

Chest Drain Insertion – Full Clinical Guideline

Reference No: CG-T/2023/107

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Purpose

The Trust recognises the significant risk of morbidity and mortality associated with the insertion of chest drains. A Rapid Response Alert issued by the National Patient Safety Agency in May 2008 highlighted cases of potentially avoidable deaths and serious harm associated with this procedure reported nationally ¹. The purpose of these guidelines is to minimise these risks through appropriate and safe insertion of chest drains.

This guideline is updated following the release of the British Thoracic Society Guideline for Pleural Disease Guidelines in July 2023 ².

Aim and Scope

The aim of the guideline is:

- To ensure that aseptic insertion of chest drains is undertaken only by competent or supervised operators in all clinical areas of where chest drains are placed
- To determine appropriate indications and contraindications for the procedure
- To standardise techniques and documentation
- To ensure the highest standards of infection control

This guideline applies to the insertion of a chest drain in adult patients in the controlled environment usually encountered by physicians. The emergency insertion of a large bore chest drain for tension pneumothorax following trauma has been well described by the Advanced Trauma and Life Support (ATLS) recommendations in the course manual³ and is not adequately addressed in this guideline. This guideline does not cover specialist indications such as the placement of chest drains in theatre in the immediate post-operative period or in the radiology department. A separate guideline exists for the nursing aspects of a patient with a chest drain and a drainage system⁴.

Definitions Used

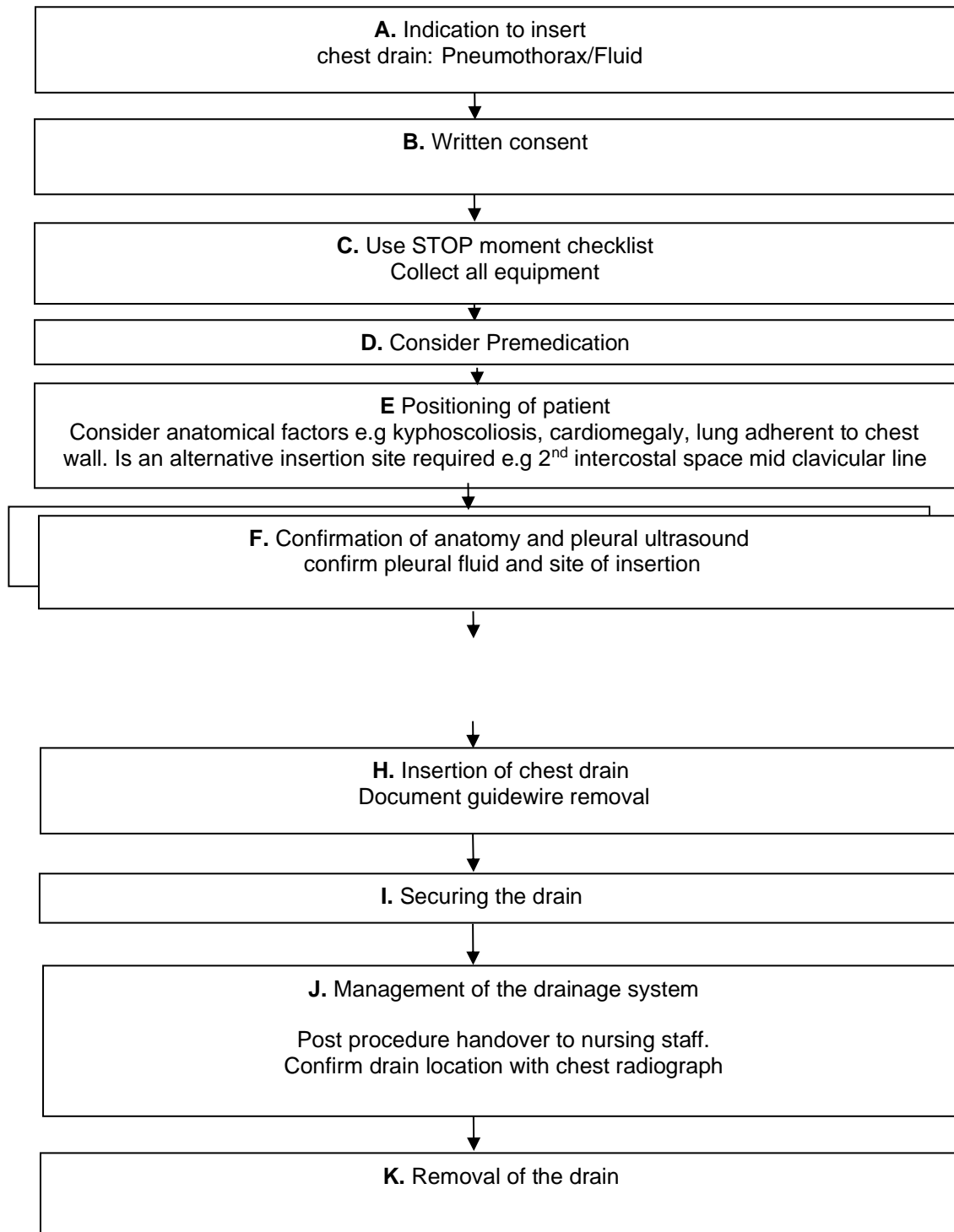
Adult:	Over 16 years of age
Competent individual:	Doctors who have received instruction in the insertion of chest drains and have demonstrated these skills.
Appropriate indications:	see section A below
Pre-drainage assessment (contraindications):	see section B below.

