Guidance for in-hospital Chest Drain Placement for Major Trauma Patients

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Introduction and Scope

Introduction

Chest trauma is a common presentation to major trauma centres and severity of chest injury is directly associated with increased patient mortality\(^1,2\). The correct insertion of appropriately sized chest drain is the only intervention required in the management of most chest injuries\(^3\). Incorrect placement of a chest drain is a recognised cause of significant morbidity and even mortality.\(^4\)

This guideline is for the placement of in-hospital chest drains in a trauma scenario. It covers the use of chest drains in adults not requiring further interhospital transfer.

Scope

This document is designed to guide and aid decision making regarding chest drain insertion, observation and management. It does not replace adequate clinical training and experience.

It has been created to support documentation, consent and ongoing care of a chest drain by providing the tools to improve this. It also seeks to clarify points of escalation to senior clinicians and specialties as well as streamlining patient pathways and care.
Indications

**Indications for trauma chest drain (28-32Fr)**
- Any open pneumothorax in addition to closing/covering open wound.
- Any tension pneumothorax.
- Any clinically significant haemothorax (i.e. visible on CXR or causing compromise).
- Haemodynamic or respiratory compromise in simple pneumothorax.
- Thoracostomies.
- In intubated patients: Moderate/large volume pneumothorax or symptomatic patients.

**Indications for Seldinger drain (10-14Fr) (after liaising with senior clinician or Thoracics)**
- Isolated moderate or large volume pneumothorax secondary to blunt trauma with no other evidence of chest trauma (including fractures, contusional injury, haemothorax or bleeding).

**Indications for consideration of observation**
- Small volume closed pneumothorax in non-intubated patients.
- Small volume asymptomatic closed pneumothorax in intubated patients.
- Minimal occult haemothorax as seen on CT scan.
  - Minimal occult haemothorax is one measuring ≤1.5cm less when measuring the maximum intrapleural fluid thickness, usually the posterior dependent pleural "gutter". A progressively worsening effusion should be managed with a trauma chest drain.
  - If the haemothorax is conservatively managed and the patient is discharged within 1-2 days of admission, ensure follow up has been arranged. In an isolated chest injury this would be in the thoracic clinic.

**NB:** If a chest drain is required in small volume pneumothorax, the open technique with an appropriately sized large bore drain is the preferred route of insertion due to the reduced incidence of lung injury and subsequent potential for a bronchopleural fistula.

**Incidences where chest drain not required:**
- Evidence of surgical emphysema where no pneumothorax is identified unless clinically worsening.
- Presence of prehospital needle catheters is not an indication for immediate chest drain unless there is evidence of a pneumothorax.

**Intrathoracic Pseudoaneurysms**
If an intrathoracic pseudoaneurysm is visualised on CT, the vascular IR team should be contacted prior to intercostal drain insertion for consideration of embolisation. If the patient is in extremis, then the drain should be sited as above, and the vascular IR team alerted urgently (preferably simultaneously to drain placement).
Imaging

Pre-chest drain imaging

- Indicated in most cases.
- Should **not** delay chest drain insertion in patients who are haemodynamically unstable or have significant respiratory compromise where there is concern for a tension pneumothorax.
- Point of care ultrasound (PoCUS) can be used as part of the clinical assessment of a patient however X-Ray or CT remains the imaging modality of choice to identify and quantify the haemothorax or pneumothorax.
- A pitfall of PoCUS - if a patient has multiple rib fractures and is splinting their chest wall it may appear as though they have a pneumothorax on Ultrasound when they do not (due to breathing artefact contributing to the imaging findings).

Further chest drain imaging

- Post chest drain imaging via CT (for those patients who need a CT to delineate their injuries) or X-Ray (those who have already had a CT) indicated in all cases to evaluate drain placement.
  - If there are concerns that the drain is incorrectly placed, seek advice from senior colleagues or thoracic surgery. The patient may require a new drain or advice on how to best manage the existing one.

