Pneumothorax Management

Sites where Clinical Guideline applies: All Newborn Service sites in HNELHD

This Clinical Guideline applies to:

1. Adults
   - No
2. Children up to 16 years
   - No
3. Neonates – less than 29 days
   - Yes

Target audience: Clinicians in NICU, SCU and Newborn sites in HNELHD

Description: Provides guidance for clinicians in the care of emergency procedures for pneumothoraces, placement of intercostal catheters and management of infants with a pneumothorax

Keywords: Neonate, Newborn, pneumothorax, air leak, chest drain, emergency aspiration, ICC, catheter, RDS, respiratory distress, JHCH, NICU, SCU.

Document registration number: HNELHD CG 19_43

Replaces existing document?: Yes

Registration number and dates of superseded documents: Pneumothorax in NICU, JHCH_NICU_12.01

Related Legislation, Australian Standard, NSW Ministry of Health Policy Directive or Guideline, National Safety and Quality Health Service Standard (NSQHSS) and/or other, HNE Health Document, Professional Guideline, Code of Practice or Ethics:

- NSW Health Policy PD 2005_406 Consent to Medical Treatment – Patient Information
- HNELHD Policy Compliance Procedure PD 2017_032:PCP2 Clinical Procedure Safety (Levels 1, 2 and 3)

Position responsible for Clinical Guideline Governance and authorised by: Dr Paul Craven, Executive Director, Children, Young People and Families Services

Clinical Guideline contact officer: Jo Davis, CNC, Newborn Services, NICU JHCH

Contact details: Jo.davis1@health.nsw.gov.au

Date authorised: 26 November 2019

This document contains advice on therapeutics: Yes

Approval gained from HNE Quality Use of Medicines Committee on 10 September 2019

Issue date: 6 December 2019

Review date: 6 December 2022
PURPOSE AND RISK

This document has been developed to provide guidance to clinical staff in Maternity and Newborn Services in HNELHD in the recognition, investigation and management of pneumothorax in the neonate.

The risks are:
- Missed diagnosis of pneumothorax
- Respiratory compromise
- Neurovascular and skin damage

The risks are minimised by:
- Clinicians having knowledge of signs and symptoms of a pneumothorax
- Clinicians seeking assistance if the therapy is outside their scope of practice
- Following the instructions set out in the clinical procedure

The Hunter New England Local Health District operates within a tiered network of maternity and newborn services which helps to ensure that women and their babies have the appropriate access to higher levels of maternity and newborn care when risk factors are identified beyond the designated role delineation of the local service. Clinicians should make the decision as to the most appropriate facility for care based on the baby’s individual needs.

Any unplanned event resulting in, or with the potential for injury, damage or other loss to infants/staff/family as a result of this procedure must be reported through the Incident Information management system and managed in accordance with the Ministry of Health Policy Directive: Incident management PD2019_034. This would include unintended injury that results in disability, death or prolonged hospital stay.

Risk Category: Clinical Care & Patient Safety

CLINICAL PROCEDURE SAFETY LEVEL

Every clinician involved in the procedure is responsible for ensuring the processes for clinical procedure safety are followed. The following level applies to this procedure (click on the link for more information):

Level 2 procedure

Staff Preparation

It is mandatory for staff to follow relevant: “Five moments of hand hygiene”, infection control, moving safely/safe manual handling, documentation practices and to use HAIDET for patient/carer communication: Hand hygiene Acknowledge, Introduce, Duration, Explanation, Thank you or closing comment.

OUTCOMES

1. Air will be evacuated from the pleural space and negative pressure will be restored to enable the lung to re-expand.
2. Pain relief will be provided to ensure the infant recovers as quickly as possible with minimal discomfort.
3. The “5 moments of hand hygiene” will be observed to minimise contamination.
4. Insertion of a chest drain will be under surgical asepsis.
The infant will maintain heart rate, oxygen saturation and respiratory rate within normal limits.

