Noah's Ark
Children's Hospital for Wales
Ysbyty Plant Cymru

Guideline for Management of a Chest Drain and Instillation of Intrapleural Urokinase

Chest Drains

Chest drains are inserted for drainage from the pleural space of air, blood or fluid. Paediatric patients with a chest drain are either under the care of the paediatric respiratory team or paediatric surgical team. The paediatric respiratory service manages patients with chest drains for empyema, reactive effusions and pneumothorax. Paediatric surgery manage surgical drains.

Indications for insertion of chest drain

- Pleural effusions and empyema
- Pneumothorax
- Chylothorax
- Haemothorax
- Post-operatively e.g. cardiac surgery, thoracotomy

Insertion of chest drain

Small bore pigtail catheters are inserted for the paediatric respiratory service under radiological guidance by paediatric radiology. This may be done under sedation or under GA. Large bore chest drains may be inserted by blunt dissection by paediatric surgery.

Complications of the procedure

- Excessive sedation with decreased respiratory effort.
- Pain
- Bronchopleural fistula
- Haemorrhage from intercostal vessels after a traumatic insertion.
- Organ damage (e.g. liver, spleen).
- Re-expansion pulmonary oedema in cases of a large pneumothorax.

Immediate management after chest drain insertion

- Children with chest drains should be managed by specialist nursing staff.
- Attach to underwater drain and connect –20 cm H_2O pressure.
- If more than 20ml/kg or >500mls of pleural fluid drains in the first hour then discontinue suction and consider clamping the drain for a short period. Re-assess the patient and assess fluid status.
- Encourage mobilisation as soon as possible after the drain has been inserted.

General management points

1. Reviewing a child with a chest drain
    - Always check that the drain has not been displaced. Attaching a flag (micropore) to the drain can help when checking for displacement.
    - Always check the drain is swinging and functioning. Chest drains may kink or become occluded. If the drain is not swinging, check for drain displacement or visible kinking, and flush the drain with 5 mL of normal saline.
    - A bubbling drain should never be clamped, as there is a risk of tension pneumothorax.
    - Consider tension pneumothorax in any patient with a drain in-situ, who has an acute respiratory deterioration.
    - Always document total volume of fluid removed (running total), and the volume of fluid removed in the last 24 hours.

2. Analgesia
    - Good analgesia is essential to encourage mobilization. This is especially important in empyema where movement helps to break down fibrinous septations.
    - Paracetamol and ibuprofen is an effective oral treatment for pleuritic pain.
    - Intrapleural bupivacaine 0.25% (0.5–1.0 mL/kg) may be instilled into the drain at the same time as urokinase in the treatment of empyema.
    - Pain may increase immediately after drainage of empyema, as pleural friction increases.

3. See trouble shooting and complications section below for more information

Management of empyema

Summary fibrinolytic protocol

- Urokinase 40 000 U in 40 mL of saline (10 000 U in 10 mL if <10 kg), given 12-hourly via the drain.
- Clamp the drain, and encourage mobility for 4 h after urokinase insertion.
- Drain on suction –20 cmH_2O pressure for the next 8 h.
- For pain relief, use oral paracetamol and NSAIDs plus bupivacaine (0.25%, 0.5 mL/kg), given through the pleural drain with the urokinase if necessary

Urokinase

- Urokinase is administered twice daily in the management of empyema
- This should be given at 6am and 6pm so that children can mobilise twice a day during instillation twice a day
- Urokinase may be discontinued after 3-5 days, depending on progress. Discuss with the Respiratory Consultant.

Recommended doses of Urokinase

- < 1 year old : Urokinase 10,000 units (dissolved in 10mls of 0.9% saline)
- > 1 year old : Urokinase 40,000 units twice daily (dissolved in 40mls of 0.9% saline)

Preparation for intrapleural Urokinase

- Aseptic technique should used when preparing and instilling Urokinase.
- Prepare a trolley with the following equipment:
- Needle and 2x 5ml syringes
- 50ml bottle of 0.9% saline
- Vials of Urokinase (1-2 vials*)
- 50ml syringe
- Sterile wipes
- Sterile red bung
- Sterile towel

For preparation of 40,000 units of Urokinase:

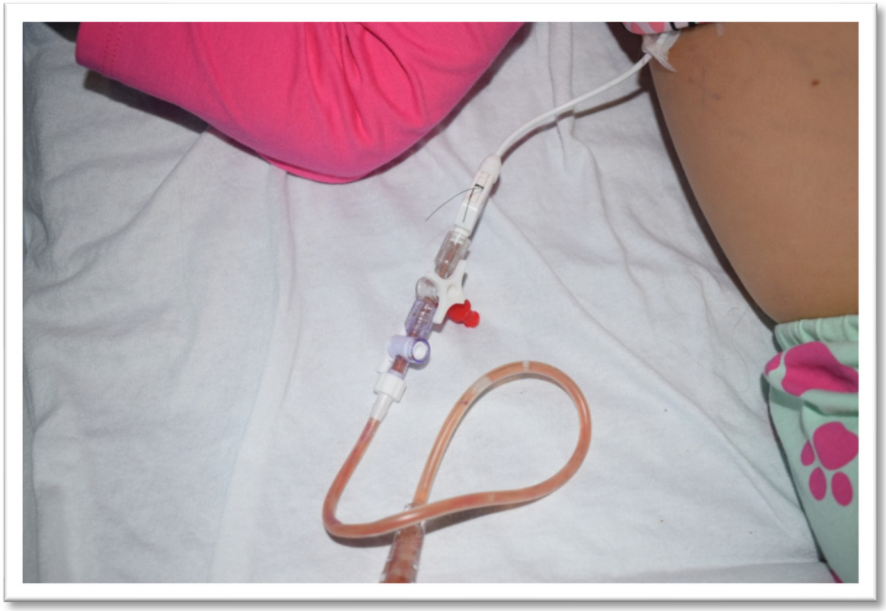
- Urokinase comes in vials of 10,000units and 25,000 units. When administering 40,000 units, 2 vials of 25,000 units are required.
- Inject 2.5mls of normal saline into each 25,000 unit vial of urokinase
- Draw up the dissolved urokinase solutions from the vials and insert both into a 50ml syringe.
- Draw up 45mls 0.9% saline using the same 50ml syringe, to make up the volume to 50ml – the solution now contains 50,000units urokinase in 50mls
- Discard 10ml of the above solution, so that the remaining final solution is 40,000units urokinase in 40ml of 0.9% Saline.

