

# Insertion and Management of Intercostal Chest Drains

(Version 2.0)

## Guideline Readership

This guideline applies to the management of patients with pneumothorax and pleural effusion cared for in the Trust. It is not aimed at patients with post-pneumonectomy spaces.

## Guideline Objectives

- To advise and instruct on the safe insertion of intercostal chest drains by both Seldinger and cut-down techniques for the management of pneumothorax and pleural effusion.
- It is not intended to advise on the specific indications for the insertion of intercostal chest drains **and instead we refer the reader to the appropriate British Thoracic Society Guidelines**. These guidelines offer evidence-based guidance on the investigation and management of pneumothorax and pleural effusion (note there is a specific guideline for pleural infection).
- These guidelines may be viewed at <http://www.brit-thoracic.org.uk/clinical-information/pleural-disease/pleural-disease-guidelines-2010.aspx>

## Other Guidance

N/A

**Ratified Date:** 1 July 2016

**Launch Date:**

**Review Date:** 1 July 2019

**Guideline Author:** Stephen Woolley, Ehab Bishay, Edward Nash

## Paper Copies of this Document

- If you are reading a printed copy of this document you should check the **Trust's Guideline website** to ensure that you are using the most current version.

## 1. Flow Chart

Not Applicable

## 2. Executive Summary & Overview

Intercostal chest drains are inserted to drain fluid or air from the pleural space. The insertion of an intercostal drain is a potentially hazardous procedure and should only be performed by a doctor with adequate competency. The BTS suggests that assessment of competency should include lecture-based teaching, simulated practice (on manikins or animal models) and supervised practice on patients. Competency needs to be maintained by sufficiently regular practical experience of the technique of intercostal drain insertion.

There are 2 methods of intercostal drain insertion, firstly small-bore drains inserted by the Seldinger technique and secondly Argyle-type drains inserted by the blunt dissection 'cut-down' technique. The majority of drains inserted by physicians are of the Seldinger type, whereas thoracic surgeons more commonly insert Argyle-type drains. Generally speaking, Seldinger drains are sufficient for the majority of clinical situations, but Argyle-type drains are preferable for empyema, complicated parapneumonic effusions, haemothorax and trauma situations. The doctor inserting an intercostal drain needs to be competent in the particular technique of insertion being employed in a particular situation.

Patients having an intercostal drain inserted should be on a ward familiar with the management of intercostal chest drains and underwater seals. This applies to the majority of patients with pleural effusions as well as clinically stable patients with pneumothorax. The exception is where an intercostal drain needs to be inserted in another location in an emergency situation (e.g. tension pneumothorax). In this situation, the patient needs to be transferred to a ward familiar with managing intercostal drains as soon as practically possible.

Intercostal drain insertion should not take place out of hours, except in an emergency (patients with significant respiratory or cardiovascular compromise). In patients with a large pleural effusion presenting out of hours, consideration should be given to pleural aspiration to relieve symptoms rather than intercostal drain insertion.

## 3. Body of Guideline

### LOCATION

- Intercostal chest drains should only be inserted on wards where nursing staff are skilled in the management of chest drains and drainage system (including Wards 4, 20, 24, 26, ED, HDU, ICU at BHH; Ward 8 and ED at GHH; ED, AMU, AMU short stay (Ward 20b), Ward 19 and HDU at SH).
- Patients should be transferred to the most appropriate ward listed above **before** having an intercostal chest drain inserted.
- The only exception to the above guidance is the requirement for emergency chest drain insertion (e.g. suspected tension pneumothorax, unstable patient)
- In this circumstance, patients should be transferred to a listed ward as soon as possible after drain insertion.
- Where possible intercostal chest drains should be inserted in a specified clean procedures room rather than at the patient's bedside.

### PERSONNEL

- All personnel inserting chest drains must have the competency relevant for the type of intercostal drain being inserted, as well as appropriate supervision.

- It is advised that the principal individual inserting an intercostal chest drain has one assistant who can don sterile gloves to help, particularly when securing the chest drain to prevent outward migration of the drain when the lung re-expands.