Implementing the Guideline

1. Doctors are responsible for undertaking procedures for which they have received approved training and are deemed competent. If the procedure is to be undertaken by an inexperienced doctor this must be under the direct supervision of a competent doctor for the duration of the procedure and he/she will take responsibility for this. The doctor undertaking the procedure will be responsible for ensuring that there is an appropriate indication for the procedure and that no contraindications exist.
2. Prior to placing a chest drain the doctor should consider the following
 - Are there any anatomical variation present e.g. cardiomegaly, pregnancy, kyphosis, pleural tethering?
 - This will then influence the choice of:
 - 1) Technique: Seldinger vs open thoracostomy/blunt dissection
 - 2) Does the operator have adequate experience or is a different doctor required
 - 3) Appropriate positioning of the patient
 - 4) Timing of drain insertion (particularly out of hours think, does the drain need to be inserted at this moment or could it be inserted at a later time? Often therapeutic aspiration of 500-1000mls of pleural fluid will provide adequate symptomatic relief while planning for more definitive pleural intervention e.g. thoracoscopy takes place.
 - 5) Site of drain insertion, e.g. 5th intercostal space, higher space, or 2nd intercostal space mid clavicular line, depending on anatomical variation e.g. kyphoscoliosis, cardiomegaly or diaphragm elevation.
3. When assessing competency, the assessor should ensure that the following areas are covered:
 - Indication and contraindications
 - Consent and pre-medication
 - Confirmation of site and side of insertion with bedside ultrasound for pleural effusion and size of chest drain
It is recognised that training in pleural ultrasound to Level 1 RCR curriculum is not universally achieved. Appropriate training could include attendance at a recognised thoracic ultrasound training course with the maintenance of an up to date log book. More experienced operators will have obtained sufficient experience for RCR Level 1 thoracic ultrasound sign off and be able to mentor less experienced operators after 2 years of independent practice.
 - Positioning of patient
 - Aseptic technique/Infection control
 - Complications and X-ray interpretation
 - Documentation
- 3 The procedure will take place in an area with appropriate lighting, availability of spare materials and resuscitation equipment. Skilled assistance must be available for the duration of the procedure.
4. The procedure will take place ensuring the highest standards of infection control.
5. Complications of a potentially or life-threatening nature must be reported to the responsible Consultant immediately.
6. Following insertion/attempted insertion the following will be recorded in the patient's notes in addition to completing the chest drain LOCSIP STOP moment checklist at RDH (appendix 1) or the Chest Drain Protocol Document on Meditech at QHB
 - Date and time of insertion
 - Name of the doctor undertaking the procedure (including supervisor)

- Site, side and technique of insertion (and whether USS was used and USS findings including maximum depth of fluid)
 - Difficulties encountered and how they were managed
 - Type of catheter used, and length of insertion
 - Post procedure chest x-ray findings (position of tip, absence of pneumothorax)
 - Guidewire removal
 - Specimens correctly labelled and sent for appropriate tests
 - Signature and designation of doctor.
7. Adherence to this guideline will be monitored through audit, training programmes and the review of associated clinical incidents.

Summary of chest drain insertion process



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A. Indication to insert chest drain

A chest drain may be required in the following settings:

- Pneumothorax
 - in any ventilated patient
 - tension pneumothorax after initial needle relief
 - persistent or recurrent pneumothorax after simple aspiration
 - large secondary spontaneous pneumothorax in patients over 50 years
- Malignant pleural effusion
- Empyema and complicated parapneumonic pleural effusion
- Traumatic haemo-pneumothorax
- Postoperative—for example, thoracotomy, oesophagectomy, cardiac surgery

Flow chart management of spontaneous pneumothorax²

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Checklist of questions before a chest drain is inserted for pleural fluid

Before a chest drain is inserted for fluid, particularly out of hours, the operator should consider the following:

1. Does the patient need a drain now?

- Avoid inserting a chest drain for fluid out of regular hours Unless there is urgent clinical need; most of the reported complications happen during drain insertion out of hours.
- There are few indications for an emergency chest drain insertion for pleural effusion.

