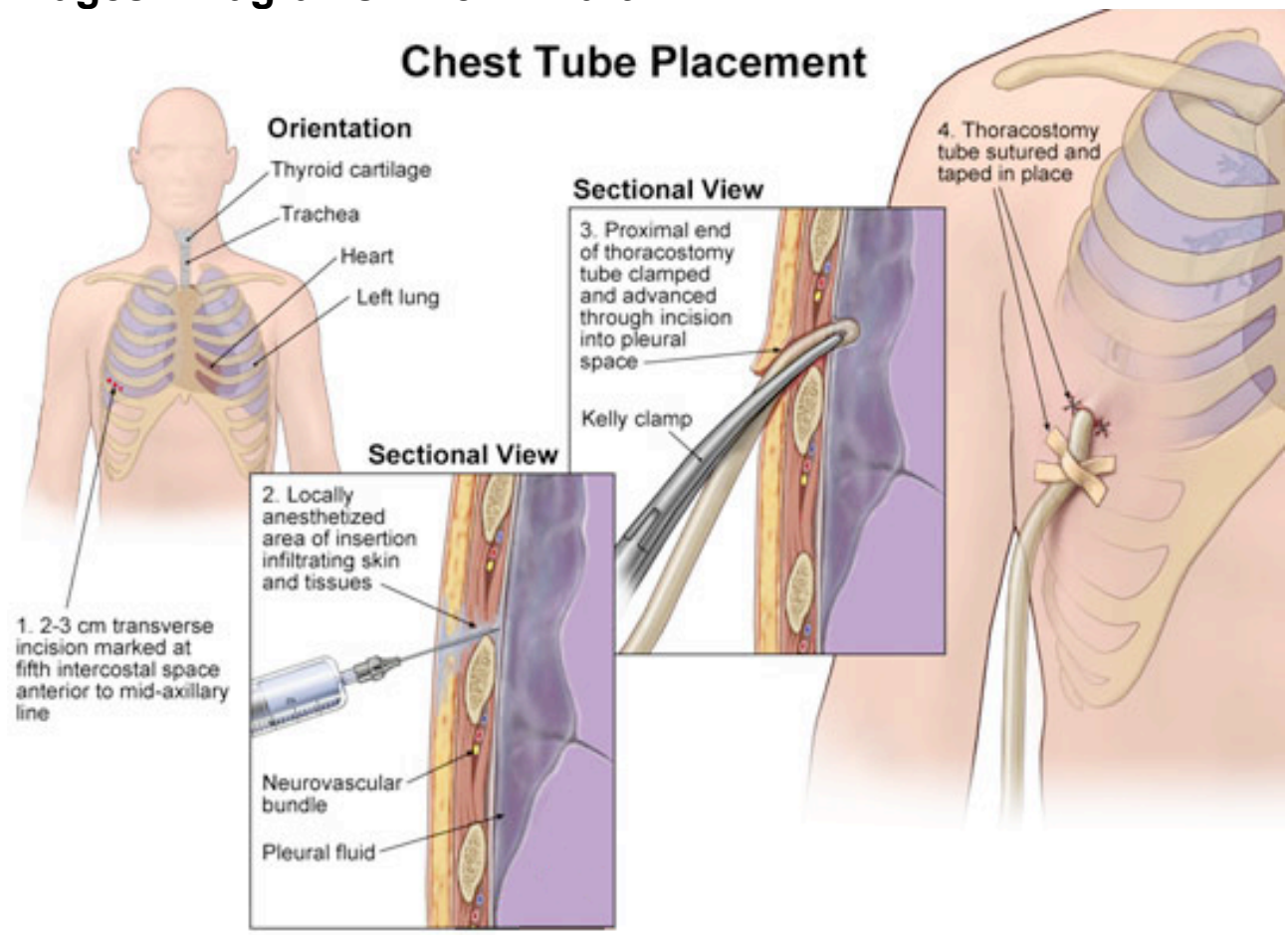
Intercostal catheter (ICC) insertion Guideline [1]

Images / Diagrams / Flow Chart [2]



Definition

An intercostal catheter enables the drainage of air or fluid from the pleural space, allowing negative intra-thoracic pressures to be re-established leading to lung re-expansion.