**CONTRAINDICATIONS** (All relative – discuss with Consultant):

- Impaired blood clotting – non-urgent chest drain insertions should be avoided in anticoagulated patients until international normalised ratio (INR) <1.5
- Post-pneumonectomy space – discuss with Thoracic surgeon.

**PREPARATION**

**Radiology**

- A recent chest X-ray is necessary to confirm the indication for the procedure and the side of the pathology. This should be correlated with the clinical signs. The only exception is a suspected tension pneumothorax, where there is usually insufficient time for a chest X-ray to be performed.

Chest ultrasound guidance is strongly recommended prior to all pleural procedures for pleural fluid – this confirms the presence of a sufficiently large quantity of pleural fluid to warrant chest drain insertion and identifies the optimal position for insertion. The marking of a site using chest ultrasound for subsequent remote chest drain insertion is not recommended except for large effusions. Chest ultrasound should ideally be performed immediately prior to drain insertion, allowing the patient to remain in the same position for both procedures.

**It is strongly advised that chest ultrasound guidance is used to confirm the presence of pleural effusion and to identify the optimal position immediately prior to intercostal chest drain insertion.**

**Written informed consent**

- All patients should receive written informed consent prior to drain insertion (except in emergency situations or when the patient is unconscious and the treatment is potentially lifesaving). In this circumstance, treatment may be carried out if it is in the patients' best interests, but must be explained as soon as the patient is sufficiently recovered to understand. Patients without mental capacity should be treated according to the GMC guideline 'Consent: Patients and Doctors Making Decisions Together'.
- BTS guidelines suggest that the following potential complications should be discussed during the consent process: pain, intrapleural infection, wound infection, drain dislodgement, drain blockage and visceral injury.

**Pre-medication (if required in addition to local anaesthetic infiltration)**

- Intravenous access should be maintained throughout the procedure and oxygen saturation should be monitored continuously.
- Consider giving pre-medication (oramorph 5-10mg, pethidine 50-100 mg IM or midazolam 1-2mg IV) prior to the procedure
- These drugs may cause respiratory depression and all patients who receive them should be observed. Patients with chronic obstructive pulmonary disease are particularly at risk and require extra care when using these drugs.

- Reversal agents (e.g. naloxone or flumazenil) are occasionally necessary and should always be immediately accessible if using opiates or benzodiazepines.
- If an intercostal drain is being inserted following non-surgical chest trauma, especially penetrating trauma, antibiotic prophylaxis should be considered. Co-amoxiclav 1.2 g IV 8 hrly is the suggestion antibiotic in this situation. If allergic to penicillin, or if there is any doubt as to whether the patient is truly allergic to penicillin, discuss with the duty microbiologist.

## DRAIN INSERTION

### Site of insertion and position of patient

- For both simple pneumothorax and pleural effusion, the preferred site of insertion is the 'safe triangle'. This is bordered anteriorly by the lateral edge of pectoralis major, laterally by the lateral edge of latissimus dorsi, inferiorly by the line of the fifth intercostal space and superiorly by the base of the axilla. (Figure 1).
- Drains should never be placed below this triangle of safety even if they have been ultrasound confirmed and marked (patient position, respiration may have changed).
- The drain should be inserted in the space just above a rib to avoid damaging the neurovascular bundle.
- The preferred position for standard drain insertion is with the patient lying back in bed at 30 degrees, slightly rotated, with the arm on the side of the lesion behind the patient's head (Figure 1). An alternative is for the patient to sit upright leaning over an adjacent table with a pillow under the arms (Figure 2).
- If the patient has had an ultrasound scan to mark a drainage site, ensure that the patient assumes the same position as that in which the scan was performed.

