiography**

The chest X-ray remains paramount in every trauma victim and should be the central focus from which potential life-threatening thoracic problems are suspected but if the patient is haemodynamically unstable this should not be the first step.

**II. Computerized Tomography (CT)**

Is not essential for every patient with chest trauma and should not be performed in the severely hemodynamically unstable patient or in the presence of life-threatening injuries.

**III. FAST and Echocardiography**

Termed as the focused assessment for the sonographic evaluation of the trauma patient, or FAST examination, four standard viewing ports are used to quickly access abnormal fluid collection: right upper quadrant, left upper quadrant, pelvis, and subxiphoid.

**V. Angiography**

Angiography remains the gold standard in the diagnosis of aortic transection or injuries to the great vessels. Indications for Angiographic Studies for Potential Thoracic Injuries are:

1) High-speed deceleration injuries
2) Chest X-ray findings:
   - Widened mediastinum, Loss of aortic knob shadow, Tracheal or esophageal deviation to the right, Widening of paraspinal stripe and/or apical capping,
Downward displacement of left mainstem bronchus, Obliteration of the aortopulmonary window.
3) Fractured first rib, sternum, or scapula
4) Multiple rib fractures or flail chest
5) Massive hemothorax
6) Upper extremity hypertension
7) Unexplained hypotension
8) Pulse deficits or asymmetry
9) Systolic murmur

**VI. ECG Electrocardiography**: Persistent new abnormal ECG findings varying from non-specific ST to T wave changes, Q-wave, conduction abnormalities or tachyarrhythmia should be considered indicative of myocardial contusion. A normal ECG does not conclusively exclude myocardial contusion.

**VII. Endoscopic Examination**: Bronchoscopy for evaluation of airway injury, haemoptysis, inhalational injury and evaluation and treatment of parenchymal atelectasis and collapse. Foreign bodies may be removed with rigid bronchoscopy. OGD is somewhat controversial as a diagnostic tool in trauma.

**VIII. Pericardiocentesis**: Performed in the resuscitative phase as a diagnostic or at best a temporising modality in cardiac tamponade. Pericardiocentesis cannot be relied on to diagnose cardiac injuries in a trauma setting because of high false positive and false negative (10 to 20%) rates

**IX. Contrast Studies**: A gastrografin swallow is a good first choice to evaluate the esophagus in a trauma victim who can swallow.

**EMERGENCY DEPARTMENT THORACOTOMY**

ED thoracotomy clearly plays a role in penetrating thoracic trauma, particularly in the setting of trauma patients with cardiac tamponade from penetrating chest injuries. Thoracotomy allows relief of the tamponade, the ability to perform open cardiac massage, and the ability to control ongoing intrathoracic hemorrhage, as well as limit intraabdominal hemorrhage and the ability to cross-clamp the aorta to improve cerebral and coronary perfusion in the setting of exsanguinating hemorrhage.
SPECIFIC INJURIES:

A. Chest wall:

1. Fracture Ribs

Fracture of the ribs is the most common blunt thoracic injury, occurring in an estimated 40% of patients. Rib fractures represent an important indicator of trauma severity. In general, the greater the number of ribs fractured, the higher the patient’s morbidity and mortality. The number of ribs fractured has been significantly correlated with the presence of hemothorax or pneumothorax, with 81% of patients having either condition if two or more ribs were fractured. Fractures of the fourth through the ninth rib are associated with injuries to the lung, bronchus, pleura, and heart, whereas fractures below the ninth rib are indicative of spleen, hepatic, or renal injuries.

The main symptoms include pain, tenderness, and possibly crepitus. An upright chest X-ray is the standard way to diagnose fractures. After adjusting for severity of injury, comorbidity, and presence of multiple rib fractures, elderly patients (>65 years old) with simple rib fractures still were five times more likely to die compared with patients under age 65. First rib fracture has particular significance because of the great force required for it to occur and the likelihood that intrathoracic visceral injury also has taken place.

Treatment:
Once a haemopneumothorax and major skeletal injuries are excluded, the management is mainly for control of chest pain by nalgesics mostly NSAIDS, intercostals blocks by local anesthesia, T.E.N.S may be useful. Chest strapping or bed rest is no longer advised and early ambulation with vigorous physiotherapy (and oral antibiotics if necessary) is encouraged.

2. Flail Chest:

Defined as multiple rib fractures of 2 or more, occurring in 2 places along the same rib producing a segment of chest wall that moves paradoxically with respiratory movements i.e. inwards during inspiration and outwards during expiration, thereby reducing effective gas exchange.

Patterns of flail chest:
Anterior: Bilateral anterior fractures with bilateral costochondral separation (15%) or fractures of sternum with associated costochondral separation (7%).
Lateral: Multiple fractures on the same side with or without costochondral separation (73%) or fractures of several ribs with two or more fracture points on the same side (5%).

Pathophysiology: The flail segment moves paradoxically, the net result is poor oxygenation from injury to the underlying lung parenchyma and paradoxical movement
of the flail segment. An increase in airway resistance and work of breathing and pain results in inadequate ventilatory exchange characterised by progressive hypoxia, hypercarbia and inefficient coughing and subsequent retention of secretions and possibly superadded infections.

**Treatment:**
Approximately 50% of patients with flail chest can be managed without mechanical ventilation with the use of epidural analgesia, chest physiotherapy, bronchoscopy for mucus plugs, bronchodilators and mucolytic agents and supplemental oxygen. Mechanical ventilation is used when signs of progressive hypoxia not responding to simple oxygen therapy.

In the more severe case, endotracheal intubation is required with positive-pressure ventilation for up to 3 weeks, until the fractures become less mobile.

Thoracotomy with fracture fixation is occasionally appropriate if there is an underlying lung injury to be treated at the same time.

An anterior flail segment with the sternum moving paradoxically with respiration can be stabilised by internal fixation but operative management is not usual for either.

### 3. Fracture sternum

Morbidity and mortality from isolated sternal fractures is low. Patients with isolated sternal fractures, a normal echocardiogram, and no elevation of cardiac enzymes in the early hours of injury will have a benign course.

Surgical repair of a sternum is very uncommon (<2%) and is indicated usually for either persistent pain or cosmesis.

Surgical management options include metal plates with or without autologous bone grafts. Although an isolated sternal fracture carries a favorable prognosis, other life-threatening concomitant injuries occur in up to one third of patients, necessitating careful evaluation and clinical vigilance.