Parents will be informed, consented, educated and supported throughout procedures.

Infant’s respiratory compromise will be supported appropriately.

CONTENT

Air leaks
Clinical presentation
Diagnosis
Consent
Emergency aspiration procedure
ICC placement & management
Chest drain set-up
Chest drain insertion procedure
Connecting to ICC drain
ICC setup for retrievals & transport
Ongoing Monitoring of ICC
Complications of chest drains
Chest drain removal
Appendices

GUIDELINE

While not requiring mandatory compliance, staff must have sound reasons for not implementing standards or practices set out within guidelines issued by HNE Health, or for measuring consistent variance in practice.

Introduction

A pneumothorax is an accumulation of gas in the pleural cavity that is usually associated with deterioration in the infant’s condition. This is a potentially life threatening emergency. Rapid recognition and effective management of the infant suffering a pneumothorax may significantly reduce mortality and morbidity rates. The long-term sequelae of hypoxia and ischaemia may be reduced with appropriate treatment. A pneumothorax can be an isolated finding in an infant with respiratory distress or may be associated with other forms of lung disease e.g. respiratory distress syndrome (RDS), lung hypoplasia or meconium aspiration syndrome. Pneumothorax is also a risk factor for those infants requiring CPAP, high PEEP or mechanical ventilation.

Air Leaks

Pulmonary air leak occurs more frequently in the newborn period than at any other time of life. It occurs when air escapes from the lung into extra-alveolar spaces where it is not normally present.

Air leak begins with the rupture of an over-distended alveolus. Over-distention may be due to generalised air trapping or uneven distribution of gas. The air dissects along the perivascular connective tissue sheath toward the hilum, resulting in a pneumomediastinum or into the pleural space, producing a pneumothorax. Less commonly, air may dissect into the pericardial space, subcutaneous tissue or peritoneal space, causing pneumopericardium, subcutaneous emphysema and pneumoperitoneum respectively.
Clinical Presentation

The infant may display one or more of the following:

- Sudden or unexplained deterioration with desaturation
- Sudden or unexplained increase in oxygen requirement
- Increase in respiratory distress/WOB
- Diminished or asymmetrical chest movements
- Unequal or decreased air entry
- Unexplained increase in heart rate (from baseline)
- Circulatory compromise e.g. drop in blood pressure, bradycardia
- Displaced apex/heart beat
- Blood gas may demonstrate hypoxia, respiratory and/or metabolic acidosis
- Occasionally some infants do not have a sudden deterioration and may only be picked up on X-ray

Confirmation of Pneumothorax

Cold light trans-illumination can demonstrate accumulated air, often more effective for diagnosis in small preterm infants (see Figure 1). These signs are, however, unreliable in:

- Infants with increased thickness of the chest wall, for example, term infants and infants with chest wall oedema.
- Infants with pulmonary interstitial emphysema, who may show a 'false positive' result.
- A CXR will confirm diagnosis and/or effectiveness of treatment (see Figure 2) but can take time to perform.

**TENSION PNEUMOTHORAX IS AN EMERGENCY AND IS POTENTIALLY LIFE THREATENING**

*If a tension pneumothorax is suspected clinically, immediate aspiration should not be delayed to obtain an X-ray*

Lung ultrasound has gained much attention around the world as a new method of diagnosis of pneumothorax, the technique is quick, safe and simple. Being a new practice to neonatal care, this is currently not a primary pathway to diagnosis and more experience with this as a diagnostic pathway is required.
Following clinical presentation and confirmation by cold light source and/or CXR, steps are taken to evacuate the air and re-expand the lung. Depending upon infant’s condition, there are two ways of achieving this:

1. Emergency needle aspiration, and/or,
2. Insertion of an intercostal catheter.

Consent

Insertion of a pleural drain is a Level 2 procedure.