- Consider chest drain imaging in the following:
  - Concerns around poor output from chest drain without clinical improvement in patient after clinical assessment.
  - Concerns around dislodged chest drain or damage to drainage apparatus.
  - Clinically worsening or persistently unstable patient.
Personnel and Consent

The inserting clinician should:
- Be aware of relevant anatomy.
- Be aware of indications and the complications that can arise from insertion.
- Be experienced and competent with drain insertion or being closely supervised by someone who is.
- **A trauma drain in an unstable patient should not be inserted by a clinician inexperienced with the procedure.**

Consent
- Informed written consent with discussion of risks and benefits should be obtained where possible.
- If this is not possible, verbal consent is appropriate if fully documented.
- If a patient is unconscious, intubated, is experiencing a life-threatening injury or are lacking capacity, a best interest decision can be made, and this should be documented in all cases.

Complications

Include but are not limited to:
- Pain
- Infection (wound and intrapleural)
- Scarring
- Failure
- Visceral injury
- Drain blockage
- Neurovascular damage
Procedure

Cautions prior to insertion
- Scarring on chest may indicate previous thoracic surgery and possibility of adhesions.
- History of COPD: bullous disease can be mistaken for pneumothorax.
- Ruptured left hemidiaphragm and intrathoracic stomach can mimic pneumothorax.
- Do not clamp a chest drain under any circumstance
- Ensure care is taken to not penetrate the breast tissue on insertion of the chest drain.

Pain relief and pain management
- In conscious alert patients, sufficient local anaesthetic should be administered and given time to work and the use of this documented with dosage given.
  o Max dose of Lidocaine for tissue infiltration 3mg/kg.
- Consider premedication with ketamine, opiates or benzodiazepines according to local protocols – be aware of the cautions and contra-indications of these in certain trauma.

Insertion of Surgical Trauma Drain

- Assemble equipment as laid out in Appendix A.
- Drain size to be guided as set out in indications. If any doubts, a large bore (28-32Fr) drain is sufficient in most trauma situations.
- Insertion is in the triangle of safety, as per ATLS guidelines on chest drain insertion.
- Position patient appropriately.
- If indicated, use premedication with opiates, ketamine or benzodiazepines according to local guidance.
- Clean chest wall using chlorhexidine swabs (use alternate cleaning agent if patient has an allergy to chlorhexidine) and drape patient allowing for operative field.
- Prepare underwater seal.
- Infiltrate local anaesthetic as above, allowing time for this to work.
- Assess length of drain needed - insertion site to apex or base depending upon need.
- Insertion is to 4th or 5th intercostal space + anterior axillary line.
- Incision through skin and subcutaneous tissues to intercostal muscles.
- Blunt dissection with large clip + “above the rib below” to avoid intercostal nerves and vessels
- Insert drain to required length, angling drain posteriorly in most cases
- Ensure all drain holes are within the chest cavity, with chest tube markings at 10-14cm at the skin.
- Secure drain using separate interrupted sutures.
- Connect to underwater seal.
- Place simple dressing around drain site.
- Arrange post-procedure imaging
- Document procedure clearly.
- Do not clamp a chest drain under any circumstance.
Documentation

This should be clear and include:
- Who performed drain insertion (+/- who supervised procedure if required)
- Drain size
- Consent
- Lidocaine dose and premedication dose (if used)
- Drain site
- Drain markings at skin.
- Volume of fluid (if any) drained immediately.
- Any immediate or post procedure complications.
- Post procedure imaging interpretation.

See Appendix B for proforma for chest drain insertion
Management, Observations and Antibiotics

Thoracics should be alerted to any patient with a trauma chest drain in situ as soon as possible. If the patient has an isolated chest injury, Thoracics should be the admitting team as per the existing LTHT isolated thoracic trauma agreement.

Observations should include:
- If the drain is swinging or not
- Presence of an air leak and if this is:
  - Constant
  - On expiration
  - On coughing
- Fluid
  - Volume
  - Colour / consistency
  - When to measure
    - Hourly
    - 24hour total
- Inspect the drain site for fluid leak, signs of infection, drain markings.
- Avoid suction on chest drains unless advised by thoracic surgery.