2. Is image guidance appropriate?

- Mandatory for fluid, see section E

3. Am I competent to insert the drain?

Yes – proceed
No – get help

4. Who can help? potential help from

- a. Respiratory team
- b. Radiology team
- c. Trauma team
- d. Cardiothoracic team

Please note that the emergency management of a pneumothorax (and simple diagnostic aspiration) differs from that of a pleural effusion.

Contraindications

Prior to chest tube insertion, a careful assessment should be made of the potential risks / complications in an individual patient, including:

1. Risk of haemorrhage

Routine measurement of the platelet count and prothrombin time are only recommended in patients with known risk factors such as;

- Known coagulopathy
 - Alcoholic liver disease
 - Malignancy
 - On warfarin
 - Known haematological disease
 - If INR is ≥ 1.4 and platelets less than 80 consideration should be given to correction of abnormal clotting.
-
- In an emergency scenario, where benefit outweighs risk, this may be overridden. Discuss with the Respiratory team and/or a Haematologist if in doubt.
 - For elective chest drain insertion, warfarin should be stopped for 4-7 days, after consideration of potential benefit/harm, and time allowed for its effects to resolve.
 - For elective chest drain insertion, clopidogrel could be stopped, after consideration of potential benefit/harm, and time allowed for its effects to resolve (5-7 days). If clopidogrel is used for an indication other than following coronary stent insertion, the drug should be stopped. Cardiology opinion should be sought if clopidogrel is used following coronary stent insertion.
 - Patients taking LMWH should have their dose omitted the evening before a drain is inserted; ideally the drain should be inserted >12 hours after a prophylactic dose and >24 hours after therapeutic doses.
 - LMWH can be recommenced 6 hours after drain insertion, if there was no significant bleeding during the procedure. Patients should not be re-warfarinised until the drain is removed unless they are taking the drug for valvular heart disease in which case they should be commenced on an IV heparin infusion.
 - IV heparin should be stopped 4 hours before a chest drain insertion is attempted.
 - For elective chest drain insertion Direct oral anticoagulants (DOAC) including Rivaroxaban and Apixiban should be stopped >48 hours before chest drain insertion. Further information available in British Society of Gastroenterology endoscopy guideline ⁵.

2. Pneumothorax vs Bullous disease

This requires careful radiological assessment and a CT may be needed to differentiate, rather than a CXR. Discuss with Radiology before requesting CT Similarly, it is important to differentiate between the presence of collapse & pleural effusion when the CXR shows a unilateral "whiteout". Image guidance is advised.

3. Lung densely adherent to the chest wall throughout the hemithorax is an absolute contraindication to chest drain insertion.
4. The drainage of a post pneumonectomy space should only be carried out by or after consultation with a cardiothoracic surgeon.
5. Patients who have had a previous esophagectomy should also be discussed with an upper GI surgeon (risk of a drain being inserted for acute gastric dilatation).

B. Consent

- Written informed consent (as per Trust policy guidelines) must be obtained prior to the procedure. Discussion of risks, benefits, consequences and alternatives of the procedure should be covered.
- Part 2 of the consent should be taken by the doctor carrying out the procedure, but Part 1 can be appropriately delegated.
- If possible, an information leaflet should be given before the procedure.

- It is within the rights of a competent individual to refuse such treatment.
- In the case of an emergency, when the patient is unconscious and the treatment is lifesaving, treatment may be carried out but must be explained as soon as the patient is sufficiently recovered to understand.
- See appendix 2 for a summary of risks/complications associated with the procedure.

C. Equipment and drain size selection

All the equipment required to insert a chest tube should be available before commencing the procedure - equipment may be available in kit form e.g. with Seldinger drain kits. A standard insertion pack will contain:

- Sterile drapes and gown
- Gauze swabs
- A selection of syringes and needles (21–25 gauge)
- Scalpel and blade
- Suture (e.g. “1-0” silk)
- Instrument for blunt dissection (e.g. curved clamp)
- Guidewire with dilators (if Seldinger technique is being used)
- Chest tube

Additional equipment will include:

- Sterile gloves
- Skin antiseptic solution, e.g. betadine / Chloraprep sticks
- Local anaesthetic, e.g. lignocaine 1%
- Connecting tubing
- Closed drainage system (including sterile water if underwater seal being used)
- Dressing (e.g. Drainfix or Mefix)



A standard Seldinger drain kit

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- **Small bore drains** (Seldinger, 10-14 French (F) are recommended as first line for use in pneumothorax, free flowing pleural effusions and pleural infection as they are more comfortable than larger bore tubes and are often as effective.
- **Large bore** (28-30 F) drains are recommended for drainage of acute haemothorax to monitor further blood loss or sometimes in empyema when a smaller drain fails. They may also be useful in the event of failure to drain a pneumothorax due to excessive air leakage - such cases should be discussed with the Respiratory team or the Thoracic surgical team.

