

## Yorkshire and Humber Neonatal ODN

**Title: Identification and management of Pneumothorax Guideline**

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The review date for this guideline has been extended to a 5 year review (**June 2025**) as agreed by the Y&H Neonatal Executive Group at the Executive Meeting held 30 March 23

**This clinical guideline has been developed to ensure appropriate evidence based standards of care throughout the Yorkshire and Humber Neonatal ODN. The appropriate use and interpretation of this guideline in providing clinical care remains the responsibility of the individual clinician. If there is any doubt, discuss with a senior colleague.**

**Please use this guideline in conjunction with the Pneumothorax Teaching Tool.**

### DEFINITION

**Pneumothorax** is a collection of air or gas in the chest or pleural space that causes part or all of a lung to collapse.

In the newborn it most commonly occurs as a birth injury or as a result of positive pressure ventilation (by mask, CPAP, high flow therapy or endotracheal ventilation). It is more common in preterm infants, meconium aspiration syndrome and pulmonary hypoplasia.

A tension pneumothorax occurs when air continues to accumulate in the pleural space with no escape. Intra-thoracic pressure increases leading to increased central venous pressure and a decrease in venous return. The resulting decreased cardiac output may lead to bradycardia, hypotension and hypoxaemia and death.

### CLINICAL FEATURES

Pneumothorax may be asymptomatic. Symptoms may appear acutely.

Clinical features include

- Respiratory distress (grunting, recession etc)
- Increasing oxygen requirement
- Cyanosis
- Pallor and hypotension (shock) may be present in a tension pneumothorax

Clinical findings

- Asymmetric chest movement
- Decreased breath sounds on the affected side
- Shift of the apex beat away from the affected side

## DIAGNOSIS

Pneumothorax should be suspected in any new-born with the sudden onset of respiratory distress. The level of suspicion should be high in a mechanically ventilated infant with an unexplained deterioration in oxygenation, ventilation, or cardiovascular status.

**Transillumination** — with a high-intensity fibre optic probe (“cold light”) in a darkened room will light up the affected side when placed against the chest wall.

*In a life-threatening situation, the air can be immediately evacuated (needle thoracocentesis, see below).*

If the infant is stable or findings are equivocal, the diagnosis should be confirmed by chest x-ray before an intervention is made.

### **Chest x-ray —**

- air in the pleural space outlining the visceral pleura
- flattening of the diaphragm on the affected side,
- mediastinal shift away from the affected side.
- the affected side may appear hyperlucent (air accumulates anteriorly when the infant is supine).

Smaller pneumothoraces may be more difficult to appreciate and may be improved by a lateral decubitus x-ray, with the affected side up.

## MANAGEMENT

### **Small, asymptomatic pneumothorax:**

If a baby has no signs of respiratory distress and is stable consider a period of close observation, with supplemental oxygen to maintain saturations. The air leak should resolve spontaneously within 1-2 days. There is no evidence to support the use of high inhaled oxygen concentrations to hasten resolution of spontaneous pneumothorax<sup>1,2</sup>.

If a pneumothorax is diagnosed in a ventilated baby, efforts to reduce mean airway pressure should be made.

### **Symptomatic pneumothorax.**

Needle aspiration (thoracocentesis) may be required in an emergency situation. For procedure see below.

### **Tension pneumothorax and pneumothorax in a ventilated patient**

These will need a formal chest drain. For procedure see below. The gold standard is to connect an underwater seal to the chest drain which is usually placed under suction at 5-15 cm H<sub>2</sub>O, or can be connected to a flutter valve. Chest x-ray should be used to confirm position of the drain. Full resolution should occur in 2-3 days although the air leak may recur.

## PROCEDURES

### Emergency thoracocentesis

**Should only be used if the situation is life-threatening and tension pneumothorax is suspected.**

1. Identify site of drainage - 2nd anterior intercostal space in the mid-clavicular line.
2. Strict aseptic non-touch technique should be used.
3. Clean skin according to local guideline.
4. Insert 21G butterfly (a cannula may be used instead)
  - a. perpendicular to skin,
  - b. just above third rib (to avoid neurovascular bundle)
5. Other end of plastic tubing should be placed underwater (a small bottle of sterile water can be used).
6. Observe for bubbling.
7. Syringe aspiration of the pneumothorax through the butterfly is not usually recommended. The aim of thoracocentesis is to relieve pressure, not fully drain the air leak. Full drainage may make chest drain insertion more difficult and the butterfly needle may damage the underlying lung.
8. The butterfly should be removed before chest drain insertion.

**Note:** if an emergency thoracocentesis is attempted and the patient does not have a tension pneumothorax there is a 10-20% risk of causing pneumothorax. Patients that have had this procedure should have a chest x-ray.

