How to Insert a Chest Drain

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Chest drains are commonly used in the treatment and management of various acute and chronic conditions in many different clinical settings, especially when respiratory function is compromised. Whilst it is usually the responsibility of the doctor to insert the chest drain, it is the responsibility of both the nurse and doctor to maintain the drain and monitor the patient. In both respects, safe practice requires understanding of the anatomy and physiology of the pleura and cardiac spaces, an appreciation of the underlying conditions and knowledge of the physics and air/fluid flow and function of thoracic drainage.

Pleural membrane

The inner visceral pleura and outer parietal pleura form a continuous double layered serous membrane, which envelops the lungs and lines the thoracic cavity. The pleural membrane is airtight but separating the two layers is approximately 10ml of serous pleural fluid, produced by the membranes. This allows the pleura to slide easily over each other during breathing and enables the pleural membranes to be held together. A negative pressure exists between the visceral and parietal pleura. This pressure provides suction and results in the lung being held close to the chest wall.

However if air, or more than a few millilitres of fluid of any kind, is allowed to enter the pleural space the negative pressure is lost and the affected lung will partially or fully collapse. It is essential in this situation for the lung to be re-expanded as soon as possible so that the mechanics of breathing and ventilation/perfusion is rebalanced[1]. Chest drains are inserted into the pleural or mediastinal spaces to remove abnormal collections of air, blood, pus or fluid.

Box 1. Conditions that require chest drain insertion[2]

Pneumothorax
- In any ventilated patient
- Tension pneumothorax after initial needle relief
- Persistent or recurrent pneumothorax after simple aspiration
- Large secondary pneumothorax

Malignant pleural effusion
Empyema and complicated parapneumonic pleural effusion
Traumatic haemopneumothorax
Post operative – for example thoracoscopy

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Three components are necessary to insert a chest drain:

1. An unobstructed chest tube of an appropriate diameter.
2. A collecting container kept below waist height.
3. A one way mechanism, water seal or valve to allow the fluid or air to leave the pleural cavity but which prevents it from being sucked back. Chest drains are made of clear plastic of various diameters, distance markers, drainage holes and a radio-opaque strip that allows for x-ray detection[3].

Where possible assess the risk of haemorrhage before inserting the chest drain and deal with any coagulation defect. Careful differentiation between collapse and pleural effusion when there is unilateral white out is essential.

Positioning the patient

The preferred position for chest drain insertion is on the bed, slightly rotated with the arm elevated above the head on the affected side. Alternatively make the patient reasonably comfortable sitting on the edge of the bed with their arms crossed and raised to chin level, their head and arms resting on a pillow placed on a bed table.

Box 2. Equipment required for chest drain insertion

Sterile gown and gloves
Sterile drapes
Suture Set
Sterile gauze swabs
Syringes and needles of various sizes
Local anaesthetic
Scalpel and blade
Skin antiseptic i.e. Chlorhexidine in alcohol
Local anaesthetic – Lignocaine 1% or 2%
Suture – size 0 – 1
Instrument for blunt dissection (e.g. curved clamp)
Chest drain e.g. wide bore or Seldinger
Connecting tubing
Closed drainage system (including sterile water for underwater seal)
A dry non adherent dressing with adhesive border
Low suction unit for use if required.

Consent and premedication

- Explain the procedure fully to the patient, and discuss the risks and benefits. Consent should be obtained according to national/local guidelines.
- Give adequate analgesia prior to the procedure, as insertion is painful[4]. Give benzodiazepine or opioids (unless contra-indicated) as well as local anaesthetic to the skin.

Inserting the chest drain

The most common position for chest drain insertion is in the mid-axillary line, through the safe triangle, see figure 1 below. This is defined by the anterior

border of the latissimus dorsi, the lateral border of the pectoralis major and a horizontal line through the anatomical position of the ipsilateral nipple[2]. However the most appropriate site maybe identified through the clinical picture and further imaging as necessary.

Clean the proposed site with an antiseptic solution and cover the surrounding area with sterile drapes, leaving only the insertion site exposed. Then inject local anaesthetic around the insertion site. When it has taken effect, make an incision in the skin – depending on type of drain being inserted[5].

Small bore chest tubes are usually inserted with the aid of a guide wire by a Seldinger technique. After local anaesthetic a guide wire is passed down the hub of the needle, the needle removed and tract enlarged by dilators. A small bore tube can then be inserted.
Medium bore chest tubes can be inserted by the same technique or by blunt dissection. The subcutaneous tissue and muscle into the pleural cavity is penetrated by Spencer wells forceps. The proximal end of the drain is clamped and inserted into the pleural space; this can then be connected to drainage tube and bottle
Wide bore drains must be inserted with blunt dissection. The incision made must be similar to the diameter of the tube being inserted; the track should be explored with a finger to ensure there are no underlying organs that might be damaged by the tube.

