**Chest drain insertion for trauma patients**

**Scope**

This guideline covers the indications for chest drain insertion and the immediate clinical management post-chest drain insertion. It is for patients who have sustained a pneumothorax or haemothorax from trauma. This guideline does not cover the management of ‘medical’ patients with a spontaneous pneumothorax or pleural effusion.

**Introduction**

Chest trauma is common but only a minority of patients require surgical intervention. For many chest injuries, analgesia ± the safe insertion of an appropriately sized and positioned chest drain are the only interventions required.

**Indications for chest drain insertion following trauma**

1. A life threatening chest condition is detected on primary survey
   1. Traumatic cardiac arrest (the thoracostomies do not require immediate chest drain insertion)
   2. Tension pneumothorax with severe respiratory compromise or haemodynamic instability
   3. Large open pneumothorax (close and cover the wound & make a new thoracostomy site)
   4. Massive haemothorax (very difficult to clinically distinguish from tension pneumothorax)

2. Detection of pathology on imaging

* Moderate or large simple pneumothorax
* Moderate or large haemothorax

The identification of an asymptomatic small pneumothorax or haemothorax on CT scan is not an immediate indication for chest drain insertion in a stable patient.

The presence of a cannula in the chest wall for needle chest decompression is not an indication for chest drain insertion on its own. Cannulae inserted in the pre-hospital environment will not always penetrate the pleural cavity and cause an iatrogenic pneumothorax. The patient should be reassessed clinically. If there are clinical signs of respiratory or cardiovascular compromise with a suspected tension pneumothorax the patient requires immediate thoracostomy ± chest drain insertion. If there are no adverse clinical signs, the patient should receive imaging (CXR or CT) to determine whether there is a significant pneumothorax requiring drainage.

Not every intubated patient who has a pneumothorax detected on CT, requires a chest drain. A risk-benefit analysis is required taking into account the size of the pneumothorax, whether the patient is going to theatre and any other injuries.

Some patients will have had pre-hospital thoracostomies performed prior to arrival and some trauma patients may require immediate decompressive thoracostomies as part of the primary survey (for traumatic cardiac arrest or suspected tension pneumothorax-. The trauma patient who is intubated and receiving positive pressure ventilation does not require immediate chest tube insertion following thoracostomy: this can be done post CT scan. The patient who is not intubated and is spontaneously ventilating will need an immediate chest drain insertion following creation of an open thoracostomy.

Chest drains can be inserted through correctly sited pre-hospital thoracostomies. A new incision is not necessary.

Chest drains should not be inserted through stab wounds or other penetrating chest trauma even if this is in the correct site.

Beware the chest trauma mimics on CXR

* Lung bullae - not pneumothorax
* Ruptured left hemidiaphragm and intrathoracic gastric bubble - not pneumothorax
* Ruptured right hemidiaphram and intrathoracic liver - not haemothorax

**Equipment required**

* Sterile gloves and gown, eye protection
* Antiseptic for skin cleaning
* Sterile drapes and gauze
* Green needle and 20ml syringe
* Local anaesthetic
* Scalpel
* Spencer Wells Forceps
* Chest tube
* Connecting tubing
* Closed drainage system with underwater seal (filled with water if applicable)
* Suture (2-0 or thicker)
* Dressings

**Procedure for insertion**

The doctor performing chest drain insertion must be adequately trained.

A 24+ Fr chest drain is sufficient in most situations. Seldinger drains are not indicated for traumatic chest conditions.

The patient should receive intravenous analgesia and local anaesthetic as a minimum.

For non-emergency chest drain insertion and when the trauma patient has the capacity to be able to give informed consent, written consent should be taken before starting the procedure. Complications include pain, bleeding, nerve damage, drain related visceral injury, wound infection, intra-pleural infection, drain blockage and drain dislodgement.

Where possible, the patient should be positioned supine or semi-recumbent, with the arm abducted on the affected side.

Prior to starting, the patient’s chest and any imaging should be re-assessed to confirm the side of chest drain insertion.