Written consent must be obtained prior to the procedure, and should be completed on the Level 2 procedure checklist (see Appendix 2) and filed into the baby’s medical record.

Consent exemption may apply in the event of a tension pneumothorax. A tension pneumothorax is life threatening and management is a time critical procedure, therefore there may not be sufficient time to conduct a comprehensive pre-procedural safety check. In clinical emergencies such as this, whenever possible, the clinical team should address the following minimum elements of pre-procedure safety including:

- Patient identification.
- Identify the proposed procedure.
- Identify the site of procedure.

Document this process accordingly on the Level 2 procedure checklist following completion of the procedure and stabilisation of the infant. Select the N/A life threatening emergency box next to the written consent section on the form (see Appendix 2).

Emergency Needle Aspiration

This procedure may be the only requirement to treat a tension pneumothorax and more importantly will provide temporary alleviation of a pneumothorax. The procedure will be performed by a Medical Officer (MO) or in NICU by a Neonatal Nurse Practitioner (NPN) in consultation with the Neonatologist/Neonatal Fellow. The infant will then be assessed to determine if an insertion of an intercostal catheter (ICC) is required.

Equipment Required

- 1 x 22G or 24G intravenous cannula (preferred) or a 23G or 25G butterfly needle (blue)
- 1 x alcohol swab
- 1 x 3-way tap
- 1 x 10 ml syringe
- Sterile gloves

Procedure

- Preferred site selection is, anteriorly through the second or third intercostal space, above the rib, in the mid-clavicular line, avoiding the nipple (see Figure 3).
- If needle aspiration unsuccessful, an alternative site to drain is the 4th to 5th intercostal space in the anterior axillary line.
- Raise head of bed, if able, and increase oxygen as needed.
- Position infant supine and identify puncture site.
- Clean area of puncture site with alcohol swab.
- Insert cannula (or butterfly needle) into the pleural space, above the rib, at a 90° angle.
- Remove the sharp from cannula and dispose safely.
Connect the 3-way tap and syringe. The 3-way tap allows for aspiration of free air into
the syringe and emptying the syringe while maintaining a closed system (see Figure 4).
Aspirate air into the syringe, then expel air through the 3-way tap, keep track of volume
expelled.
When free air is obtained, stabilise the cannula and continue aspiration until
preparations for insertion of an ICC are complete or until the air leak is evacuated.
Monitor infant’s condition, including heart rate, oxygen saturation & temperature.
Document procedure in patient notes including total amount of air aspirated.

**Intercostal Catheter Placement and Management**

**Site Selection**
Laterally through the fourth or fifth intercostal space, above the rib to avoid injury to the intercostal
vessels which run under the rib, known as the VAN bundle, vein, artery and nerve (see Figure 5).
Maintain the insertion landmark in the mid to anterior axillary line. This should be well lateral to the
nipple to avoid the breast/ nipple area.
Catheter Selection
The intercostal catheters are the Cook’s Catheter, size selection is based on infant size.

- 6.0 Fr (<1000gms)
- 7.0 Fr (<1500gms)
- 8.5 Fr (>1500gms)
- 10.2 Fr (>2500gms)

Preparing the Chest Drain System

This procedure is for NICU ONLY

The water seal drainage system is comprised of a one piece, 3 chamber set-up, which separates the functions of fluid collection, water seal (which serves as a simple one way valve) and suction control.

Equipment Required

- Sterile Dry Seal chest drain pack
- Clean suction tubing and low suction unit
- Cook’s multipurpose tubing adaptor (spigot) with Luer lock
- Sterile scissors

Procedure

- Open Dry Seal chest drain pack (see Figure 6).
- Deliver all the sterile water into back port of chamber (C).
- Attach suction tubing to suction port on drainage system and attach other end to the wall suction.
- Leave clear adaptor intact until required to maintain sterility.