The drain position should ideally be aimed apically for pneumothorax or basally for fluid. Although any tube position can be effective at draining air or fluid and an effectively functioning drain should not be repositioned because of its radiographic position, unless it is causing pain[2].

Throughout the insertion:
- Monitor the patient closely according to his/her physical condition and current illness.
- As a minimum, note the patient's respiratory rate, peripheral oxygen saturations, blood pressure, pulse and pain.
- Explain to the patient what is happening and reassure him/her.
- Give oxygen by nasal cannula or facemask – depending on the patient's condition.

Prior to the procedure make sure intravenous access is available.

Close medium and large drains by a suture. This should be inserted in a linear way. Do not use large amounts of tape and padding to cover and secure the drain. A clear dressing over the wound site allows observation for leakage or infection.

After inserting the drain obtain a chest x-ray to view its position and regularly assess the amount of bubbling, drainage and swinging.
Swinging is fluctuation of around 5 -10cm in the amount of fluid in the underwater seal as the patient breathes in and out. If not visible, check there are no kinks or loops in the tubing and notify medical staff.
Bubbling indicates that air is being removed from the pleural space and can be seen in the water bottle without suction when the patient breathes or coughs. If bubbling is continuous this maybe because there has been dislodgement of the tube or a loose connection. If bubbling stops the lung maybe fully expanded, or there is a leak in the pleura or a leak at the insertion site. Check all tubing and exposed eyelets at the insertion site. Inform medical staff[6].

There have been reports of re-expansion pulmonary oedema after rapid drainage of large effusion, which can be fatal. Signs that should be monitored closely include cough and shortness of breath. It has been suggested that only 1.5 litres of fluid be drained at any one time, the drain should be clamped and opened again when the patient's condition is stable. Continuous drainage can occur when there is less than 500ml per hour.

Common problems and suggested action

- Lack of drainage – check tubing for kinks or obstruction and straighten/raise as required. Change tubing if occluded.
- Accidental disconnection of drainage tubing from drain –\clamp the tube immediately to avoid air entering the pleural cavity. Re-establish connection as soon as possible, using a clean sterile system. Notify medical staff, a chest x-ray maybe required.
- Collecting bottle falls over – quickly stand bottle upright again to establish underwater seal.
- Intra pleural drain falls out – place a clean dressing over the insertion site immediately and close the wound with a suture. Check patient's vital signs.

Chest drain insertion and management can appear complex and daunting at first. A good understanding of the physiology related to drain insertion is important. Evidenced-based practice should be applied to the care of the patient and drain equipment. This reduces the risk of complications and improves outcomes for the patient.

References

1. McMahon-Parkes K. 2007 *Management of pleural drains*. Nursing Times, 93 (52) pp48 - 51
2. British Thoracic Society 2003 Thorax 58 ii53
3. Allibone L. 2003 *Nursing Management of Chest drains*. Nursing Standard 17 (22) pp 45 -54
4. Tomlinson MA. & Treasure T. 2003 *Insertion of a chest drain: how to do it*. British Journal of Hospital Medicine 58: 6 pp 248 - 252
5. Avery S. 2000 *Insertion and Management of chest drains*. Nursing Times 96 (37) pp3-6
6. O'Hanlon-Nichols T. 1996 *Commonly asked questions about chest tubes*. American Journal of Nursing 96, (5) pp 60 -64

Answers to Quiz

1. Lack of iron
2. They must make many new red blood cells, provide iron for the foetus and may lose much blood during childbirth
3. 110 g/L
4. Foods containing blood, such as meat and liver.
5. No, not until they have been treated for infections, are eating well and gaining weight.

The website **Health Researchers in Sudan** http://hrsudan.pbwiki.com compiled by Dr Ghaiath M. A. Hussein (ghaiathme@gmail.com) aims to create an online community for the researchers and all those involved in research involving Sudanese people. The site gives information on Grants and Fellowships, and National and International Guidelines (including guidelines for preparing a research proposal). The materials may soon be available on CD.

News item: Sudanese physicians' reintegration programme

On May 17, 2008, in Juba, 11 Sudanese-Canadian physicians were recognised for completing medical training and returning to Southern Sudan to practice. Few internationally educated physicians are prepared to return to a homeland as challenging as Southern Sudan; yet this group has done just that, against the globally entrenched flow of physicians migrating from developing to developed countries. For South Sudan's population of more than 10 million people, the return of these doctors is a long-awaited fruit from seeds of hope planted 22 years ago in Cuba.

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Did you know?

Africa accounts for nine out of every 10 child deaths due to ***malaria*****,** for nine out of every 10 child deaths due to ***AIDS***, and for half of the world's child deaths due to ***diarrhoeal disease and pneumonia***.

The top five causes of all deaths in low-income countries are pneumonia, heart disease, diarrhoea, HIV/AIDS and stroke.

From WHO's Global Burden of Disease 2004 Update published 27 October 2008

http://www.who.int/healthinfo/global_burden_disease/2004_report_update/en/index.html