D. Pre-medication

Pre-medication is not routinely used for the insertion of a small-bore chest drain (using the Seldinger technique) or when a drain is inserted using radiological guidance. Local anaesthetic is usually adequate (See section G).

It is recommended that premedication (with a benzodiazepine or opioid) should be considered to reduce patient distress particularly when inserting a large bore or 'surgical' drain unless there are contraindications to its use. Premedication could be:

- an intravenous anxiolytic such as midazolam 1mg-2mg, carefully titrated to achieve adequate sedation, or
- an oral opioid (e.g. Oramorph 10mg) given 30 minutes to 1 hour before the procedure.

Both these classes of drugs may cause respiratory depression – therefore patients with underlying lung disease such as COPD should be carefully observed/monitored as reversal agents – e.g. naloxone or flumazenil- are occasionally necessary. If sedation is given, then saturations should be monitored throughout the procedure using pulse oximetry.

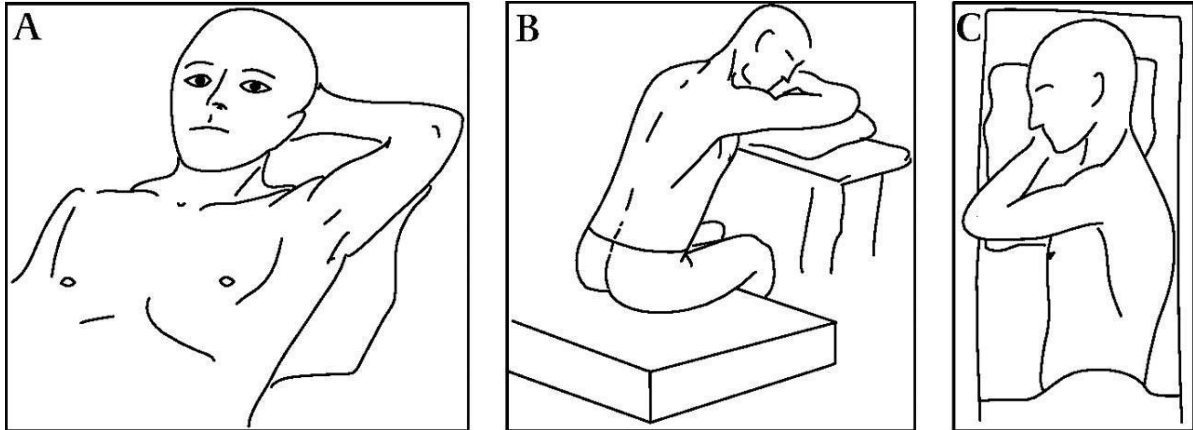
If over sedation is suspected the initial dose of reversal agent is indicated below;

- Naloxone 0.4mg IV
- Flumazenil 0.2mg IV

E. Patient position

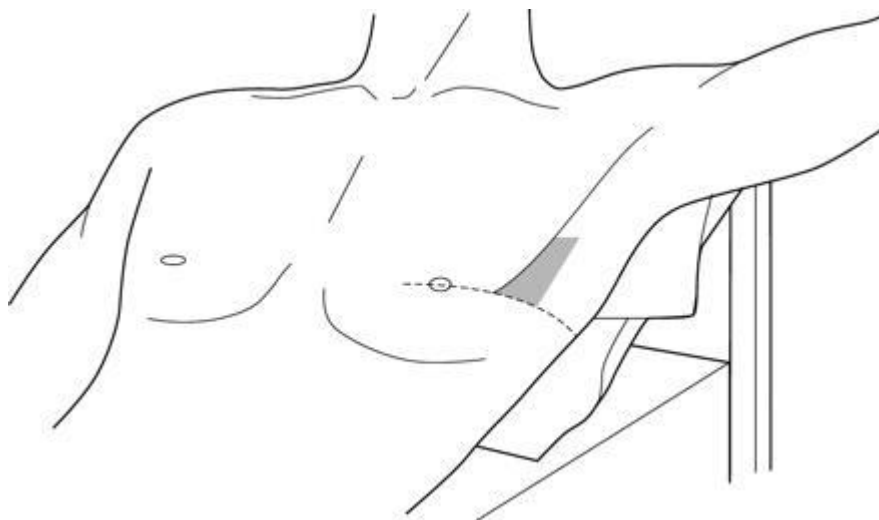
The preferred position for drain insertion is on the bed, slightly rotated, with the arm on the side of the lesion behind the patient's head to expose the axillary area (A). Alternative positions are:

- for the patient to sit upright leaning over an adjacent table (B), or
- in the lateral decubitus position (C).
- US should be used once patient has been positioned appropriately.



