Thoracostomy (Chest drain Insertion)

Indications:
- To drain a pneumothorax
- To drain a pleural effusion

Drain site:
Confirm pneumothorax / pleural effusion by chest X ray
Insertion site: 4th or 5th intercostal space, at the mid axillary line (lower arrow in image below). Keep away from breast tissue. The nipple is an anatomical landmark for the 4th intercostal space
  - If pneumothorax, aim for anterior tube placement
  - If effusion, aim for posterior tube placement

Choice of Tubes:
- 10F 3.3mm diameter (black)  23cm length
- 8F 2.7mm diameter (blue) 23cm length

Equipment:
- Sterile mask, cap, gown & gloves
- Sterile surgical drapes
- Scalpel & blade
- 2 straight haemostats
- Scissors
- Needle holder (mosquito forceps is an alternative)
- 2 curved mosquitoes (neonates)
- 3.0 silk suture with curved needle
- Chest tube(s) of age appropriate size
- Antiseptic skin preparation (Chloraprep)
- Sterile 0.9% NaCl (to wash off chlorhexidine for LBW infants of < 2,500 grams)
- 1% lignocaine
- 5 ml sterile syringe, green needle
- Tegaderm
- Sterile gauze pads
- Cloth roll and restraints
- Sedation/analgesia as required
- Chest drainage device. (e.g., Heimlich one-way flutter valve, Pleur-evac)

Procedure:
- Administer sedation as required
- Place patient in supine position (ensuring thermoregulation). Placing a cloth roll under chest on affected site may improve access and visibility
- Maintain respiratory support as needed. Monitor heart rate, colour and oxygen saturation.
- Apply mask, perform sterile scrub and don sterile gown and gloves
- Estimate insertion distance (distance from the insertion site to the apex of the lung). Prepare the catheter for insertion by removing trocar and fixing end with a pair of artery forceps
• Landmark the appropriate site (as above). Cleanse the area with Chloraprep thoroughly; working from the identified site of insertion out to at least 3 -5 cm. Allow Chloraprep to dry for at least 1 minute. (Wash off in LBW infants with 0.9% NaCl to prevent burns to their delicate skin)
• Drape with sterile towels leave head and neck visible. Avoid covering the patient's head
• If condition permits, anaesthetise the insertion site subcutaneously first, and then advance to muscle and pleura using 1% lignocaine. Wait 2 minutes to allow anaesthetic to take effect
• Using the scalpel, create a superficial, horizontal incision (parallel to the rib) just above the edge of the rib
• Insert a closed mosquito forceps into the incision and advance by performing blunt dissection. The forceps points should be positioned down towards the rib, as the device is slowly opened. This process requires several separating manoeuvres. Using the tip of the forceps, carefully puncture the pleura just above the rib, and spread it apart gently. A rush of air is often audible
• Direct the catheter through the incision into the pleural cavity with help of artery forceps and connect the drain to the drainage device. Slowly advance the catheter to the desired position (aim tube ventral, cranial and medial towards sterno-clavicular joint in case of pneumothorax or dorsal and medial in case of effusion). Condensation in the lumen of the tube indicates that it has entered the pleural space. Its entry site should be palpated to ensure that it is not in the subcutaneous tissue. Ensure that all of the catheter openings are within the pleural space
• Place a simple suture around the tube and then secure the chest tube by wrapping and then tying the skin suture around the tube. In small preterm infants, avoid sutures completely
• Cover insertion site with sterile gauze and tegaderm, taking care not to use so much tape as to make chest examination difficult
• Coil tubing on bed and secure tubing with a safety loop in order to avoid tension being applied directly to the site of insertion
• Obtain a chest X-ray to verify correct catheter placement, and to check for any residual/re-accumulated air or fluid
• Document procedure

Evaluation after insertion:
• Monitor vital signs, SaO₂, amount and type of drainage
• Observe chest dressing (looking for any drainage at the site)
• Should be gentle, continuous bubbling in the water-seal chamber
• Assess colour, amount of drainage*, changes in level of respiratory distress, chest pain and breath sounds
  * Note that a sudden increase in drainage may indicate bleeding or haemorrhage; whereas a sudden decrease in drainage may indicate a possible clot.

Complications:
• Tube misplacement
• Trauma – lung perforation, haemorrhage, permanent scarring, heart and liver perforation
• Nerve damage – phrenic nerve damage causing diaphragm paralysis
• Tube blockage
• Infection
• Subcutaneous emphysema

Removal of Chest Drain:
• Prepare occlusive dressing. It is essential that this is ready in advance of removing the chest tube, as it needs to be applied immediately upon removal of the chest tube in order to prevent air from entering the pleural space
• Ensure pre-medication (analgesia)
• Wash hands and don apron
• Drape the insertion site
• Clamp the tube and disconnect it from the connection tubing
• Remove the dressing over the chest tube
• Cut suture if present. Retract tube 1 -2.5 cm in order to loosen it from where it may have adhered to the skin
• Remove tube on inspiration. Start to remove the chest tube as the patient reaches peak inspiration. It should be possible to remove a chest tube without having to use significant traction
• Examine tube to ensure that all of it has been removed
• Document procedure

References: Roberton’s Textbook of Neonatology (5th Ed) 2012
M Chakraborty and S Barr May 2012; to be re-evaluated in May 2015