Diagnosis of Potential Delayed Haemothorax /Pneumothorax in Blunt Thoracic Trauma: Clinical Guideline

Scope

<table>
<thead>
<tr>
<th>Site</th>
<th>Department, Division or Operational Area</th>
<th>Applicable to</th>
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</thead>
<tbody>
<tr>
<td>Royal Perth Hospital</td>
<td>Trauma Service</td>
<td>Medical, Nursing and Allied Health</td>
</tr>
</tbody>
</table>

Links to Relevant Documents

- Appendix I: Algorithm – Haemothorax/Pneumothorax

Related Standards

NSQHS

9.4.1 Mechanisms are in place to escalate care and call for emergency assistance

Definition

**Delayed Haemothorax/pneumothorax**

Haemothorax/pneumothorax not diagnosed on initial CXR following blunt thoracic trauma, usually associated with fractured ribs.

General Information/Preamble

A haemothorax is a condition that results from blood accumulating in the pleural cavity. Its cause is usually traumatic, from a blunt or penetrating injury to the thorax, resulting in a rupture of either of the pleural membrane lining the thorax and covering the lungs. This rupture allows blood to spill into the pleural space, equalizing the pressures between it and the lungs. Blood loss may be massive in people with these conditions, as each side of the thorax can hold 30%-40% of a person's blood volume.

If left untreated, the condition can progress to a point where the blood accumulation begins to put pressure on the mediastinum and the trachea, effectively limiting the amount of diastolic filling of the ventricles and deviating the trachea to the unaffected side.

Anatomy and Pathophysiology

Normally, the pleural space, which is between the parietal and visceral pleurae, is only a potential space. Bleeding into the pleural space may result from either extrapleural or intrapleural injury.

Extrapleural Injury

Traumatic disruption of the chest wall tissues with violation of the pleural membrane can cause bleeding into the pleural cavity. The most likely sources of significant or persistent bleeding from chest wall injuries are the intercostal and internal mammary arteries.
Intrapleural Injury

Blunt or penetrating injury involving virtually any intrathoracic structure can result in haemothorax. Massive haemothorax or exsanguinating haemorrhage may result from injury to major arterial or venous structures contained within the thorax or from the heart itself. These include the aorta and its brachiocephalic branches, the main or branch pulmonary arteries, the superior vena cava and the brachiocephalic veins, the inferior vena cava, the azygos vein, and the major pulmonary veins.

Injury to the heart can produce a haemothorax if a communication exists between the pericardium and the pleural space.

Injury to the pulmonary parenchyma may cause haemothorax, but it is usually self-limited because pulmonary vascular pressure is normally low. Pulmonary parenchymal injury is usually associated with pneumothorax and results in limited haemorrhage.

Aneurysms of other intrathoracic arteries such as the internal mammary artery have been described and are possible causes of haemothorax if rupture occurs.

Signs and Symptoms

- Tachypnoea
- Dyspnoea
- Cyanosis
- Decreased or absent breath sounds on affected side
- Tracheal deviation
- Dull resonance on percussion
- Unequal chest rise
- Tachycardia
- Hypotension
- Pale, cool, clammy skin
- Possibly subcutaneous air
- Narrowing pulse pressure

Delayed Haemothorax

Delayed haemothorax after blunt trauma is a rare, but significantly morbid entity with a rate described in the current literature of approximately 8% of all blunt chest trauma patients having an initial normal CXR, associated with one or more displaced rib fractures. The delayed haemothorax can occur at some interval after blunt chest trauma. In such cases, the initial evaluation, including chest radiography, reveals findings of rib fractures without any accompanying intrathoracic pathology. However, hours to days later, a haemothorax is seen. The mechanism is believed to be either rupture of a trauma-associated chest wall hematoma into the pleural space or displacement of rib fracture edges with eventual disruption of intercostal vessels during respiratory movement or coughing.

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Simon et al. described twelve cases that presented with delayed haemothorax 18 h to six days after severe blunt chest trauma associated with rib fractures. The authors characterized delayed haemothorax as a potentially lethal complication unique to displaced rib fractures following blunt chest trauma. It is clear from the literature that fatal consequences of chest trauma are not all immediate. Sharma et al. reported an incidence of 5% for delayed haemothorax, defined as haemothorax occurring after discharge from the hospital. These patients were found to be less severely injured, and initially were confined for shorter periods in the hospital. Rib fractures were present in 75% of cases. In 2006, Chilma et al. reported delayed massive post-traumatic haemothorax in a patient without rib fractures. At operation, it was found that the site of haemorrhage was the internal mammary artery.