Potential pitfalls of drain insertion in the 'safe triangle'

The preferred site for insertion of a chest drain is in the mid axillary line in what has traditionally been known as the **"safe triangle"**. This triangle is bordered by the anterior border of the latissimus dorsi, the lateral border of the pectoralis major muscle, a line superior to the horizontal level of the nipple at the level of the 5th intercostal space, and an apex below the axilla.



- Inserting a chest drain in this triangle avoids major muscle groups, breast tissue and minimises unsightly scars but it is not universally 'safe' as there are a many anatomical structures that can lie within the triangle and that can be

injured including a dilated left ventricle, the diaphragm, lung parenchyma or intra-abdominal organs. It can often be challenging to accurately define the location of the triangle accurately with surface anatomy landmarks particularly in a very breathless patient or a patient with anatomical variation such as kyphoscoliosis, cardiomegaly or elevation of the diaphragm or liver. The lower boundary of the triangle can be difficult to define and depending on patient position and the degree of respiratory distress.

Anatomical variation

- Confirming the presence of anatomical variations and ensuring a truly safe insertion tract with thoracic ultrasound is mandatory for insertion of chest drain for pleural fluid and strongly recommended for insertion of a chest drain for pneumothorax.
- **Alternative sites for intercostal chest drain insertion need to be considered in certain situations.** In cases where there is chest radiograph evidence of cardiomegaly and a patient requires an emergency LEFT-sided intercostal drain, the lateral decubitus position should be considered.
- In cases of anatomical variation, e.g. gross cardiomegaly, pregnancy or patient stabbed in triangle of safety consideration should be given to using an alternative site for drain insertion. This may be either a higher intercostal space, or the second intercostal space in the mid-clavicular line
- The 2nd intercostal space mid-clavicular line (2nd ICS MCL) is an alternative site of insertion particularly for an apical pneumothorax or following needle aspiration of a pneumothorax. Experienced operators may be required to insert a chest drain in the 2nd ICS MCL, seek advice if you are unfamiliar with this technique. Downsides to insertion in this anterior location include the potential for injury to the internal mammary artery, the potential for an unsightly visible scar and the drain can be uncomfortable for the patient in this location.
- During chest drain insertion particular attention is needed to ensure adhere to the boundaries of the 'triangle' any pleural fluid or air can move if the patient changes position. Great care should be taken to ensure that the insertion tract is perpendicular to the skin, so that the insertion tract does not inadvertently enter a lower rib space than planned. This is particularly relevant when the planned insertion site is in the lower border of the triangle as accidental insertion of the drain into the 6th intercostal space could cause damage to a vital organ.
- If the drain is to be inserted into a loculated pleural collection, the position of insertion will be dictated by the site of the locule as determined by imaging. This may result in a more posterior position being chosen. While this is safe, it may be more uncomfortable for the patient to lie on after insertion and there is an increased risk of the drain kinking.

Frequency of possible complications of chest drain insertion

- | | |
|------------------------------------|------|
| • Pain | 5% |
| • Haemorrhage | 1% |
| • Infection (skin or intrapleural) | 0.2% |
| • Organ penetration | |

- Re-expansion pulmonary oedema
- Hydropneumothorax (if draining fluid) 4%
- Drain dislodgement / malposition 0.6%
- Drain blockage 8.1%
- Death

F. Confirming site of drain insertion and use of image guidance

Immediately before the procedure, the identity of the patient should be checked and the site and side for insertion of the chest tube confirmed by reviewing the clinical signs and the chest radiograph and documented on the chest drain LOCSIP STOP moment checklist at RDH (Appendix 1) or the Chest Drain Protocol Document on Meditech at QHB.

- **A chest radiograph must be available at the time of drain insertion except in the case of tension pneumothorax.**
- **Bullous emphysema and skin folds can mimic a pneumothorax on a radiograph and lead to inappropriate chest drain insertion. Prior to aspirating or inserting a chest drain for a pneumothorax the operator must ensure that the radiologists have confirmed the presence of a pneumothorax. If no report is available contact the radiology SpR or Consultant as detailed in the chest drain insertion LOCSIP STOP moment checklist (Appendix 1).**

Before insertion, air or fluid should be aspirated; if none is forthcoming, more complex imaging than a chest radiograph is required.

