Chest Drain Insertion for Trauma Patients
Network Guideline

Scope

This guideline covers the indications for chest drain insertion for pneumothorax or haemothorax due to injury and immediate clinical management after insertion. 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 most chest injuries, appropriate analgesia ± safe insertion of an appropriately sized and positioned chest drain are the only interventions required. See trauma network chest injury guideline for overall management recommendations.

Indications for chest drain insertion following trauma

1. A life threatening chest condition is detected on primary survey
    a. Tension pneumothorax with severe respiratory compromise or haemodynamic instability
    b. Large open pneumothorax (close and cover the wound & make a new thoracostomy site)
    c. Massive haemothorax (very difficult to distinguish clinically from tension pneumothorax)
    d. Following resuscitation from traumatic cardiac arrest (these patients will have bilateral thoracostomies performed as part of the resuscitation protocol which do not need immediate chest drain insertion)

2. Detection of pathology on imaging
    a. Moderate or large simple pneumothorax
    b. 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; a chest drain may not be needed at all.

Recent [attempted] needle decompression of a suspected pneumothorax is not, on its own, an indication for chest drain insertion. Cannulae do not always penetrate the pleural cavity and cause an iatrogenic pneumothorax: assess the patient.

Imaging for patients with suspected chest trauma should be performed urgently, and the images should be interpreted immediately by a healthcare professional with training and skills in this area.

Consider immediate chest X- ray and/or eFAST (extended focused assessment with sonography for trauma) as part of the primary survey to assess chest trauma in adults (16 or over) with severe respiratory compromise.

If there are signs of respiratory or cardiovascular compromise due to suspected tension pneumothorax the patient requires immediate thoracostomy followed soon after by chest drain insertion. If there are no severe adverse clinical signs, perform imaging (Preferably CT) to determine if there is significant pathology (eg pneumothorax or haemothorax) 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, any other injuries and whether the patient is going to be transferred to theatre or another unit. This assessment should be undertaken by senior clinicians and the decision clearly documented and handed over to the team assuming responsibility for patient care.

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 thoracostomies (performed pre- or in-hospital): a new incision is not necessary.

Chest drains should not be inserted through stab wounds or other penetrating chest injuries 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 may be considered if CT shows no evidence of haemothorax.

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

For non-emergency chest drain insertion and when the trauma patient has capacity 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 4^{th} or 5^{th} 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 4^{th} 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 not be used as the sole method.

Where landmarks are difficult eg obesity, rib fractures, 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.

Clean the skin with alcohol/chlorhexidine solution and drape the patient.

Infiltrate local anaesthestic 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.

Make a 4-5 cm intercostal parallel to the ribs and use Spencer Wells forceps to dissect bluntly through the subcutaneous tissues and intercostal muscles; keep the tract straight and avoid burrowing.

Puncture parietal pleura with the tip of the forceps, open them to expand the hole, and insert a gloved finger to maintain the tract.

Use a 360-degree finger sweep to clear any adhesions or clots but beware of rib fractures which may puncture gloves and give a sharps injury.

With the inserted finger, identify if 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 a chest tube is positioned up for air and down for blood but either direction will cover both injury patterns.

Post chest drain insertion

Checks that the chest tube is fogging with expiration. Attach the drain to an underwater seal bottle or one-way valve bag designed for this purpose, and kept below the level of the patient's chest to prevent backflow. Fluid in the chest tube should swing with respiration or bubble if there is a large air leak. A record of the volume of fluid draining must be documented. Re-examine the chest and vital signs; in the awake patient, reassess symptoms.

Secure the chest drain to the skin using 2-0 or thicker non-absorbable sutures. A horizontal mattress 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 thoracostomy
- Emergency Department emergency (ie non-sterile) thoracostomy
- Penetrating chest trauma eg stab or gun shot

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

Antibiotic selection is based on local trust policy for prophylactic antibiotics for open fractures (eg 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.

Moore FO, Duane TM, Hu CK, et al. Presumptive antibiotic use in tube thoracostomy for traumatic haemopneumothorax: An Eastern Association for the Surgery of Trauma Practice management guideline. J Trauma Acute Care Surgery 2012; Vol 73: S341-S344.

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.

NICE Guideline 39: Major Trauma. February 2016. https://www.nice.org.uk/guidance/indevelopment/gid-cgwave0642

Date for review: December 2019