

# Pneumothorax – NICU - Full Paediatric Clinical Guideline – Joint Derby and Burton

Reference no.: NIC RC 07/June 20/V005

## 1. Introduction

To ensure early diagnosis and management of pneumothorax in Neonates

## 2. Aim and Purpose

For medical and nursing staff to prevent delay in diagnosis and ensure correct management of pneumothorax

## 3. Main body of Guidelines

1% of all newborn babies have evidence of air leak on CXR but only 10% of these have symptoms. However, pneumothorax is common in sick infants and should be considered in:-

- Babies with respiratory distress
- Acute deterioration in a baby receiving positive pressure respiratory support
- Failure to respond to normal resuscitation measures

### **At Risk Groups**

- Assisted ventilation – CPAP or IPPV particularly if the mean airway pressure is >12
- Breathing out of phase or poor synchronicity with the ventilator
- Underlying lung disease – RDS, congenital malformations and particularly meconium aspiration (all these conditions lead to alveolar overdistention and air trapping often made worse by IPPV)

### **Presentation**

Spontaneously Breathing

- Depending on the size of the pneumothorax; symptoms range from asymptomatic to mild/moderate respiratory distress with grunting, tachypnoea, recession and cyanosis

Assisted Ventilation Often as an emergency:

- An acute collapse on the ventilator with one or more of the following - sudden increase in oxygen requirement, pallor, shock or decrease in HR and BP
- Deterioration in blood gas (obtaining an arterial blood gas is best practice), with respiratory acidosis, hypoxia and hypercarbia.

Clinical findings are often difficult to elicit but may include: –

- asymmetrical chest movements,
- decreased air entry on the affected side and shift of the mediastinum if a tension pneumothorax develops

### **Diagnosis**

Transillumination using a fiberoptic light should be used when a pneumothorax is suspected. To do this turn the room lights down and place the light at right angles to the chest comparing the right and left sides. A pneumothorax will show up as an area of increased transillumination; this is most useful in preterm thin babies. Transillumination will often be negative in more mature babies. Care must be taken in interpretation in preterm babies with Pulmonary Interstitial Emphysema (PIE) as this will give a false positive result.

If transillumination is not diagnostic and if the baby is not compromised a CXR should be requested. If you suspect a pneumothorax from clinical examination and transillumination findings and the baby is acutely compromised go straight to emergency treatment. Do not delay to confirm with a CXR

### **Treatment**

- Asymptomatic – no treatment, careful observation for signs of respiratory distress.
- Do not use CPAP/ HFO in any baby who has a suspected or confirmed pneumothorax.
- Term infants with mild symptoms; try increasing the inspired oxygen content to favour re-absorption of

extra-alveolar gas. Maintain close observation of this neonate.

- Pneumothorax should be drained in any baby with a tension pneumothorax, significant respiratory distress, most symptomatic preterm babies or those receiving IPPV using aseptic **Seldinger Technique**.

### ***Practical Procedures For Drainage Of Pneumothorax - Needle Aspiration and Chest Drain Insertion and removal***

In babies showing severe respiratory compromise emergency drainage of the pneumothorax should be carried out using needle aspiration. To do this:-

- Ensure parents are kept informed about what is happening.
- Nurse baby in an incubator with continuous cardiac and respiratory monitoring.
- Make sure you have resuscitation equipment, oxygen and suction available.  
**Needle Aspiration Equipment**  
Required before insertion of chest drain in severe desaturation. 21  
Butterfly needle.  
3 way tap or bottle of sterile water  
10ml syringe  
Mediswab/Steriswab
- Clean the site with an alcohol swab
- Ensure the end of the butterfly is placed into a sterile gallipot filled with sterile water. (Alternatively use a 10ml syringe with a 3 way tap attached to the butterfly to draw off the free air from the pleural space)
- Insert the needle at a right angle to the chest wall, through the skin into the second intercostal space in the mid-clavicular line or the fourth/fifth space in the anterior axillary line, well clear of the nipple
- If using a syringe, draw back on the syringe whilst inserting the needle. Stop inserting once you begin to extract air. The needle probably will have gone in only about 0.5 cm. If you insert the needle any further there is a risk of puncturing the lung
- If using a gallipot with water, as the pneumothorax drains you will see bubbles of air in the water. Care must be taken not to remove too much air as this will tear the expanding lung.
- Following needle aspiration a chest drain should usually be inserted to allow full drainage and expansion of the lung except in exceptional circumstances.

### **Chest Drain Insertion**

This is performed using an **aseptic Seldinger technique**. This is much less painful for the baby as compared to the previously used blunt dissection method. Many babies will already be on IV Morphine infusion and this may provide adequate analgesia. However an IV bolus of morphine 50-100mcg/kg should be considered prior to chest drain insertion. Local anaesthetic (1% Lignocaine up to 0.3ml/kg) should be infiltrated subcutaneously at insertion site.