- **A chest tube should not be inserted without further image guidance if free air or fluid cannot be aspirated with a needle at the time of anaesthesia.**

Image guidance: Thoracic ultrasound guidance is now **mandatory** when inserting a drain for pleural fluid (not for a pneumothorax) as a planned (non-urgent) procedure, particularly if the effusion is small. It is particularly useful for localising the diaphragm and defining loculations and pleural thickening especially with suspected empyema. The ultrasound must be performed immediately prior to aspirating the pleural fluid or under 'real time' guidance. If the patient changes position, then ultrasound should be used to reconfirm that the chosen insertion site is safe. **Thoracic ultrasound is strongly recommended for chest drain insertion for pneumothorax to identify a safe site of insertion.**

US Guidance – Referral Pattern

1 1) Respiratory team

Those that require pleural intervention should be under the care of the respiratory team on wards 402, 403 or 404 at RDH; or ward 3 at QHB. Advice on the investigation and management of pleural disease can be obtained from the respiratory team (SpR/Respiratory Fellow or Respiratory Consultant) who will be able to assist in arranging ultrasound guided pleural procedures where necessary on the Pleural Procedures Lists. The respiratory team can be contacted via switch board or via 'Consultant to Consultant' referral system on the Whiteboard at RDH. At QHB the Respiratory Team can be contacted via RFO on Meditech or on ward 3. The respiratory team do not manage chest wall trauma or multiple rib fractures (refer to Chest wall trauma guideline).

- 2 US Drainage (US Chest + US Drainage)**, following this request, the whole procedure will be done in the radiology department on dedicated interventional US lists or ad hoc onto other lists.
- This requires prior discussion by the clinical team (SpR or above) with the performing radiologist (usually consultant grade). This would seem appropriate for complex drainage procedures e.g. small effusions, extensive pleural thickening, large loculations and some empyemata.
 - Before submitting a request all patients must be consented as per Trust guidelines.
 - The radiology department should be informed of significant anticoagulant and anti-platelet medication (warfarin, heparin, enoxoparin, clopidogrel, DOAC etc) and these should be stopped according to the usual radiology dept guidelines.
 - Blood tests should be performed including:
 - FBC Hb>10
 - Platelets >80
 - INR \leq 1.4
 - After chest drain insertion in the radiology department, the drain will routinely be connected to standard radiological drainage bags unless otherwise requested. This should be changed to an underwater seal drainage system on the ward.

G. Aseptic technique and local anaesthesia

- **Aseptic technique** should be employed during drain insertion to avoid wound site infection or secondary empyema. While the full sterile technique afforded by a surgical theatre is usually unnecessary, sterile gloves, gown, equipment and the use of sterile towels after effective skin cleansing using chlorhexidine or iodine are recommended. A large area of skin cleansing should be undertaken. Drain insertion should ideally occur away from the bedside in a dedicated procedures room on the ward.
- **Prophylactic antibiotics should be given in trauma cases.** (see trust guidelines or discuss with consultant microbiologist)
- **Local anaesthetic** should be infiltrated prior to insertion of the drain. A small gauge (orange) needle is used to raise a dermal bleb before deeper infiltration of the intercostal muscles and pleural surface. Local anaesthetic such as lignocaine (up to 3 mg/kg) is usually infiltrated. Higher doses may result in toxic levels. The volume given is considered to be more important than the dose to aid spread of the effective anaesthetic area. Most simple procedures inserting a small-bore drain require only 10-20ml of 1% lignocaine. Attention should be paid to anaesthetising the skin, periosteum and pleura as these are the most pain sensitive sites
- **Post procedure analgesia**
It is good practice to ensure PRN analgesia is prescribed on the drug chart as some patients experience pain post procedure as the local anaesthetic wears off. Simple analgesics such as Paracetamol, Co-codamol and Ibuprofen usually suffice. If a patient requires high doses of stronger pain relief you should consider whether the drain has been sited appropriately.

