Thames Valley & Wessex
PAEDIATRIC CRITICAL CARE
Operational Delivery Network

Paediatric Chest Drain Insertion for DGH use
Quick Reference Guide

The aim of this quick reference guide is to act as a tool for clinical staff at District General Hospitals in the event that a child or young person requires an **emergency chest drain**.
It does not replace or change current local care pathways for CYP but can be utilised in addition, if required. The guide consists of:

- **Insertion guidance**
- **Nursing care**
- **Nursing observation chart**

Indications for chest drain:

- Pneumothorax
- Haemothorax
- Pleural effusion
- Empyema
- Chylothorax

STOP & ASSESS

Is there a time-critical ABCDE problem?

Signs of a tension pneumothorax?

Place 2222 call immediately

Consider:

- Need for intubation & ventilation.
- Discussion with local ITU/anaesthetic team & SORT.
- Need for emergency needle thoracocentesis.

Further Information

Please find below links to useful resources:

PIER EPPIC Videos - chest drain

SORT Intubation checklist

SORT Care of Ventilated Child

PIER trouble shooting chest drains

SORT Empyema

SORT Pneumothorax (spontaneous)

For more detailed guidelines: Thames Valley – refer to OUH guidelines.
Wessex – refer to UHS guidelines.

Contacts

SORT
023 8077 5502

For patient referrals and transfer – contact early.

Oxford University Hospitals –
Urgent referrals contact switchboard: **0300 304 7777** for Paediatric Respiratory Consultant on-call.

University Hospitals Southampton –
Urgent referrals contact switchboard: **02380 777222** for Paediatric Respiratory Consultant on-call.

Educational queries:
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Pre-insertion considerations

The insertion of a chest drain will require a **Multidisciplinary Team Approach.**

- ☐ **Has CXR been done to confirm diagnosis?**
  (Ultrasound helpful but should not delay treatment).
- ☐ **Have you identified the most appropriate clinician to perform procedure?**
  (May vary between hospitals).
- ☐ **Have you got the appropriate equipment ready?**
  (see below).
- ☐ **Has sedation and airway support been considered?**
  (If the child is awake, discussion to be made between SORT and local paediatric and anaesthetic teams regarding need for local anaesthetic, procedural sedation or intubation).
- ☐ **Where will the patient be cared for during/post procedure?**

Consider intubation if:

Reduced conscious level

Worsening hypoxaemia
(SpO2 <92% with FiO2 >0.6)

Worsening hypercarbia and respiratory acidosis

Hypotension

Significant fluid resuscitation
(>40mls/kg)

Procedure will not be tolerated by child

Equipment Required

Needle thoracocentesis:

- ☐ Skin antiseptic cleaning solution
- ☐ 1% lidocaine for local anaesthetic
- ☐ Topical anaesthetic if appropriate (ametop or EMLA)
- ☐ Small and large syringes
- ☐ 3-way tap
- ☐ Waterproof dressing
- ☐ Large bore cannula (12, 14, 16G)

Chest drain insertion (including thoracocentesis items):

- ☐ Underwater sealed drain system
- ☐ 500ml sterile water
- ☐ Intercostal catheter (choose smaller size for air leak and larger size for fluid)
- ☐ Spigot connector and connecting tubing
- ☐ Suction (confirm it is working)
- ☐ Sterile gown, gloves and facemask
- ☐ Sterile drapes x2
- ☐ Scalpel blade
- ☐ Suture material
- ☐ Syringes and needles
- ☐ Instrument for blunt dissection/cut down set
- ☐ Chest drain/seldinger drain set

Preparation

- ☐ Correct a coagulopathy or platelet defect before chest drain insertion if possible.
  (Routine measurement of platelet count and clotting studies are only recommended in patients with risk factors)
- ☐ Operator with the most experience should undertake drain insertion.
- ☐ Operator will require an assistant.
- ☐ Written consent should be obtained if time permits.

Method of insertion

Seldinger technique or open procedure with blunt dissection/slit thoracostomy technique.