### **Insertion of Chest Drain Equipment**

Cut down pack / fine stitch set	<u>Mediswab</u>
Gown and sterile gloves	Sterile towels
Pigtail chest drain Pack size 8.5F or 6F	<u>Tegaderm</u>
1 x under water drainage set or Heimlich flutter valve	<u>Steristrips</u>
<u>Chlorhexidine</u> sachets	Sleek
10ml syringe	1% lignocaine solution
3 way tap	1ml syringe
Blue and Orange needles	Sterile water
Green connections	Needle Artery forceps



- Lay the baby on its side with the side requiring the chest drain uppermost. Stretch the arm out and raise above the head
- The preferred site is the fourth/fifth intercostal space in the anterior axillary line
- Using an aseptic technique clean area with pink Chlorhexidine. Ensure a sterile field
- Infiltrate area with Lignocaine, raising a small pea sized bubble under the skin
- Attach 10ml syringe to introducer (pink) needle from chest drain pack. Slowly insert the needle through the chest wall while aspirating with attached syringe. Stop and hold position as soon as air or fluid can be aspirated. Remove the syringe leaving pink needle in-situ occluding end with finger.
- Insert guide-wire in through pink needle with the help of the white plastic introducer until the coloured line on the wire is level with the hub. Remove plastic sleeve and then take out the pink needle over the guide wire leaving the guide wire in-situ.
- Pass dilator over guide wire and advance through the chest wall & then remove
- Thread pigtail drain over the guide-wire and through the chest wall ensuring all the small drainage holes at the end are within the chest. Advance the catheter to the 2<sup>nd</sup>-3<sup>rd</sup> mark (1-2cm) in preterm and to the 3<sup>rd</sup>-4<sup>th</sup> mark (2-3cm) in term/larger babies
- Once pigtail drain is inserted remove the guide-wire and connect to underwater drainage bottle and observe for bubbling OR Heimlich Flutter Valve and observe for fluttering.
- Assemble the chest drain circuit and connect to drainage bottle with under water seal. Ensure the drain is secured by steristrips and tegaderm over the top to secure drain (no suturing required)
- Attach drainage bottle to the incubator securely with fastenings supplied. The bottle must always be lower than the insertion site.
- Ensure tubing from baby is secure and there is no traction on the tubing. Ensure baby is comfortable following procedure is given prescribed analgesia and its effectiveness is monitored.
- Take a CXR post insertion to check the position.
- Underwater sealed drainage is inappropriate during transport so the use of a Heimlich Flutter Valve is used to drain air from the chest. This valve will allow air to escape from the chest but will not allow air to return through the system, i.e passage of air is one-way only, and is available from the transport team on request.
- Nursing staff to observe bubbling and swinging activity in the chest drain bottle and tubing hourly or fluttering of the Heimlich valve and record on observation chart.
- Ensure tubing in this drainage bottle is well below the fluid level at all times. Record the amount of fluid in the drainage bottle initially and monitor the amount of fluid draining (if any) hourly and record on observation chart and change the bottle only if the bottle becomes full or contaminated.
- Once the chest drain has stopped bubbling/Heimlich valve stops fluttering (usually at least 24 hours following insertion) it should be closed off and a CXR taken to ensure re-expansion of the lung. If the lung remains expanded and there is no deterioration once the drain is closed (this is normally assessed over a period of 12 - 24 hours, longer in ventilated babies) remove the chest drain.
- Clamp tubing x 2 using artery forceps (put gauze around tubing, or use flat forceps to avoid damage to the tubing). Clamp as near to chest wall as possible (Artery forceps should be available at all times).

### **Chest Drain Removal**

Removal should be done aseptically by the medical team.

#### **Equipment**

Sterile gloves and apron  
Fine stitch set Steristrips  
Occlusive dressing

- Ensure adequate pain relief and that the baby is kept warm and comfortable during the procedure.
- Under aseptic conditions clean the site using chlorhexidine solution, and using a non-touch aseptic technique remove the dressing and cut the suture (if present).
- Remove the drain carefully, usually during the end of the respiratory phase, trying to keep the two skin edges of the entry site together. Care should be taken that air is not sucked into the chest after catheter removal.
- The wound is preferably secured with steristrips, but it may need to be sutured. Seal the area with occlusion dressing/ tegaderm over the top of the steristrips/ sutures.
- Send the drain tip for culture and sensitivity where medically indicated.
- Make the baby comfortable and leave to rest. Baby should be observed and assessed for any deterioration in condition following removal and may require a chest Xray
- If two pneumothoraces are present, remove only one drain at a time. The second drain can be examined 24 hours after the first.
- Give parents/ care providers a full update on the procedure and the baby's condition.

#### **Complications**

- Bruising of diaphragm/mediastinal structure
- Perforation of the lung (reported especially in neonates with stiff lungs secondary to RDS)
- Haemorrhage
- Cardiac tamponade
- Phrenic nerve injury
- Infection
- Persistence of pneumothorax if drain not properly positioned or if air leak is too great to be drained from one tube
- In the event that the operator considers that the heart or liver (or other organ) may have been perforated by the drain the 3 way tap should be immediately turned 'off to the baby' and the drain left in situ and inform consultant. IT IS VITAL THAT THE DRAIN IS NOT REMOVED AT THIS POINT

#### **References (including any links to NICE Guidance etc.)**

- Nottingham Neonatal Service Guidelines
- Kingsmill Neonatal Guidelines for Pneumothorax December 2005
- Sherwood Forest Hospitals NHS Trust Care Management system, Neonatal Nursing. June 2004
- North Devon District Hospital guideline for Chest Drain Insertion for Pneumothorax for Neonates (Guidelines) 2016
- Neonatal Intensive Care Unit Clinical Guideline- Pneumothorax: Ashford and St. Peter's Hospital NHS foundation trust 2011
- Wei, Yi-Hsuan et al. Pigtail Catheters Versus Traditional Chest Tubes for pneumothoraces in premature infants treated in a Neonatal Intensive Care Unit. Pediatrics & Neonatology , Vol 55, Issue 5,376-380
- LA Cates. Pigtail catheters used in the treatment of Pneumothoraces in the Neonate. Advances in Neonatal Care Vol.9, N0.1. PG 7-16

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