H. Insertion of chest drain

- **Insertion of a chest drain should never be performed with any substantial force** since this risks sudden chest penetration and damage to essential intrathoracic structures.
- **Insertion of a small-bore drain** does not require blunt dissection and is usually inserted with the aid of a guidewire and dilator by the Seldinger technique. After infiltration with local anaesthesia, a needle and syringe are used to localise the position for insertion by the identification of air or pleural fluid.
- The needle is passed between two ribs and should be inserted just above the lower of the two. This reduces the risk of damaging the intercostal neurovascular bundle, which runs in a groove on the underside of each rib. Posteriorly and approaching the midline, the blood vessels may be less closely opposed to the underside of the rib. Hence, particular care is required to ensure the needle passes just above the lower rib.
- Once the needle tip is in the pleural cavity, a guidewire is passed down through the hub of the needle until the distal part of the guidewire is in the pleural cavity. The needle is removed back over the guidewire. The tract is then enlarged using the dilator that is fed over the guidewire. Once the tract is wide enough, a small-bore tube can be passed into the thoracic cavity along the wire.
- The removal of any **guidewires** or insertors should be documented on the STOP moment checklist at RDH and the Chest Drain Protocol Document on Meditech at QHB. It should also be documented in the medical notes using the appropriate guidewire removal sticker as per the ***Guidewires, Introducers, Stiffeners Clinical Guideline-TRUST/2016/001***

Caution: The dilator should not be inserted further than 1cm beyond the depth from the skin to the pleural space. Ignoring this practice risks injury irrespective of use of ultrasound. The pleura is rarely > 6cm in from the skin.

Most Seldinger kits now have a guard on the dilator to prevent excessive penetration.

- **Medium sized drains (16–24 F)** chest drains may be inserted by a Seldinger technique or by blunt dissection. As the incision size should afford a snug fit around the chest tube, it is not possible to insert a finger to explore the pleura when inserting this size of drain.
- **Large bore (>24F) chest drains.** These require blunt dissection down to the pleura before insertion. The incision for insertion of the chest drain should be similar to the diameter of the tube being inserted. The incision should be made just above and parallel to a rib.

The position of the tip of the chest tube should ideally be aimed apically for a pneumothorax or basally for fluid. However, any tube position can be effective at draining air or fluid and an effectively functioning drain should not be repositioned solely because of its radiographic position. The drain should be inserted such that the drainage holes are 5-10cm within the pleural cavity. It rarely needs inserting to the hilt.

I. Securing the drain

A common complication of drain insertion is accidental removal of the drain, usually as a result of inadequate securing techniques. This occasionally results in a second drain needing to be placed and the patient subjected to further procedure.

The drain should be sutured in place using a thick non-absorbable suture (such as '0' or '1-0' silk). Thinner sutures may snap on tying. The force applied when tying the suture around the drain itself should be enough to cause a slight kink in the drain without occluding it.

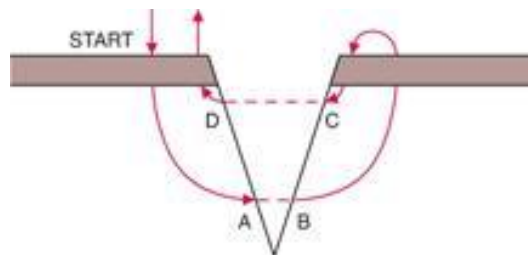
Consider using a drainfix dressing (available on both respiratory wards) **in addition to sutures** to hold the drain securely in place (see below).



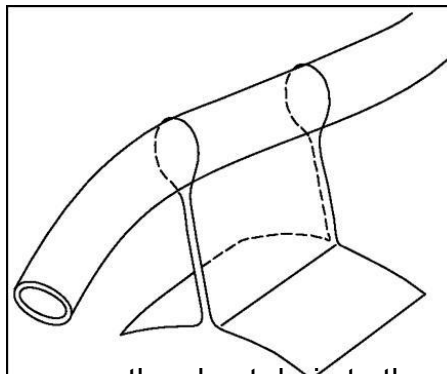
Large and medium bore chest drain incisions should be closed by a suture appropriate for a linear incision. "Purse string" sutures must not be used.

Two sutures are usually inserted—the first to assist later closure of the wound after drain removal and the second, a stay suture, to secure the drain.

Large amounts of tape and padding to dress the site are unnecessary and concerns have been expressed that they may restrict chest wall movement or increase moisture collection.



A vertical mattress suture used to close the wound of a large bore chest drain



An 'omental tag' used to secure the chest drain to the chest wall helps prevent tube kinking and tension at the insertion site.