Diagnosis and Management

Haemothorax

Upright erect chest x-ray (CXR) is the ideal primary diagnostic study in the evaluation of haemopneumothorax. In the normal unscarred pleural space, a haemothorax is noted as a meniscus of fluid blunting the costophrenic angle or diaphragmatic surface and tracking up the pleural margins of the chest wall, when viewed on the erect CXR film. As much as 400 mL to 500 mL of blood is required to obliterate the costophrenic angle as seen on an erect CXR. In the acute trauma setting, the supine CXR may be the first and only view available from which to make definitive decisions regarding therapy. The presence and size of a haemothorax is much more difficult to evaluate on supine films. As much as 1,000 mL of blood may be missed when viewing a supine CXR film. Additional imaging studies, such as ultrasonography (FAST) and computed tomography (CT), may sometimes be required for identification and quantification of a haemothorax noted on a plain chest radiograph.

Pneumothorax

In evaluating the CXR, first impressions of pneumothorax presence and size can be misleading. To assist in determining the size of pneumothorax on the CXR, a 2.5-cm margin of gas peripheral to the collapsing lung corresponds to a pneumothorax of about 30%. Complete collapse of the lung is a 100% pneumothorax. Supine chest AP films are notoriously inaccurate. Because they result in air spreading out over the anterior chest, supine films often appear normal, even in the presence of significant air. Frequently, the only indication is the “deep sulcus sign”, so named because of the appearance of an especially deep costovertebral sulcus.
Chest x-ray findings

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<th>Erect CXR</th>
<th>Supine CXR</th>
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<tr>
<td>• Sharp delineation of visceral pleura by dense pleural space</td>
<td>• Anteromedial pneumothorax (earliest location)</td>
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<tr>
<td>• Absence of vascular markings beyond visceral pleural margin</td>
<td>• Outline of medial diaphragm under cardiac silhouette</td>
</tr>
<tr>
<td>• Mediastinal shift to opposite side</td>
<td>• Deep sulcus sign</td>
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<tr>
<td>• Air-fluid level in pleural space on erect chest radiograph</td>
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<td>• White margin of visceral pleura separated from parietal pleura</td>
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<td>• Usually seen in the apex of the lung</td>
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<td>• May be accentuated by an expiratory film in which lung volume is reduced while amount of air in pneumothorax remains constant so that relative size of pneumothorax appears to increase</td>
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Unless there is obvious urgent indication (such as tension PTX/HTX) for immediate insertion of an Intercostal Catheter (ICC), all patients with a history of blunt thoracic trauma should undergo CXR as an adjunct to primary trauma survey.

If the chest x-ray reveals a haemothorax or pneumothorax, manage appropriately (e.g. insertion of ICC, conservative management) according to patient’s presentation and clinical status.

If the CXR is normal (i.e. no haemothorax or pneumothorax), however, the patient has risk factors for delayed pathology (significant mechanism and at least one rib #, elderly, anticoagulants, altered mental state/sedated/intubated, c-spine cord injury), continue to observe the patient for at least 24 hours for signs of clinical deterioration or changes in clinical signs previously discussed.

An erect chest x-ray must be performed and reviewed by the Trauma Fellow/Consultant prior to discharge in these high risk patients.

On discharge, the patient should be provided with the Pneumothorax Patient Information Brochure and advised of the risk for delayed pneumothorax/haemothorax and to seek medical help:

Acknowledgements

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Trauma Committee reviewed and approved August 2018

References

Appendix I: Algorithm – Haemothorax/Pneumothorax

Blunt Thoracic Trauma

Urgent indication for Intercostal Catheter (ICC) (tension HTX/PTX)

Direct to ICC Insertion or finger thoracostomy

Chest X-Ray

Haemo/Pneumothorax?

Standard blunt chest trauma management

High index of suspicion for delayed HTX / PTX (significant mechanism and at least one rib #, elderly, anticoagulants, altered mental state/sedated/intubated, c-spine cord injury)

Daily clinical chest examinations for duration of admission

Clinical deterioration or new clinical signs

Erect Chest x-ray prior to discharge**

Discharge home with appropriate clinical advice*#

*Consider patient’s discharge destination (e.g. geographical isolation) and physical activities

# assuming no other injuries

** Erect chest x-ray to be reviewed by Trauma Fellow/Consultant prior to discharge