



Title	<u>A guide to chest drain management</u>
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Introduction

A chest drain is a tube inserted through the chest wall between the ribs and into the pleural cavity to allow drainage of air (pneumothorax), blood (haemothorax), fluid (pleural effusion) or pus (empyema) out of the chest. In any one patient it is essential to understand what the drain is trying to achieve. The effective drainage of air, blood or fluid from the pleural space requires an adequately positioned drain and an airtight, one-way drainage system to maintain subatmospheric intrapleural pressure. This allows drainage of the air/fluid and re-expansion of the underlying lung.

Incorrect placement or management of a chest drain can lead to significant morbidity and even mortality.

Aims

This is not a guide on the insertion of a chest drain. Such a guide has been produced by the BTS and can be found here.

<http://www.brit-horacic.org.uk/Portals/0/Clinical%20Information/Pleural%20Disease%20Pleural%20Guideline%202010/Pleural%20disease%202010%20pleural%20procedures.pdf%20>

After reading on the theory this procedure is best learnt from first observing the procedure until you feel confident to perform this under supervision (DOPS) from a trained colleague until deemed competent enough to perform independently.

This is a guide on how to manage a patient with a chest drain for both pneumothorax and pleural fluid.

This document intends to explain

- Good chest drain practice
- How a normal drain should function
- Troubleshooting when a drain is not functioning
- How to manage complications
- How and when to apply suction
- How and when a drain should be removed

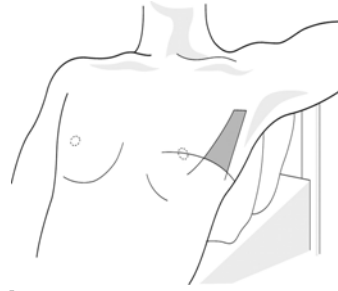
Good chest drain practice

There are a few points of good clinical practice regarding to chest drains that would be worth mentioning. Please note these 'rules' are not always relevant in the cases where urgent intercostal drainage is required.

- Chest drains should only be inserted or supervised by those fully trained and competent in the procedure
- Except in an emergency pleural procedures should not take place out of hours.
- Obtain written consent, with an explanation of common and serious complications (pain, intrapleural and wound infections, drain dislodgement and blockage are the most frequent with visceral injury the most serious).
- Non urgent procedures should be avoided in those on warfarin therapy or with coagulopathy until INR <1.5.
- A recent CXR should be available prior to insertion.
- Real time USS guidance is strongly recommended with remote marking prior to aspiration recommended only in large effusions.
- When requesting thoracic USS indicate to ultrasonographer whether this is for diagnostic aspiration or therapeutic purposes (aspiration/drain)
- Where possible chest drains should be inserted in the 'triangle of safety'(fig. 1) This may not be possible where loculated fluid/air exists.
- With therapeutic aspiration aspirate a maximum of 1.5L (fluid) or 2.5L(air, however if the patient develops prominent cough or discomfort you should stop and reassess.
- A small drain (12F) is adequate as first line for pneumothorax or fluid, however if it is an empyema or haemothorax a larger drain may be required. Patients who have pleurodesis planned should ideally have a 16F drain inserted.
- Consider premedication with benzodiazepine or morphine in selected patients to reduce pain and anxiety. Having morphine drawn up and ready at the start of the procedure is reasonable for any pain.
- Following drain insertion care should be taken to not drain off greater than 1.0L in first hour as not only can this result in discomfort or cough, but can lead to the more serious complication of re-expansion pulmonary oedema

Figure 1: Triangle of safety site

Bordered by lateral border of pectoralis Major, midaxillary line and inferior nipple line/4th or 5th inter-costal space.



Management following chest drain insertion

- A **CXR** should be performed. This confirms position of drain tip and excludes the complication of iatrogenic pneumothorax/haemothorax.
- Appropriate **analgesia** should be prescribed as an indwelling drain can often be uncomfortable.
- Clear guidance on drainage rates should be documented and provided verbally to the nursing staff. This depends on the situation and predicted volume of fluid in the chest but draining 500ml-1L every 2-3 hours is reasonable.
- A **chest drain chart** should be placed in the nursing notes and drain activity should be observed and documented every with regular nursing observations.
- Advice should be given to the patient with regards to how to handle the drain and tubing when moving to reduce the risk of displacement. If the ward chest drain kit (picture 1) has been used this should be replenished and a pleural procedure sticker (picture 2) should be inserted in the notes.

Ensure a functioning drain

A normal functioning drain should swing with respiration, indicating the tip is in the pleural space. Failure to swing suggests the drain is not patent (blocked), has been dislodged from the pleural space or an attached three way tap is switched to 'off'. This may not always be obvious and may require close inspection of the drain itself rather than the connecting tube and bottle.