Once ICC inserted and drain connected;

- Set drain suction to -10cm water by moving the rotary dial located behind (A) on left side of drain. Please note this pressure may be required to be increased to draw out bellows.
- Maximum settings are:
  - - 15cm for preterm infant and,
  - - 20cm for term infant.
- Set wall suction at required setting to draw out bellows balloon (E) out to white arrow.
- Observe (C) for active bubbling.
- Monitor drainage at drainage chamber on side (D).

*NOTE wall suction MUST NOT exceed -10 kPa (-80 mmHg)
Insertion of an Intercostal Catheter

**Equipment Required**

- Procedure trolley
- Large sterile plastic drape
- Mask, sterile gown, sterile gloves and disposable hat
- Dressing pack
- Paediatric instrument kit
- Fenestrated drape and/or sterile plastic drape
- Cook’s Intercostal Catheter (including fixing device and clear dressing)
- Disposable drainage system (Atrium Express Dry Seal Chest Drain see instructions for setting up below)
- Cook Multipurpose Adaptor with Luer lock
- 3-way tap
- Curved scalpel blade with handle
- Local anaesthetic lidocaine (lignocaine) 1%, needle and small syringe
- Chlorhexidine solution 2%

**Procedure**

- Observe universal precautions.
- Explain the procedure to parents ensuring they are fully informed and document written consent on the Level 2 procedure checklist (see Appendix 2).
- Complete the consent for medical procedure/treatment (minors) form and place in patient file (see Appendix 3).
- Complete patient identification pathways.
- Give sucrose orally (as per protocol) prior to local anaesthetic. Morphine may be given for ongoing pain relief.
- Assess the infant’s pain score pre pre-procedure, during procedure and post-procedure using the N-PASS tool (see Appendix 4).
- Gather all necessary equipment.
- Insertion of an ICC is a sterile procedure. Staff must wear sterile mask, gown, hat and gloves after completing a surgical hand wash.
Monitor infant’s temperature, heart rate and oxygen saturation during the procedure.

Raise head of bed by 15-20°.

Assisting nurse to position the baby with the affected side elevated to 30-40° and extend the arm above the head.

Infiltrate the insertion site with 1% lidocaine (lignocaine) (dose depending on size of infant).

**LIDOCAINE (LIGNOCAINE) DOSING FOR NEONATES – Infiltration anaesthesia**

Up to 3 mg/kg, (equivalent to 0.3 mL/kg of 1% solution), dose to be given according to patient's weight and nature of procedure. The dose may be repeated, but not more often than every 4 hours.

Clean with appropriate skin cleansing solution (Chlorhexidine irrigation solution 0.2% recommended) and allow minimum 30 seconds to dry prior to insertion.

Place sterile fenestrated drape or clear plastic drape in position.

The intercostal catheter is inserted in the 4th or 5th intercostal space in the anterior axillary line. This corresponds to a point at least 2cm lateral to and below the nipple. The incision must be well clear of the nipple.

Use the scalpel blade to make a small incision in the skin. Position blade parallel to rib and avoid multiple ‘slashing’ movements.

Site the cutting trocar (sharp stylet) into the introducer.

Optionally, mark off 1cm to 1.5cm on the catheter with artery forceps to act as safety measure to prevent inserting drain too deep.

At a right angle to the chest wall, insert the drain through the chest wall into the pleural space.

Remove the cutting trocar as soon as the tip of the catheter is inserted into the pleural space.

Advance the catheter off the introducer into the pleural space by 3-5cm and use the 1-3cm marking on the catheter to direct the tip anteriorly as well as superomedially so that the tip lies beneath the anterior chest wall.

Connect the ICC to the dry seal drainage system and note whether the fluid in drain is swinging and/or bubbling.

The position of the ICC should be maintained to ensure adequate drainage of the pleural space. Should the catheter become dislodged, drainage may be interrupted, the closed nature of the drainage system is rendered ineffective and the patient may be compromised.