J. Management of the drainage system

Patients with chest tubes should be managed on specialist wards by staff who are trained in chest drain management. This aspect of drain care is discussed in a separate guideline⁴. The principles are briefly summarised here:

A chest radiograph should be performed after insertion of a chest drain and reviewed by the doctor inserting the chest drain or if out of hours then appropriately handed over to HOOH team

- Nursing observations are required 15min and 1-hour post procedure, then 4 hourly.
- Obtain an urgent chest-x-ray to confirm position and document findings yourself
- Record and start a chart for recording chest drain activity/drainage
- Record procedure details, including any complications and results of chest x-ray in the patient's notes
- In the event of the patient developing tachycardia or hypotension, or if significant amounts of frank blood come out of the chest drain, the possibility of a major bleed (due to intercostal artery injury or ventricular penetration) should be considered. The patient should be assessed and treated systematically following an ABC approach, and bloods sent for haemoglobin, clotting, and cross match. If major bleeding is confirmed the trust major bleed pathway should be triggered, including involvement of a consultant haematologist. Strategies to halt an intercostal bleed may be embolization by an interventional radiologist or a thoracotomy and ligation of the bleeding vessel by a cardiothoracic surgeon.

Clamping drain

- **A bubbling chest tube should never be clamped.**
- On 1st December 2020 a National Patient Safety Alert (NatPSA/2020/008/NHSPS) was issued to control the rate of pleural fluid drainage in order to prevent cardiovascular instability and collapse, and re-expansion pulmonary oedema⁶.
- **No more than 1 litre should be drained at one time, or drainage should be slowed to about 500 ml per hour. Patients should be monitored continuously for the first 15 minutes.**
- Following the initial 1L of pleural fluid, remaining pleural fluid can be drained 1.5L at a time at 2-hour intervals stopping if the patient develops chest discomfort, persistent cough or vasovagal symptoms.

- **In cases of pneumothorax, clamping of the chest tube should usually be avoided.**
- If a chest tube for pneumothorax is clamped, this should be under the supervision of a respiratory physician or thoracic surgeon, the patient should be managed in a specialist ward with experienced nursing staff, and the patient should not leave the ward environment.
- If a patient with a clamped drain becomes breathless or develops subcutaneous emphysema, the drain must be immediately unclamped and medical advice sought.

Closed system drainage

- All chest tubes should be connected to a single flow drainage system e.g. underwater seal bottle (or flutter valve) or radiological drainage bag.
- Use of a flutter valve system should be under specialist supervision – it allows earlier mobilisation and the potential for earlier discharge of patients with chest drains.

Suction

- When chest drain suction is required, a high volume/low pressure system should be used at a level of 10-20 cm H₂O.
- When suction is required, the patient must be nursed by appropriately trained staff (Wards 402, 403 and 404 at RDH and ward 3 at QHB).
- If appropriate, patients should be encouraged to walk around. If Drain is on suction, patient will be restricted to the bedside.

K. Removal of a chest drain

The chest tube should be removed either while the patient performs Valsalva manoeuvre or during expiration with a brisk firm movement while an assistant ties the previously placed closure suture if one was placed on insertion. The timing of removal is dependent on the original reason for insertion and clinical progress.

- In the case of pneumothorax, the drain should not usually be removed until bubbling has ceased, the drain is confirmed still patent (i.e. swinging) and chest radiography demonstrates lung reinflation. Clamping of the drain before removal is generally unnecessary.
- In the case of pleural effusion or post pleurodesis removal of the drain should generally follow 24 hours of a drain output of less than 200ml.

Patients requiring assisted ventilation

During the insertion of a chest tube in a patient on non-invasive ventilation, it is essential to disconnect from the ventilator at the time of insertion to avoid the potentially serious complication of lung penetration, although if blunt dissection is carried out and no sharp instruments are used, this risk is reduced.

Audit

Chest drain insertion and its management should be regularly audited. Suggested audit points include:

- The frequency of chest drain complications.
- The use of premedication and analgesics and patient pain scores relating to chest drain insertion.
- The duration of chest tube drainage.
- The presence and use of an appropriate nursing chest drain observation chart.

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4. Care of Chest Drains & Drainage Systems Ref No: CG-T/2005/026
5. Endoscopy in patients on antiplatelet or anticoagulant therapy, including direct oral anticoagulants: British Society of Gastroenterology (BSG) and European Society of Gastrointestinal Endoscopy (ESGE) guidelines. *Gut*. 2016;65(3):374-389. doi:10.1136/gutjnl-2015-311110.
6. National Patient Safety Alert (Nat/PSA/2020/008/NHSPS); Deterioration due to rapid offload of pleural effusion fluid from chest drains.

Appendix 1: Pleural procedure LOCSIP STOP moment checklist

Uncontrolled when printed

Appendix 2

Document Control

Development of Policy:	Consultant Respiratory Physician
Consultation with:	Consultant Radiologist Burton colleagues
Approved by:	Respiratory Medicine Governance Medical Division- Dec 2023 Trustwide CGG – Dec 2023
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Review Date:	December 2026
Key Contact:	Dr Kerry Woolnough, Respiratory Physician