Troubleshooting in pneumothorax

Scenario 1: The drain is swinging and bubbling

The drain is patent and functioning but there is persistent air leak from the pneumothorax. After 48 hours post insertion for pneumothorax low grade suction should be applied.

Scenario 2: The drain is swinging but not bubbling

The drain is patent and functioning. The absence of bubbling suggests the air leak has healed over. Bubbling can occasionally be intermittent so should be observed for a further 24 hours to ensure this is not the case prior to removal.

Scenario 3: The drain is not swinging or bubbling.

This suggests the drain is not functioning. A drain that is not swinging will not bubble so it is impossible to tell the status of the pneumothorax. The drain site needs inspection for displacement and may need flushed to unblock, and a CXR may be required.

Troubleshooting in pleural effusions

Scenario 1: The drain is not swinging

The drain is not patent or has become dislodged due to the drain not being adequately secured following insertion. If the drain remains secure then the drain should be flushed.

If a drain has stopped functioning because it has been displaced then it should be removed and **SHOULD NEVER** be pushed back into the pleural cavity. **A drain can be withdrawn to improve function but never inserted further into the pleural cavity** once the sterile field has been removed.

Scenario 2: The drain is now bubbling

This suggests the presence of pneumothorax and air in the pleural cavity. This may be due to pre-existing hydropneumothorax or iatrogenic pneumothorax on insertion of the chest drain. The drain should remain in situ until bubbling has ceased and **a bubbling chest drain should NEVER be clamped.**

Scenario 3: No more fluid is draining

Again check for drain patency. Assuming patency your next step depends on whether the drain has drained the expected or desired volume. A CXR could be performed to check on volume remaining in the pleural space particularly if pleurodesis is planned. Further imaging may be required if you suspect you may have only drained part of a multiloculated collection. Malignant effusions may continue to drain what they are producing (often <150ml/24 hrs) and not cease. Before removing a drain in malignant effusion clarify with a senior whether pleurodesis is planned.

Applying suction to a chest drain

In pneumothorax, a persistent air leak with or without re-expansion of the lung is the usual reason for consideration of the use of suction. It is arbitrarily defined as the continued bubbling of air through a chest drain after 48h in situ. The theory that underpins the role of suction is that air might be removed from the pleural cavity at a rate that exceeds the egress of air through the breach in the visceral pleura and to subsequently promote healing by apposition of the visceral and parietal pleural layers. It has been suggested that optimal suction should entail pressures of 10 to 20 cm H₂O (compared with normal intra-pleural pressures of between -3.4 and -8 cmH₂O, according to the respiratory cycle). High-volume

low-pressure systems are recommended either through mobile pump attachments or wall suction units with low pressure adaptors. Suction pumps can be found in ward 6 (picture 3). All staff should familiarize themselves with these units. A disposable filter is attached to the side of the unit and these attach simply to the top of the drain bottle to two easily recognizable ports and the unit is plugged into a mains socket. A diagram of this is included in every packet of disposable filters.

How to flush a drain

A simple but underperformed procedure. Regular flushing may be required in heavily blood stained effusions or empyema to prevent tube blockage. It is also required as mentioned above to check drain patency when a drain has stopped swinging or draining.

Equipment: Sterile swab
Sterile gloves
Drain clamps (x2) if no three way tap
20ml syringe with 20ml sterile water/saline

- Take cap off three way tap connector leaving three way tap closed to the port for the syringe.
- Wipe port with sterile swab.
- Attach syringe with 20ml water or saline in. Turn the three way tap to 'off' to the drain bottle then gently flush fluid into pleural cavity through drain asking the patient to report any discomfort and observing for any resistance that can be overcome.

Pain during this procedure suggests the drain tip may be sitting in the soft tissue of the chest wall. Drains larger than 12F may not come with three way taps and when flushing, the chest drain and connective tubing should both be clamped during separation. The syringe (catheter tip) should be connected directly to the chest drain and the clamp can be released for flushing. After flushing, the drain should be clamped again before reconnecting with tubing and removing both clamps. Following flushing observe drain function.

The patient has developed subcutaneous emphysema

The development of surgical emphysema is an unfortunate but well recognised side effect of pneumothorax and intervention.

Surgical emphysema is the abnormal presence of air within the subcutaneous tissues. Its presence suggests that the drain is occluded or misplaced. If neither is the case, then this means that the drainage system is inadequate to deal with the degree of air leak. The degree of drainage can be increased by applying suction, inserting a second chest drain or a larger drain.

Other than being uncomfortable it is usually only of cosmetic importance but can be distressing for patients and relatives. In the severest of cases this may track up to the face and neck and cause airway compromise. It may occur during drain insertion due to rapid release of air through the insertion site.