### Chest drain insertion

A pig-tail chest drain is the drainage tube of choice. It is inserted using a Seldinger technique. Recommended insertion site is above 5<sup>th</sup> rib, in 4-5<sup>th</sup> intercostal space, anterior axillary line. See pictorial guide: **Appendix A**.

**Pain relief** should be used for this procedure. If the patient is ventilated give a dose of fentanyl 3 micrograms/kg prior to the procedure (Morphine as an alternative). If the patient is not ventilated, then a reduced dose of fentanyl 1 micrograms/kg should be considered. Local infiltration with 1% lignocaine up to 0.3ml/kg should be used in all babies (5)

### **Attaching to and management of an underwater seal drainage system or flutter valve.**

An underwater seal is considered the Gold Standard, but the priority is that the system is used correctly so units should decide based on their own staff confidence/competence with each system. See pictorial guide: **Appendix A**.

### **Connecting an underwater seal chest drain to suction:**

The decision to connect to suction is a medical one, If suction is required, it is usually set between 5-15cmH<sub>2</sub>O/0.5-1.5 kPa. See pictorial guide: **Appendix A**.

**Emergency equipment:** At the bedside you will need the following:

- 2 chest drain clamps non toothed (or artery forceps)
- A pack of sterile gauze
- A Tegaderm dressing

**Please Note:** The tubing should only be clamped when changing the drainage bottle or if the tubing becomes disconnected, requires the inclusion of a Y connector, or on specific medical instruction.

## Removing the drain

- Leave drain in situ for 24 hours after bubbling has stopped
- The drain may be clamped for a period (4-6 hours) before removal. Drains can be clamped by turning the 3-way tap off (ideally to the patient and ensuring the 3<sup>rd</sup> port has a cap/bung attached) or with artery forceps if a 3-way tap is not included in the drainage system.

If, however, the transparent drain tubing contains static fluid it is effectively clamped and additional measures may not be needed. If the baby is asymptomatic the drain may be removed without imaging, although some units may choose to x-ray before removal. If there is no re-accumulation, then proceed to removal.

- Gather equipment:
  - sterile pack
  - sterile gloves
  - steristrips,
  - tegaderm
- Clean the area, gently removing the tegaderm.
- Remove the drain, immediately occluding the incision site (consider sending tip for culture).
- Close incision site with steristrips, applying tegaderm over this.
- Consider re-x-ray after 2 hours unless clinical deterioration before.

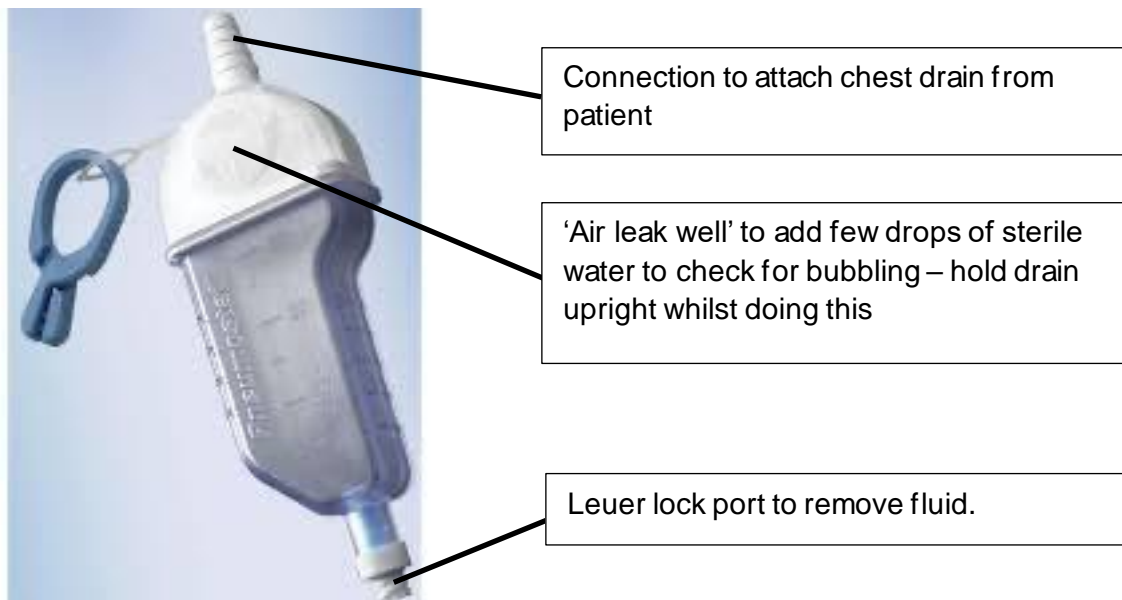
## Patients transferred with chest drains

Embrace use an Atrium Pneumostat drainage system for neonates requiring transfer. This includes a dry-seal valve to prevent air/fluid returning to the patient regardless of drain position during transfer.