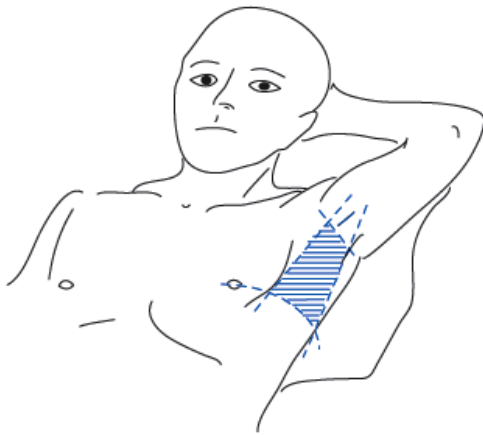


Figure 1

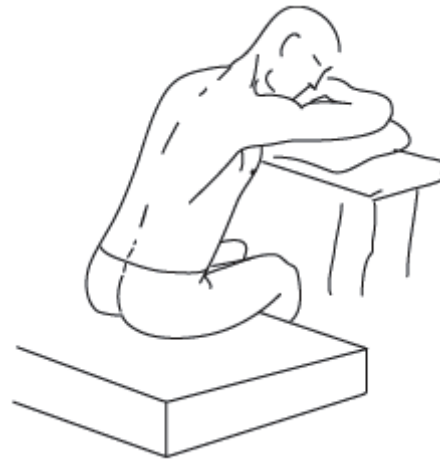


Figure 2

### Equipment

- Sterile gloves and gown
- Skin antiseptic solution (e.g. iodine or chlorhexidine in alcohol)
- Sterile drapes
- Gauze swabs
- A selection of syringes and needles (21-25 gauge)
- Local anaesthetic (e.g. lidocaine 1%)
- Scalpel and blade (preferably number 11)
- Suture (e.g. 0 or 1-0 silk)
- Instrument for blunt dissection if required (e.g. Blunt Roberts clamp)
- Guide wire and dilators for Seldinger technique
- Chest tube

- Connecting tubing
- Closed drainage system (including sterile water if underwater seal being used)
- Dressing

This equipment may also be available in kit form.

### **Aseptic technique and local anaesthesia**

- Chest drains should be inserted in a clean area using full aseptic technique including gowns, drapes, sterile gloves and skin cleansing.
- Scrub and clean patient's skin over a wide area in a circular fashion starting from proposed insertion site of drain, outwards.
- Check all equipment fits adequately and the under water bottle is primed.
- Palpate the intercostal space, infiltrate with up to 3mls/kg of lidocaine 1% using orange needle to target the skin over proposed insertion site. Wait for local anaesthesia to occur before proceeding through anaesthetised skin with green gauge needle to the parietal pleura and periosteum of superior border of lower rib.
- Once the parietal pleura is breached, confirm presence of air or fluid by aspirating back. It is useful to also give some lidocaine infiltration deeper near the rib to make procedure as pain-free as possible.
- If blood is aspirated see relevant section below.

**If fluid or air cannot be aspirated freely when giving local anaesthesia using a green gauge needle, STOP, review all imaging and seek specialist advice from Respiratory Medicine or Thoracic Surgery**

### **Decide on appropriate insertion technique (Seldinger or cut-down technique)**

- If a small bore drain (10-16 F) is deemed appropriate, the Seldinger technique is usually used, avoiding the need for blunt dissection.
- If a medium bore drain (16-24 F) is deemed appropriate, use either the Seldinger technique or cut-down technique.
- The cut-down technique should be used for large bore drains (>24 F).

#### **a) Seldinger Technique**

- Introduce the needle into the pleural space and aspirate the pleural contents (air or fluid) to confirm the position of the needle tip in the pleural space.
- Note the depth of the needle when it enters the pleural space.
- Pass the guide wire through the needle - gently guide the wire to the apex or the base of the pleural cavity as required.
- Withdraw the needle, leaving the guide wire in place and make a small skin incision using the blade provided.
- Pass the first dilator gently over the guide wire using a slight twisting action.
- Force is unnecessary and the dilator only needs to be passed 1 cm beyond the depth to the pleura as measured with the introducer needle.
- Widen the tract further by using a series of enlarging dilators up to the size of the drain.
- Gently insert the drain over the guide wire, aiming upwards for pneumothorax or basally for fluid. The drain should be inserted to a depth sufficient to ensure the last drainage hole is well within the pleural space (approximately 5-10 cm) - this does not require insertion to the hilt.
- Remove the guide wire, leaving the drain in place. The drain should be stoppered until secured and then connected to a drainage system.
- Use an anchor suture to secure the drain
- Apply sterile absorbent gauze and secure with a sterile dressing. A transparent dressing

is recommended since this allows the wound site to be inspected by nursing staff for leakage or signs of infection. Transparent dressing also allows inspection of the drain as it enters the skin – this enables a nurse or doctor to check that the drain has not become kinked.