If emphysema develops,

- Ensure that the drain is patent and that there is no air leak at the site of drain insertion such as a port in the drain sitting in the chest wall.
- Inspect the drain entry site to ensure the drain is sealed tight within this.
- Ensure the patient has adequate analgesia and observe to ensure there are no signs of airway compromise.

Usually subcutaneous emphysema requires no additional treatment and resolves over a few days.

When should a chest drain be removed?

A chest drain should not be left indwelling longer than absolutely necessary.

Chest drains should be removed when

- 1) A pleural effusion has been drained (Fluid drained <150ml/24hrs)
- 2) A pneumothorax with cessation of bubbling > 24hrs- and resolution on CXR
- 3) After pleurodesis of a malignant effusion (see later)
- 4) Drain is non-functioning (covered above)

What if a drain 'falls out'?

First of all ensure the drain is removed properly, the drain site is clean, is sutured and dressed appropriately. Does the drain need replaced? In the case of an unresolved pneumothorax the answer is almost certainly yes. This decision should be made promptly with senior guidance.

If a chest drain needs re-sited NEVER do so through the original incision.

With pleural effusions it will depend on how much residual fluid there remains in the pleural space and why it is there. It may be unacceptable to site a further drain to drain a small residual collection of fluid particularly in a malignant effusion unless there is a strong desire for pleurodesis. If the effusion is due to pleural infection the decision is based on volume of residual fluid and presence of ongoing sepsis and is best guided by a respiratory specialist. In the vast majority of pleural effusions a decision on whether the drain needs replaced can be delayed until working hours.

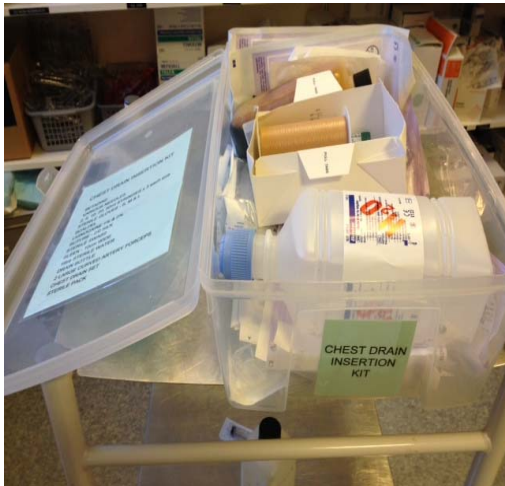
Removing a chest drain

A chest drain should be removed either while the patient performs valsalva manouvere or during expiration with a brisk withdrawing movement. A suture should be placed and a dressing applied. Arrangements should be made for the suture to be removed in 5 days.

Should you wish any further information on chest drain management or insertion then contact the respiratory SPR on the green team bleep 6632.

Recommended reading

1. <http://www.nrls.npsa.nhs.uk/resources/?EntryId45=59887>
2. <http://www.brit-horacic.org.uk/Portals/0/Clinical%20Information/Pleural%20Disease/Pleural%20Guideline%202010/Pleural%20disease%202010%20pleural%20procedures.pdf>



Picture 1: Chest drain kit

BORDERS GENERAL HOSPITAL - PLEURAL PROCEDURE

PROCEDURE: ASPIRATION CHEST DRAIN

REASON: PLEURAL EFFUSION PNEUMOTHORAX

DATE: / / TIME:

PERFORMED BY: GRADE:

SUPERVISED: YES NO GRADE:

RISK ASSESSMENT: YES NO UNKNOWN

COAGULOPATHY

EVIDENCE OF BULLA

IMMUNOSUPPRESSED

MESA

NURSING STAFF PRESENT DURING PROCEDURE: YES NO

NAME OF NURSE/S:

PATIENT CONSENT: VERBAL WRITTEN

USS THORAX: YES NO

SITE OF DRAIN/ASPIRATION:

TECHNIQUE: NEEDLE/CANNULA SELDINGER BLUNT DISSECTION

DRAIN SIZE: ()

SAMPLES SENT: CBS AAFBC

MICRO

PATHCYTOL

pH

BIOCHEM

OTHER

(*Take concurrent blood samples when appropriate)

APPEARANCE OF FLUID:

CLEAR

STEAM

PURULENT

BLOOD

CHYLE

VOLUME ASPIRATED: _____mls

VOLUME DRAINED IN 1st HOUR: _____mls

POST PROCEDURE CXR: REQUESTED VIEWED

CHEST DRAIN CHART:

SIGNED:

PRINT NAME:

Picture 2: Pleural procedure sticker



Picture 3: Suction unit- this is reusable do NOT discard