Indications

- Drainage of a Pneumothorax:
  - under tension
  - with respiratory distress or failure
  - with significant subcutaneous emphysema
  - with failed aspiration or recurrent collapse after aspiration
- Drainage of a moderate or large Haemothorax or Pleural Effusion
- Drainage of an Empyema

- Prophylactic insertion in a patient with chest injuries, prior to positive pressure ventilation or aeromedical transport

Contra-indications

Absolute

- Nil (as indication is often for a life-threatening process)

Relative

- Uncontrolled bleeding diathesis
- Infection over insertion site
- Loculated effusion

Preparation

Patient

- Check Indications and Contraindications
- If patient has a coagulopathy yet procedure necessary, aim to reverse coagulopathy prior to ICC insertion
- Explanation and Reassurance
- **Informed Consent (verbal)**
  - Risks of procedure (See complications and include statistics where relevant)
  - Risks without procedure (stats)
  - **Patient competency**
  - **Patient comprehension**
  - **Patient decision**

Area

- Monitored resuscitation cubicle

Staff

- 1 doctor experienced in ICC insertion (or closely supervised by an experienced operator) to do procedure
  - If patient unstable/high-risk, to be done by most experienced available doctor
- 1 procedure assistant
- If procedural sedation required, a 2nd doctor dedicated to airway, breathing, circulation
- Minimum 1 nurse to perform observations and tend to patient during procedure

Equipment

- Comprehensive non-invasive monitoring equipment

- Absorbent pad or 'bluey'
- Surgical mask and sterile gloves
- Sterile procedure pack with gown, tray and drapes
- Chlorhexidine and alcohol or Povidine iodine prep solution
- Appropriate size chest tube
    - Depends on indication and patient size (can estimate by ICC size = 4 x ETT size)
        - Adult:
            - Simple pneumothorax: **20 – 24F**
            - Effusion, Haemothorax, Haemo-pneumothorax, Empyema: **28 – 36F**
        - Child**:** **18 – 24F**
        - Infant: **14 – 20F**
        - Neonate: **8 – 12F**
- Scalpel with blade
- Chest drain insertion kit (with blunt dissectors)
- Gauze swabs
- 10ml syringe
- 25G (or 27G) + 21G needles
- Suture set: needle holders, forceps, scissors
- Suture material: 00 or 0 nylon
- Dressing: drain swabs and occlusive dressing
- Underwater sealed chest drain unit prepared with sterile saline

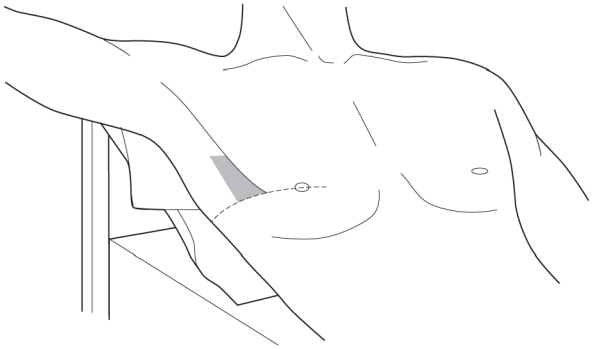
Drugs [3]

- Lignocaine 1% 20ml (max 3mg/kg)
- Morphine 2.5-5mg IV boluses (if analgesia required despite local anaesthesia)
- Midazolam 1-2mg IV boluses (if anxiolysis or sedation required)

Procedure

- Have a trolley ready with all sterile contents laid out
- Confirm the side, position and size of the Pneumothorax or fluid:
    - Review recent CXR
    - Auscultate and percuss the chest

- Position the patient lying on a trolley with head-up 30-45 degrees and with the ipsilateral arm elevated above the head
- Aseptic technique with mask, gown and gloves
- Identify the insertion site in the 4th or 5th intercostal space, just anterior to the mid-axillary line. This will be just inferior to the axillary hair, on a line lateral to the nipple. This will avoid puncturing the diaphragm inferiorly, and the long thoracic nerve which courses posteriorly (image 2)