When to update and alert thoracic surgery and senior clinicians:
- If there is significant blood loss of greater than 1000ml on insertion
- Ongoing blood loss of ≥ 100ml per hour
- Persistent air leak after >24 hours.
- If the effusion is consistent with gastric contents, consider oesophageal rupture, ruptured diaphragm, or a misplaced (intragastric) drain.
- Concerns with position of chest drain on imaging

In the context of life-threatening haemorrhage, if the patient is at LGI ED contact the Cardiac Surgery team on bleep 2924 for haemorrhage control in theatre. Cardiac Surgery will subsequently contact Thoracics if their assistance is required.

Tranexamic acid:
In trauma patients with evidence of haemothorax the use of tranexamic acid should be considered for prevention and treatment of significant haemorrhage. A loading dose of 1 g intravenously to be given over 10 minutes, treatment should be commenced within 3 hours of the injury, followed by (by intravenous infusion) 1 g to be given over 8 hours.

Antibiotic Usage:
Penetrating Chest Trauma or Pre-Hospital Thoracostomies
- All patients should receive intravenous prophylactic antibiotics:
  - First line: IV Co-Amoxiclav 1.2g for three doses
  - If penicillin allergic: IV Clindamycin 600mg for four doses
  - Other allergy affecting above: contact microbiology consultant.
- Further guidance regarding antibiotic cover should be directed by a microbiology consultant.

Blunt Chest Trauma
- These patients do not require antibiotic prophylaxis for intercostal drain insertion.

Authors: Dr. A Shaw and Dr. P Winstanley
Lead Clinicians: Dr. S. Zeb (Emergency Medicine), Mr. R. Milton (Thoracic Surgery), Dr. M. Denton (Microbiology)
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Removal of a Chest Drain

**Indications for removal:**
- Drain has stopped draining
- Drain is no longer needed
- Drain has stopped functioning correctly.
- If the drain was placed for pneumothorax, there should be no air leak for 24 hours prior to removal.
- Patients should have a pre-removal CXR to ensure there is no radiological evidence for the drain to remain in-situ.

**Procedure:**
- Should be performed by someone experienced and competent with removal, or being closely supervised by someone who is.
- Aseptic, two person technique - one to remove drain and the other to secure wound with suture.
- Drain should be removed in one steady movement. Evidence suggests that removal at full expiration leads to lower incidence of non-clinically significant pneumothorax.
- If suture and lidocaine used, document dose of lidocaine used.
- Post-removal CXR is not mandatory if patient stable and clinical examination reassuring. However, this is recommended, especially if any clinical concerns or doubts.
Appendices

Appendix A

For Surgical Trauma Chest Drain insertion you will require:

- Chlorhexidine swabs
- Gown and gloves
- 10 to 20 ml of 1% lignocaine
- Suture
- Trauma chest drain kit (with syringes, needles, scalpel blade, drape, dressing)
- 28-32Fr trauma chest drain
- Connecting tubing
- Chest drain bottle
- Sterile water for under water seal

Assembled Drainage Apparatus
References


Also indirectly referenced

- *Advanced Trauma Life Support (ATLS)*. Elsevier, Urban Et Fischer, 2015, p. Appendix G.


Contributing Senior Clinicians

**Dr. Shahzadi Zeb**  
Consultant in Emergency Medicine  
Accident and Emergency Department  
Jubilee Wing  
Leeds General Infirmary

**Mr. Richard Milton**  
Consultant in Thoracic Surgery  
Department of Thoracic Surgery  
Bexley Wing  
St James’s University Hospital

**Dr. Miles Denton**  
Consultant Microbiologist  
Department of Microbiology  
Old Medical School  
Leeds General Infirmary

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Lead Clinicians: Dr. S. Zeb (Emergency Medicine), Mr. R. Milton (Thoracic Surgery), Dr. M. Denton (Microbiology)  
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