The site for chest drain insertion is just anterior to the mid-axillary line in the 4th or 5th intercostal space. The site should be formally located by palpating the angle of Louis, moving laterally into the 2nd intercostal space, counting down to the 4th space and rechecking the position.

Techniques such as using the male nipple, the patients hand in the axilla or the ‘safe triangle’ alone are inaccurate at locating the correct space and should be avoided (Bowness 2015).

Where landmarks are difficult due to obesity/rib fractures or in pregnant patients with a raised diaphragm, aim for a higher intercostal space (as long as the incision is lower than the axilla) to avoid an intra-abdominal incision. The practitioner should also confirm that the defined site is well within the ‘safe triangle’ - bordered by the anterior border of the latissimus dorsi, the lateral border of the pectoralis major muscle, and a line superior to the horizontal level of the nipple.

The skin should be cleaned with alcohol/chlorhexidine solution and the patient should be draped.

Local anaesthestic should be infiltrated under the skin along the site of the proposed incision, and then perpendicular through the layers of the chest wall into the pleural cavity. The needle should be aspirated to confirm aspiration of pleural contents. If this is not possible, chest drain insertion should not continue. BTS

A 4-5 cm incision is made in the intercostal space in the line of the ribs and Spencer Wells forceps used to bluntly dissect through the subcutaneous tissues and intercostal muscles. The practitioner should keep the tract straight and avoid burrowing.

The parietal pleura should be punctured with the tip of the forceps, the forceps opened to expand the hole, and a gloved finger should be immediately inserted into the incision to maintain the tract.

A 360-degree finger sweep should be performed to clear any adhesions or clots. Beware of rib fractures which may puncture gloves and give a sharps injury.

The practitioner should identify whether the lung is up or down and whether the lung is re-expanding upon decompression.

Trocars must never be used. Spencer wells forceps should be used to pick up the proximal end of the chest tube and advance into the pleural space until all holes are within the chest.

Ideally the chest tube is positioned up for air and down for blood but either direction will cover both injury patterns.

**Post chest drain insertion**

Checks should be made that the chest tube is fogging with expiration. The drain should be attached to an underwater seal bottle or one-way valve bag designed for this purpose, and kept below the level of the patients chest to prevent backflow. The chest tube should swing with respiration or bubble if there is a large air leak. A record of the volume of any fluid draining must be documented. In an awake patient, the chest should be re-examined and any symptoms reassessed.

The chest drain should be secured to the skin using 2-0 or thicker non-absorbable sutures. A horizontal matress suture is recommended. Purse string sutures create poor cosmetic results, difficult wound healing with chronic pain so must be avoided. Place a small dressing over the wound and secure lightly with tape.

Obtain a CXR and check the position of the drain: are all holes within the pleural cavity, is the drain too far in and abutting the mediastinum.

For misplaced drains, eg intra-abdominal or intra-parenchymal, consult the on-call Cardiothoracic team at the regional Major Trauma Centre.

Involve Cardiothoracic surgery if there is significant blood loss of more than 1000mls on insertion or ongoing blood loss of >100 mls per hour or persistent air leak >24 hours. If no Thoracic Surgery is provided on-site, discuss with the regional Major Trauma Centre regarding transfer.

**Prophylactic antibiotics**

A minimum of three doses of intravenous antibiotics should be administered to patients who have had:

* pre-hospital thoracostomies
* Emergency Department non-sterile thoracostomies performed in an emergency
* penetrating chest trauma eg stab or gun shot (Moore)

Patients having routine sterile chest drain insertion with skin cleaning do not require prophylactic antibiotics (BTS).

Antibiotic selection is based on local trust policy for prophylactic antibiotics for open fractures (for example Co-amoxiclav, or Clindamycin in the case of Penicillin allergy).

**References**

Havelock T, Teoh R, Laws D, et al. Pleural procedures and thoracic ultrasound. British Society Pleural Disease Guideline 2010. *Thorax* 2010;vol 65:supp II.

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Bowness J, Kilgour PM, Whiten S, et al. Guidance for chest drain insertion may not prevent damage to abdominal viscera. Emerg Med J 2015;32:620–625.

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