- An omental tag is recommended by the BTS guidelines – this allows the tube to lie a little away from the chest wall to prevent tube kinking and tension at the insertion site (figure 3).

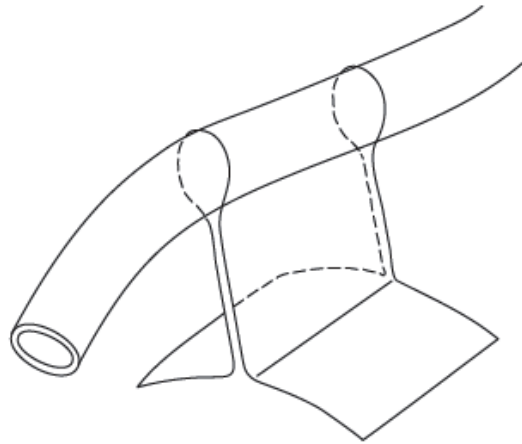


Figure 3

#### **b) Cut-down Technique**

- Follow all steps above and confirm presence of air or fluid with green gauge needle through adequately sterilised and anaesthetised skin
- Make a horizontal skin and sub-cuticular fat incision above and parallel to rib.
- The length of this incision should be long enough to allow easy passage of the index finger of user.
- Insert anchor and wound closing sutures around the incision and leave untied (Figure 4, with horizontal wound closing mattress suture also shown here). Do not use purse-string sutures as these leave an unsightly scar
- Perform careful blunt dissection with Roberts Clamp through the intercostal muscles to and through the parietal pleura.
- Once the pleural space is entered, insert an index finger into the pleural space, sweep and palpate. If Lung, Liver, Spleen or any solid resistance is palpated ABORT the procedure and seek Respiratory or Thoracic surgical advice.
- Only if nothing is palpated should the chest drain be advanced into the pleural space on the tip of a blunt Roberts Clamp and guided apically to drain air or basally to drain fluid.
- Ask the assistant, with sterile gloves on, to connect to underwater seal and to hold the drain with forward pressure, to prevent outward migration of chest drain once the lung re-expands, whilst securing the drain to the anchor suture.
- Loop the wound-closing suture (left untied) to the chest tube and secure with adhesive plaster. If there is a poor seal around the drain, insert further vertical suture near the drain and tie to partially close incision.
- Apply sterile absorbent gauze and sterile adherent dressing.

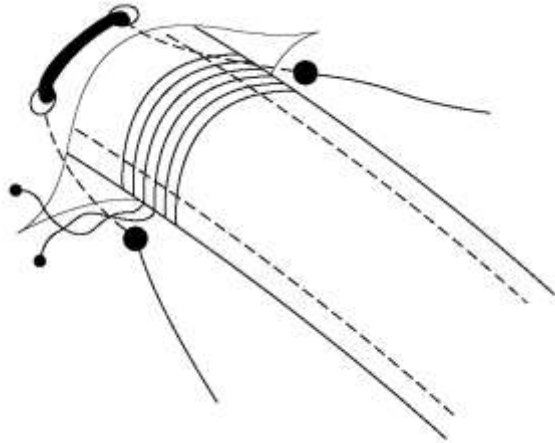


Figure 4

### Following drain insertion

- Confirm that the fluid in the underwater seal is swinging, and that fluid is draining (with pleural effusion) or that the drain is bubbling (with pneumothorax).
- Record the procedure fully in the notes.
- In the case of a pleural effusion, clearly document how you would like the nursing staff to manage the drain after insertion. Usually drainage is stopped after 1.5 litres have been drained, to prevent re-expansion pulmonary oedema, and then drainage is re-started after 1 hour has elapsed.
- Inform the patient that they need to keep the underwater seal bottle below the level of the chest and that they need to carry it with them (if ambulatory). Also ensure that the patients know to inform nursing or medical staff if the bottle is knocked over, or if they are concerned that the tubing has become loose or disconnected.