Choice of technique, and whether ultrasound guidance is used, will depend on operator experience and preference.
(Video guidance available via QR code/link to PIER)

EPPIC Videos - PAEDIATRIC INNOVATION, EDUCATION & RESEARCH NETWORK (piernetwork.org)

Chest Drain Size Guide

- ☐ Newborn: 8-12 Fr
- ☐ Infant: 12-16 Fr
- ☐ Child 12-24 Fr
- ☐ Adolescent: 12-32 Fr

Small bore drains should be used whenever possible to minimise patient discomfort.

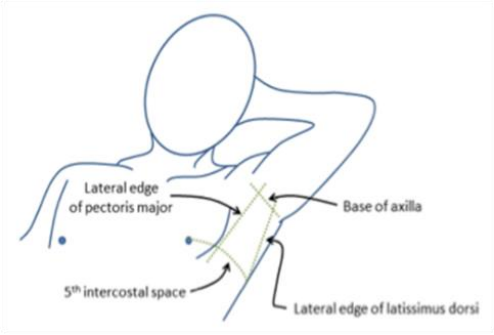
Safe Transfer Tips

- ☐ Ensure chest drain secured appropriately.
- ☐ Confirm underwater seal is working, secure below level of the patient.
- ☐ Heimlich/flutter valves can be considered with a drainage bag, but this may not provide effective drainage in neonates and small children.
- ☐ Consider 3-way tap to allow for aspiration/flushing en-route.
- ☐ Ensure suction avaiable.
- ☐ Carry emergency needle thoracostomy equipment during transport.

Insertion Guide

The chest drain is inserted using a sterile, non-touch technique.

- ☐ Place patient with arm away from site and abducted away and bent at elbow with palm below head to get better access.
- ☐ Insertion should generally be within the 'triangle of safety' defined as lying within the anterior border of latissimus dorsi, lateral border of pectoralis major, a line superior to the horizontal level of the nipple and an apex below the axilla unless being inserted with USS assistance.
- ☐ Once the site is identified the skin should be cleaned with 2% chlorhexidine, and a large surgical drape applied around the insertion site.



- ☐ Insertion should be just superior to a rib to avoid damage to intercostal vessels and nerves on inferior border of the rib.
- ☐ Use lidocaine 0.3ml/kg of 1% solution (total maximum dose) in all layers to be breached.
- ☐ Chest drains should be inserted using a Seldinger technique ensuring the wire is being always controlled and dilators should not pass more than 1cm into the pleural space
- ☐ Drains should usually be positioned inferiorly for empyema. All drain holes must lie in the pleural space to avoid surgical emphysema.
- ☐ Drains should be secured by suturing to skin or to specific adherent dressing with criss-crossing up the drain to ensure it is secure.
- ☐ Mark on the chest drain the point level with the skin so any movement can be easily seen *(with steri-strip or similar).*
- ☐ Drains should be secured with an appropriate transparent dressing – eg. IV3000. Ensure chest drain is secure for transfer.

Post procedure

- ☐ All chest drains should be attached to a unidirectional flow drainage system, such as underwater seal.
- ☐ Attach three-way tap between chest drain and underwater seal bottle, can be utilised for clamping if required.
- ☐ Serial observations (as detailed in nursing care) to monitor haemodynamic stability.
- ☐ Check drain is bubbling/swinging.
- ☐ Obtain a chest X-ray to assess chest drain position and its effect on lung inflation.
- ☐ Ensure adequate and regular pain relief is prescribed and given.

Underwater Seal Bottle

- ☐ Allows air/fluid to be removed and prevents backflow into the pleural space.
- ☐ Must **ALWAYS** be kept securely positioned, upright and floor level or below the level of patient's chest
- ☐ Tubing should be free, positioned in flat loops on the bed, not hanging.
- ☐ ANTT should be utilised when setting up.
- ☐ Video of how to set up the underwater seal can be found here.

(Note: equipment may vary between trusts).

Drain Output

Chest drains for effusions/empyema are usually left on free drainage initially.

- ☐ Monitor output in first hour closely, it should not exceed 10mls/kg of fluid. If output exceeds this, consider clamping using **3-way tap.**
- ☐ If clinically stable after 1 hour, can reopen 3-way tap.