To check for bubbling the drain should be held vertically and a few drops of sterile water added to the semi-circular 'air leak well' on the front of the device.

Fluid can be removed using the leuer lock sampling port at the base of the pneumostat.

**We recommend that these are changed to your local drainage device as soon as possible on arrival of the patient into your unit.**



## References

1. Fernandes CJ. Pulmonary Leak in the Newborn. UpToDate accessed 26th July 2016.
2. Clark SD, Saker F et al. Administration of 100% oxygen does not hasten the resolution of symptomatic spontaneous pneumothoraces in neonates. *J Perinatol.* 2014 Jul;34(7):528-31
3. Shaireen H, Rabi Y et al. Impact of oxygen concentration on time to resolution of spontaneous pneumothorax in term infants: a population based study. *BMC Pediatr.* Aug 2014;14:208
4. Advanced resuscitation of the newborn infant, 1<sup>st</sup> edition. Resuscitation Council UK.
5. Jessop Wing, Neonatal Acute procedural Pain Guideline (2021)

With thanks to neonatal units across the Y&H ODN for submitting their own guidelines and Dr Liz Pilling and Dr Sharon English, for their original pictorial guides and to Leeds Teaching Hospitals for sharing the procedural checklist.

### **Appendix A** - Pictorial guide to chest drain insertion

*Available on Yorkshire & Humber Neonatal ODN Guideline & Education Resources Page*

**Appendix B** - Example procedural checklist for chest drain insertion with thanks to Leeds Teaching Hospitals (*see next page*).

# Invasive Procedure Checklist

Patient's Name..... Patient's Address..... Date of Birth..... Hospital No..... Consultant.....Ward.....	Date of Procedure: ..... Clinical Area: .....
<b>Neonatal Procedure: Chest drain insertion</b>	
<b>SIGN IN (read aloud)</b> Nursing staff & medical/specialist should be present	
<b>Before procedure</b>	
Has the patient's parent or carer been informed of the procedure and given consent? <input type="checkbox"/> YES <input type="checkbox"/> N/A <i>(Retrospective in emergencies)</i>	
Is the patient wearing correct ID bands? <input type="checkbox"/> YES	
Are the consultant & nurse in charge aware? <input type="checkbox"/> YES	
Has the insertion site been identified and confirmed (trans-illumination or X-ray)? <input type="checkbox"/> YES What is the indication for the procedure? ..... <input type="checkbox"/> YES <input type="checkbox"/> N/A	
Has all equipment been gathered [for completing the Seidinger technique]? <input type="checkbox"/> YES <i>(list on reverse)</i>	
Name: ..... Signature: ..... Designation: ..... Date & Time: .....	
<b>SIGN OUT (read aloud)</b> <b>After procedure before team leaves</b>	
Confirm:	
<input type="checkbox"/> drain secured with Tegaderm <input type="checkbox"/> guide-wire removed	
<input type="checkbox"/> X-ray ordered to confirm position	
Has the procedure been documented, including amount of local anaesthetic used? <input type="checkbox"/> YES	
Did the patient tolerate the procedure?	
<input type="checkbox"/> YES <input type="checkbox"/> NO <i>(record details in patient notes)</i>	
Were any equipment problems identified and have these been reported? <input type="checkbox"/> YES <input type="checkbox"/> N/A	
Have the nurse and parents or carers been updated?	
<input type="checkbox"/> YES	
Follow-up plan recorded in patient notes?	
<input type="checkbox"/> YES <input type="checkbox"/> N/A	
Name: ..... Signature: ..... Designation: ..... Date & Time: .....	
<b>TIME OUT (read aloud)</b> <b>Before procedure begins</b>	
Are all members of the team present? <input type="checkbox"/> YES	
Does everyone know each other's name & role? <input type="checkbox"/> YES	
Confirm:	
<input type="checkbox"/> Patient's name <input type="checkbox"/> Allergy status <input type="checkbox"/> Planned procedure	
Is the patient positioned appropriately (insertion side up) and have comfort and warmth been optimised? <input type="checkbox"/> YES	
Has the sterility of instruments been confirmed and aseptic technique followed? <input type="checkbox"/> YES	
Local anaesthetic prescribed and prepared? <input type="checkbox"/> YES	
Sedation prescribed and prepared? <input type="checkbox"/> YES <input type="checkbox"/> N/A	
Is suitable patient monitoring in place (ECG & SaO <sub>2</sub> ) and pre-procedure observations completed? <input type="checkbox"/> YES	
Have pain relief measures been implemented (non-nutritive sucking, comfort holding, sucrose/EBM etc.)? <input type="checkbox"/> YES	
Name: ..... Signature: ..... Designation: ..... Date & Time: .....	

