SOUTHAMPTON OXFORD
NEONATAL TRANSPORT

Pneumothorax and Chest Drain Insertion

- Early recognition, and prompt treatment of a tension pneumothorax is important
- Diagnosis is usually clinical (see table below) but also by chest x-ray.
- Transillumination of the chest is also useful, but check with CXR or US if clinical status allows.

Risk factors	General clinical signs
• Mechanical ventilation • Traumatic delivery • IPPV resuscitation • Respiratory distress syndrome • Pulmonary interstitial emphysema • Cardiac/chest surgery • Infection • Meconium aspiration	• Increasing oxygen and/or ventilation needs • Increasing CO2 on blood gases • Unstable observations (HR, RR and sats) • Loss of chest wobble if on HFOV • Asymmetric breath sounds **If a tension pneumothorax developing:** • Increased work of breathing • Mediastinal shift • Decreased air entry on affected side/ unequal chest movement • Apnoea/ Bradycardia • Hypotension/ poor perfusion

Thoracentesis

Indication: diagnostic and therapeutic procedure in an unwell infant who has respiratory and/or haemodynamic compromise due to a pneumothorax or pleural effusion.

Equipment	Pre-Procedure Checks
Alcohol swab, Sterile gloves	Except in an emergency, the infant must have venous access
23g butterfly needle	Obtain an urgent CXR if able, to confirm pneumothorax
3-way tap , 10mL syringe	Continuous ECG, and sats monitoring, NIBP available
Bottle of sterile water	

Procedure:

1. Attach the butterfly needle to the 3-way tap and syringe or place the end in a galipot or bottle of sterile water.
2. Clean skin surface. Insert needle into 2nd intercostal space, mid clavicular line.
3. If using syringe apply continuous suction, a rapid flow of air will occur when the pneumothorax is entered. Rotate the 3-way tap to waste the air and then repeat the aspiration/waste cycle.
4. If the air leak is continuous, the butterfly tubing may be left underwater and allowed to bubble whilst a chest drain is inserted.
5. Document procedure.
6. Obtain x-ray post drainage if not placing a formal chest drain

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Chest drain insertion

Equipment

- Sterile dressing pack
- Sterile gloves and gown
- Skin preparation (0.05% chlorhexidine gluconate solution)
- Correctly sized intercostal catheter (ICC) - Discretion advised but routinely Size 6Fr for all simple pneumothoraces in any size/gestation infant but size 8.5Fr drains may be advisable for drainage of large pneumothorax in any size/gestational age.
- 18G cannula (Pink)
- 3-way tap
- Steri-strips
- Clear sterile dressing
- Underwater seal chest drainage bottle and tubing or Heimlich flutter valve.

Additional Equipment if inserting a Trocar Drain:

- Scalpel. Fine blunt forceps (x2), Silk suture, 1% lignocaine

Positioning

- Lateral Position: 3rd- 5th intercostal space, mid axillary line (Preferred)
- Anterior position: 2nd-3rd intercostal space, mid clavicular line

Cautions:

- **Avoid the nipple and breast bud**
- Go above the rib to avoid intercostal vessels
- Caution of the liver and heart
- **If using a trocar drain please remove the trocar from the drain**. The use of the trocar during insertion risks impaling/penetrating the lung, liver or heart.
- **Do not use a purse-string suture** as this will result in a permanent disfiguring scar.

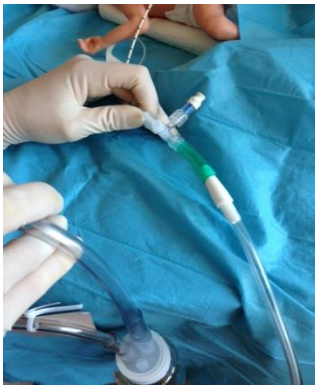
Insertion by Seldinger technique of a Neonatal Pigtail (or Seldinger straight drain)

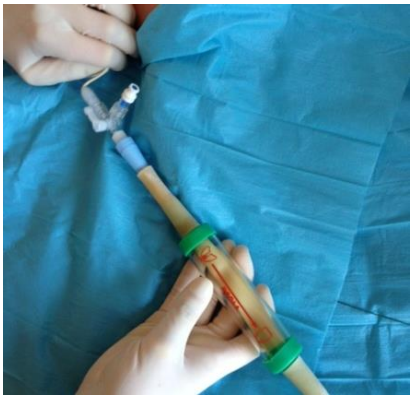
1. A full aseptic technique should be employed.
2. An assistant should be available to hold the infant during the procedure.
3. Ensure appropriate sedation/analgesia for the infant (consider Morphine or fentanyl 2-4mcg/kg and local anaesthetic)
4. For lateral positioning:
    a. Lay the baby on its side at 45° with the side requiring the drain uppermost.
    b. Use a roll under the shoulder.
    c. Stretch the arm out and raise above the head.