Suction should be discussed with SORT/tertiary teams for advice on a patient-to-patient basis.

General guidance:

- ☐ Attach low flow wall suction to underwater seal bottle.
- ☐ Pressure of -5 to -10 cm H2O.
- ☐ Ensure suction port is opened on underwater seal bottle.
- ☐ Check suction system prior to connection and ensure suction chamber filled to the appropriate level with sterile water.
- ☐ Suction should not be used in penetrating injuries as air might be entrained.

Nursing Care

Children and young people must be observed closely after the insertion of a chest drain.

PIER chest drain trouble shooting video is available here.

Recommended bedside equipment

- □ Access to emergency equipment.
- □ Two chest drain clamps (with child at all times).
- □ Gauze
- □ Sterile water.
- □ Tape to secure tubing to patient's side
  (never secure to clothing as risk of pulling on chest drain).
- □ Low & high-pressure wall suction.
- □ Fluid balance/chest drain chart.
- □ Sterile dressings.

Observation Frequencies

First hour after insertion	Continuous monitoring for initial 15 minutes followed by 15 minutely complete set observations. ***(Note – continuous oxygen saturation monitoring is essential throughout).***
Hourly	Complete set observations. Chest drain unit: - Is it upright, floor level or below level of child's chest? - Securely positioned? - Check fluid in underwater seal, - Check suction water level. - Tubing free and unkinked? Document drain output. Document whether bubbling or swinging present. Any change in clinical condition, seek help and inform medical team.
4 hourly	Temperature (more frequent if child pyrexial).
12 hourly	Check drain site: - Is suture visible? Note position of suture. - Is dressing clean and dry? If not, change using ANTT. - Note any signs of erythema, bleeding or surgical emphysema.

Fall in blood pressure and/or rising heart rate may indicate cardiac tamponade or recurring pneumothorax. Inform senior immediately. **Consider 2222 call.**

Trouble Shooting – turn suction off and assess.

Swinging *Fluid in the chest drain tube should rise with inspiration and fall with expiration due to changes in thoracic pressure.*	No swinging? ***(To assess, suction must be turned off).*** ▪ Is the chest drain still in situ? Check site. ▪ May indicate blockage. ▪ Tubing kinked or disconnected? ▪ Resolution of collection/pneumothorax?	
Bubbling *Bubbles coming from the draining tube into the drainage bottle is normal in a pneumothorax, abnormal in empyema.*	Pneumothorax – not bubbling? ▪ May indicate blockage. ▪ Has pneumothorax resolved? (Bubbling will be continuous when suction is on and on expiration when off).	Empyema – bubbling? ▪ Is there an air leak? ▪ Check connections sealed. ▪ Check drain site – still in situ?
Clamping *Clamping should only occur in the following circumstances. Document reasoning.* ***Clamping can be achieved by turning the three-way tap off. If physical clamping needs to occur, use gauze with clamps to prevent damage to drain.***	▪ Changing the chest drain unit. ▪ If chest drain catheter and chest drain unit become disconnected. ▪ When locating an air leak. ▪ After urokinase instillation (4 hours). ▪ If >10ml/kg fluid is drained within first hour of insertion – inform doctor. ▪ If known pneumothorax DO NOT clamp chest drain (risk of creating a tension pneumothorax). **IF PATIENT DETERIORATES REMOVE CLAMPS IMMEDIATELY.**	

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Chest Drain Observation Chart

Patient Name: *(Attach sticker if available)*	Position of drain:
Hospital Number:	Inserted on: *(dd/mm/yyyy)*
Date of Birth:	Today's Date: *(dd/mm/yyyy)*

Time	Bubbling	Swinging	Suction if applicable	Correct suction water level	Chest drain unit and connections intact	Site checked	Hourly drainage	Total drainage	Initials
07:00	*(y/n)*	*(y/n)*	*cmH_2O*	*(y/n)*	*(y/n)*	*(y/n)*	*millilitres*	*millilitres*	
08:00									
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