### Aftercare

- Prescribe adequate analgesia (e.g. regular co-codamol with prn oramorph).
- Request and review post-insertion chest X-ray to confirm correct drain position.
- A chest drain may be withdrawn to correct a malposition but should never be pushed further in, due to the risk of infection.
- Drains should be checked daily for wound infection, fluid drainage volumes and documentation for swinging and/or bubbling.
- If the fluid in the underwater seal is not swinging on inspiration, inspect the drain to see if it has become kinked or blocked. If the drain is blocked it may need to be flushed with sterile saline using strict asepsis. This should only be performed by someone competent at this procedure.
- A further drain should never be inserted through the same hole as a previously dislodged drain as this can introduce infection.

### Removal of drain

- In the case of pneumothorax, consider removing the chest drain once complete resolution has been confirmed by chest x-ray and bubbling has stopped for at least 24 hr.
- In the case of pleural effusion, consider removing the chest drain once effective resolution has been confirmed by chest x-ray.
- In malignant effusion, consider talc pleurodesis before removal to reduce the chances of reaccumulation – see '**Protocol for medical chemical pleurodesis**'
- When removing the drain, cut the drain-securing suture, withdraw the tube while the patient holds their breath in expiration.

- For Argyle (blunt dissection) drains, close the wound by gently pulling on and tying a knot in the wound-closing suture.
- Apply a sterile dressing.
- Request a post-drain removal chest x-ray.

### **BLOOD ASPIRATED**

- If blood is aspirated this may indicate one of three possibilities
  - Haemothorax.
  - Blood-stained pleural effusion
  - Misplacement of the needle into intercostal vessel, liver, spleen, etc.
- Haemothorax; If you suspect a haemothorax, particularly following trauma, it is strongly advised to use the cut-down technique as outlined above to insert the drain at which point you can confirm by digital palpation that you are in the right place.
- A heavily blood stained effusion is usually due to malignancy. Providing the blood is not obviously arterial and all the above precautions have been followed, particularly the site of insertion is within the triangle of safety, it is safe to proceed with the insertion. Again if the effusion is heavily blood stained it is advised to use the cut-down technique, which would use finger palpation to confirm correct placement as well as allowing a larger bore drain (which would be less prone to getting blocked) to be inserted.
- If arterial blood is aspirated and the user is not happy in any way the procedure should be aborted and specialist advice sought.

## **4. Reason for Development of the Guideline**

This guideline has been developed to provide evidence-based guidance on the insertion of intercostal chest drains within the Trust.

## **5. Methodology**

This guideline is based on the BTS Pleural Disease Guideline 2010 and has been approved by the respiratory directorate, the thoracic surgical directorate and the Clinical Standards Committee.

## **6. Implementation in HEFT & Community**

The guideline will be available in the appropriate clinical areas and an electronic version will be available on the Trust intranet for access at all times.

## **7. Monitoring & Suggested Quality Standards**

The annual BTS Pleural Procedures Audit is the recommended method of monitoring compliance with this guideline. Respiratory, thoracic surgical and acute medical staff will also monitor compliance to the guideline.

## **8. References**

Havelock T, Teoh R, Laws D, Gleeson F; BTS Pleural Disease Guideline Group. Pleural procedures and thoracic ultrasound: British Thoracic Society Pleural Disease Guideline 2010. *Thorax* 2010;65 Suppl 2:ii61-76.



## Meta Data

<b>Guideline Author:</b>	Mr Stephen Woolley, Mr Ehab Bishay, Dr Edward Nash
<b>Guideline Sponsor:</b>	Mr Richard Steyn
<b>Date of Approval:</b>	1/7/16
<b>Approved by:</b>	
<b>Date of CGG Ratification:</b>	
<b>Date of Launch:</b>	
<b>Review Date:</b>	1 July 2019
<b>Key Words</b>	
<b>Related Policies / Topic / Driver</b>	

## Revision History

Version No	Date of Issue	Author	Reason for Issue
1.0	13 Jan 2008	Stephen Woolley, Ehab Bishay, Edward Nash	
2.0	15 March 13	Stephen Woolley, Ehab Bishay, Edward Nash	Revision due

**Clinical Director: Signed...**



**Name...Dr Rifat Rashid**

**Date...1<sup>st</sup> July 2016**