5. Clean the skin over the insertion site, confirm correct position and infuse no more than 0.5 mL of 1% lignocaine through the tissues down to the parietal pleura. Wait 1-2 minutes for anaesthesia to work.
6. Attach 10ml syringe to an 18G cannula (PINK) or needle from pack
7. Whilst withdrawing the syringe, advance the cannula/needle into the 4th intercostal space directly above the 5th rib (roughly level with nipple), in the mid axillary line, aiming anteriorly after insertion, until air is withdrawn

8. Remove the syringe and needle and leave the cannula insitu placing a finger over the hub.
9. Insert the guide wire through the cannula/needle to a length of 5-8 cm (there is a silver mark at 10cm)
10. Holding the wire at all times, carefully thread the white cap off the wire and take out the cannula.

11. Holding the wire in place, thread the dilator over the end of the wire then with a twisting motion advance it over the wire to a distance of: 1cm (preterm) or 2cm (term) from the surface of the skin.
12. Holding the wire in place, remove the dilator.
13. Now advance the curly end of the ICC over the wire and insert to the 3-5th mark (1-2cm for preterm / 2-3cm for term).
14. Holding the catheter in place, withdraw the guidewire.
15. Attach the 3-way tap and blue ‘Christmas tree’ connector to the end of the catheter and in turn connect this to the drainage tubing ensuring the 3 way tap is closed to the patient.
16. Ensure catheter is securely fixed to the chest wall with sterile dressings.
17. Attach the catheter to underwater seal drain below the neonate’s chest level and secure to neonate and bed or to a Heimlich valve for transport (shown). Open the 3-way tap.





Chest drain insertion - Neonatal 'cut-down' procedure

1. Prepare and check equipment
    - Gown, sterile gloves and face mask.
    - Cleaning fluid and gallipot with cotton wool or gauze skin wipes
    - Sterile drapes
    - Lidocaine 1% solution, 2 ml syringe, green and blue needle (if anesthesia appropriate)
    - Chest drain size 10 FG (or size 8 FG for premaure infants)
    - Instruments:
        i. Fine artery forceps
        ii. Blade holder and blade (size 15) or disposable blade and handle
        iii. Non-toothed forceps
        iv. Scissors
    - Three way tap, green luer lock to chest drain tubing
    - Chest drain tubing with the bottle filled to create underwater seal or Heimlich flutter valve
    - Silk suture 3.0

A sterile technique should be used. Baby should be positioned as previously described and the drain inserted in the same position

2. Infiltrate skin and muscle layers with local anaesthetic (if time allows)

3. Incise skin and dissect chest wall layers.
    - Insert the blade horizontal to and above a rib in the identified intercostal space creating a small skin incision approximately 0.5 - 1 cm long through the skin and muscle layers.
    - Insert fine artery forceps or fine forceps into the incision and advance the instrument through the tissue layers by blunt dissection.
    - At approximately 0.7 - 1cm depth you should feel a 'give' as you enter the pleural space.

4. Insert drain
    - Remove trocar from chest drain and apply artery forceps toward the far end of the drain.
    - Apply reasonable but not excessive pressure to advance drain with the aid of forceps through the defect in the chest wall layers in a direction angled towards an anterior and apical position. Observe for water vapour condensing or bubbling in drain.
    - Advance the drain by 2-5 cm to an imaginary position in the mid clavicular line.
    - **** Beware the chest drain tracking through the chest wall rather than the pleural space.****

5. Connect drain and secure

Patient assessment and observation

Close observation is required after insertion of a chest drain. Continuous monitoring should include as a minimum:

- oxygen saturations,
- respiratory rate and assessment of work of breathing,
- heart rate
- Non-invasive blood pressure
- Pain scoring

Air leak activity should be recorded hourly such as continuous bubbling, intermittent bubbling, and no bubbling.

Troubleshooting

- Drain stopped bubbling –
  - Is the seal adequate?
  - Is the level of fluid too high or too low?
  - If using wall suction, check connection and set pressures.
  - If unresolved, inform medical staff. It may be that the air leak has resolved, or the drain has blocked or dislodged.
- Air leak around the insertion site –
  - Is the incision site too large?
  - Does it need re-suturing?
  - Ensure adequate dressing around site.
  - Check for surgical emphysema or signs of infection around the site.
  - Has the drain moved out of the chest?
  - Inform medical staff.
- Chest drain falls out
  - Call medical team immediately.
  - Close observation of baby's clinical state and TPR.
  - If the baby had a pneumothorax that was bubbling, cover the site with a dressing secure on 3 sides. This will allow air to escape and prevent a tension pneumothorax.
  - If the baby did not have a bubbling pneumothorax, apply an occlusive dressing