Instillation of urokinase

- If the child is in pain that cannot be managed with oral paracetamol and NSAIDS, consider instillation of intrapleural bupivacaine (0.25%, 0.5 mL/kg) just before you administer the urokinase each 12 hours
- If you use bupivacaine, wait 5 minutes before instilling the urokinase

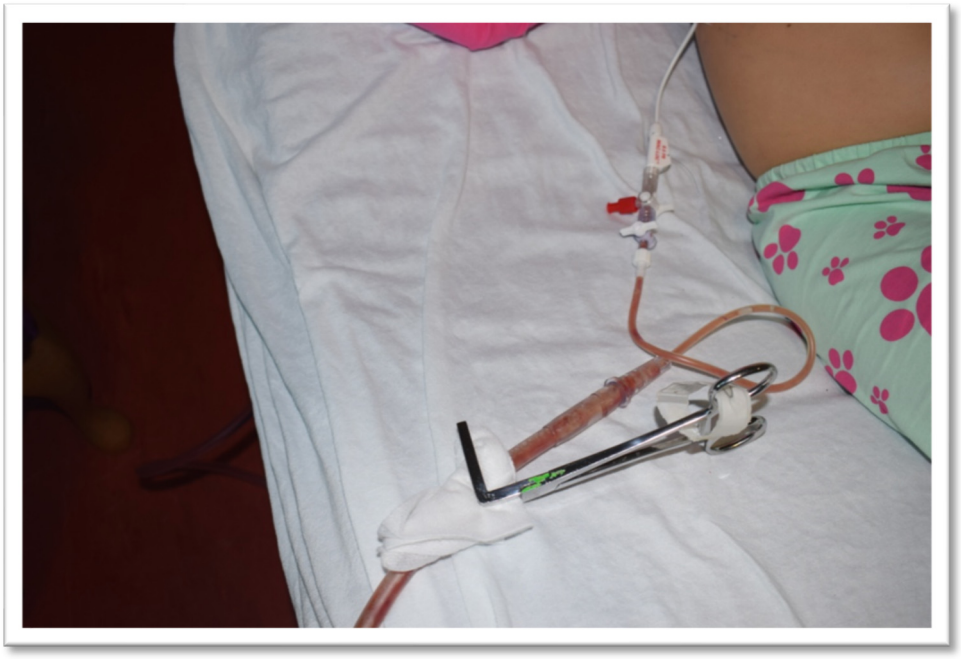
- Using aseptic technique, attach the urokinase syringe containing the prepared Urokinase solution to the 3-way tap attached to the chest drain.
- Close the 3-way tap off to the drain and open to the tube entering the pleural space, before instilling the solution into the pleural space.
- Clamp the chest drain after instillation is complete for 4 hours.
- Encourage mobilisation by disconnecting the drain from the wall. Children should be encourage to get out of bed and walk with their underwater drain still connected.
- A bubbling drain should NOT have Urokinase instilled and should NEVER be clamped
- After 4 hours, unclamp the drain and put the drain on suction at 20cmH_20 for the next 8 hours
- Repeat every 12 hours

Drain open and unclamped



Drain open to patient and closed to drain (for instillation of urokinase)

Appearance of a closed and clamped chest drain, following instillation of urokinase.



Trouble-shooting and complications

1. Drainage problems
   - The drain and all tubing should be below patients' chest level to allow drainage.
   - Check the drain has not been displaced by finding the flag and reviewing its position
   - Check that all tubing is tightly attached to the drain and luer locks are all tightly sealed.
   - Check that the 3-way tap is open.
   - Ensure that the tubing is unclamped
   - Check that there are no visible kinks preventing drainage.

2. Difficulties with instillation of Urokinase
   - Check the 3-way tap is correctly connected and open towards the patient and closed to the drain. This will allow insertion of Urokinase into the pleural space.
   - Flushing 5mls of normal saline into the pleural space may be beneficial before re-attempting administration of Urokinase.

3. Heavily blood staining/ bloody pleural fluid:
   - Do not instill urokinase. Discuss with respiratory consultant since urokinase may still be given if blood staining is mild.
   - Urokinase breaks down fibrinous septations but also has a role in keeping small bore pigtail catheters patient. If urokinase cannot be given, change to 5mls normal saline flushes twice a day into the pleural space, to ensure the drain remains open.

4. Bubbling drain (air leak):
   - A bubbling drain should never be clamped, as there is a risk of tension pneumothorax.
   - Check the drain for disconnection and displacement. If the drain has been pulled partially out, there may be entrainment into the drain from the drain insertion site.
   - Do NOT instill Urokinase

5. Leaking drain:
   - Ensure that that the tubing is correctly and tightly attached to the drain, and that all luer locks are tightly fastened
   - Check the drain for disconnection and displacement. If the drain has been pulled partially out, there may be leakage at the drain insertion site. This may mean the drain needs to be removed, since there is a possibility of air entrainment into the pleural space. Discuss with consultant.