- Clean a wide area of skin around the insertion site with antiseptic solution using a gauze swab held with a pair of forceps. Use a circular motion commencing at the insertion site and working outwards, and repeat with a new swab
- Drape the area
- Draw up 10-20ml Lignocaine 1% and anaesthetize the drain site:
    - Use the 25G (or 27G) needle to infiltrate 4-5 cm of the surface skin over the desired intercostal space
    - Change to the 21G needle and infiltrate local anaesthetic deeper towards the pleura. Aim for the upper border of the rib below, to avoid hitting the neurovascular bundle that runs along the inferior rib margin
    - Use liberal doses of local anaesthetic, particularly at the pleural entry site
    - Take care to draw back on the syringe before infiltrating and stop when air or fluid is aspirated from the pleural cavity
- Make a 3-4 cm incision through the anaesthetized skin, parallel to the line of the ribs, at the level of the upper border of the rib
- Using artery forceps, blunt dissect through the intercostal space just above the upper border of the rib, until the pleura is reached.
- Use the index finger of your dominant hand to push through the pleura between the ribs. With the finger flexed within in the pleural cavity sweep in a 360^{o} plane to ensure the cavity has been breached and no adherent lung is present. If any resistance

is felt to sweep of finger within pleural space, reassess your position and consider reinserting one rib space higher (can usually use same hole in skin)

- **REMOVE THE TROCHAR (INTRODUCER) FROM THE CHEST TUBE** and insert the tube into the pleural cavity to a distance of 10-14 cm. **THE TROCHAR SHOULD NEVER BE USED**
- Connect the chest tube to the underwater sealed drain
- Insert 00 or 0 nylon sutures to each side of the chest drain, keeping the ends of the suture material long (5-10 cm). Tie the outer sutures as normal, pulling the skin taut around the chest tube, and use the additional length of the remaining suture material to wrap around and secure the chest tube. Gently pull on tube to check it is secure.
- Place gauze swabs around the chest tube and secure with an occlusive dressing
- In the case of Pneumothorax, check that the drain is swinging, draining and bubbling freely. In the case of Haemothorax, blood should drain from the catheter
- Check position of chest tube with a post-procedure CXR
- Ensure all sharps are disposed of into a sharps disposal unit

Complications

Early

- Haemorrhage (from generalized coagulopathy or vessel disruption)
- Trauma to heart, lung, diaphragm, liver or spleen (never use of trochar or re-insert through an old drain site)
- Mal-positioning, either extra-thoracic (obvious on CXR), or intra-thoracic but extra-pleural (not obvious on CXR, but extremely painful)
- Subcutaneous Emphysema

Late

- Re-expansion Pulmonary Oedema
- Infection and Empyema

Treatment

- **Local haemorrhage**:
  - Usually settles when wound closed
  - Give blood products if coagulopathic

        - Replace significant volume loss (IV fluid/ RBCs)
        - Urgent cardiothoracic surgery involvement if not settling
    - **Trauma to organs**: Depending on site and degree of damage, this will often need urgent surgical involvement
    - **Misplacement of ICC or diffuse subcutaneous emphysema**: Replace ICC
    - **Infection / Empyema**: Remove ICC and replace if indicated. Commence antibiotics
    -

After care

- Keep the underwater seal chest drain below the level of the heart at all times
- Initially half-hourly documentation of patient observations, ICC function, volume and character of fluid draining from ICC, and presence or absence of Surgical Emphysema
- ICC function:
    - Frequent assessment of ICC function required:
        - Is the drain 'swinging' with respiration?
        - Is the drain 'bubbling'? (with Pneumothorax)
        - Is the fluid level in the drain increasing?
    - If there is no swinging, the ICC is either kinked, blocked or mal-positioned
    - If there is no bubbling or increase in the amount of fluid in drain, either the ICC is kinked, blocked or mal-positioned, or there is no more air or fluid in the pleural space to drain
    - Correlate with CXR and consider slightly withdrawing (eg, if abutting mediastinum) or inserting a new ICC
    - Never push an ICC in further after its original placement
- If a large pleural effusion is being drained, clamp the tube after ~1L has been drained to prevent pain due to mediastinal shift, and to prevent re-expansion pulmonary oedema. The clamp can be removed again after ~30 minutes, and repeat if necessary

Disposition

Depends on indication for ICC, but must be to ward where nursing staff familiar with care of intercostal catheters

Documentation

Ensure thorough documentation of the ICC insertion procedure including; technique used (sterile, local anaesthetic), tube size, depth of insertion, any difficulties or complications and initial volume of drainage

Reviewed by

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References

1. Miller's Anaesthesia, 6th Edition
2. Image 1: Medical Legal Exhibits (under copyright) amicusvisualisations.com/cgi-bin/reference.cgi?topic=0711071_ChestTubePlacement
3. Image 2: Thorax 2005;60:152
4. Australian Medicines Handbook 2008