The ICC is stabilised by securing it to the chest with the catheter fixation device from the ICC pack. It should be trimmed to accommodate the size of the infant’s chest.

Purse string sutures are not used due to poor long-term cosmetic result. Sutures should only be used to shorten the incision. Tubing may be loosely attached to the bed linen with the use of tapes and safety pins to limit mobility and prevent dislodgement of the tube.

The disposal of sharps is the responsibility of the practitioner performing the procedure using appropriate sharps container.

Details of the ICC insertion should be noted on the observation sheet and documented in the progress notes.

Observation of the closed system should be documented hourly, noting drainage and bubbling in drain tubing and chamber.
Connecting the ICC to the Drain System

- With sterile scissors cut end of drainage tubing to remove clear adaptor and discard.
- Insert Cook multipurpose adaptor (blue) into drainage tubing (with white end facing out).
- When ICC inserted connect the white end of the multipurpose adaptor (blue) to the 3-way tap that has been connected to the Cook catheter as shown in Figure 7.

![Figure 7: ICC & Atrium drain set-up (Picture from NICU, JHCH)](image)

ICC set-up for Transport

This procedure is for HNE District sites and JHCH NETS team only

During retrieval and transport of unwell babies requiring insertion of a chest drain, the Atrium system cannot be used, and a Heimlich valve is required to maintain the negative pressure system (see Figure 8). The internal rubber valve acts as a one way valve and allows accumulated air to escape through the rubber tunnel during expiration. Once the breath is completed the valve collapses, ensuring the air cannot return to the pleural space. Once arriving at the tertiary centre, the chest drain should be clamped and placed onto the Atrium system for ongoing management and observation.

![Figure 8: Heimlich valve (Picture from Google images)](image)

Equipment Required

- Chest drain (cook catheter)
- 3-way tap
- Luer-Lock connector with tube
- Heimlich valve

Procedure

- Connect the luer lock connector with tubing to the 3-way tap.
- Insert Heimlich valve (blue end) into remaining end of sterile silicone tubing.
Ongoing Monitoring of ICC

- Leave infant clean, dry and comfortable.
- Record procedure on observation flow chart and in progress notes.
- Post insertion a CXR must be completed to ensure ICC placement is correct and effective.
- Inform and reassure parents as soon as possible.
- Observe ICC site, activity and drainage hourly and document.
- Use clamp provided on tubing to anchor line to patient’s bed to avoid tension on the ICC.
- The requirement for ongoing pain management is based on an assessment using the N-PASS score (see Appendix 4).
- NEVER position the baby lying on the affected side &/or on chest drain.

Complications of a Chest Drain

- Malpositioned chest drain
- Localised trauma
- Infection

Removal of ICC

When the ICC is no longer active for a significant period of time the need for the chest drain will be assessed. Often this is assessed by clamping the ICC system and assessing for re-accumulation 4 to 6 hours post clamping. A chest X-ray may be performed to assist this assessment. If no re-accumulation has occurred the chest drain may be requested to be removed by the on-service Neonatologist/Neonatal Fellow.

Equipment Required

- Clean trolley
- Dressing pack
- Sterile gloves
- Steri strips

Procedure

- May be undertaken by an MO, NNP, and TNP or experienced RN.
- Inform parents of procedure, explain and reassure.
• Observe aseptic technique.
• Position infant with affected side uppermost.
• Remove all dressings and steri-strips gently and clean area.
• If catheter tip is to be saved and sent to pathology, have sterile container ready.
• Remove catheter carefully and gently.
• Apply steri-strips to wound site as needed. If site is gaping, have medical officer or NNP review and suture as necessary.
• Leave infant clean, dry and comfortable.
• Dispose of used drainage system as indicated.
• Document removal procedure on observation flow chart and in the progress notes.
IMPLEMENTATION PLAN

The clinical guideline will be:
- Circulated to General Managers and Sector Managers.
- Circulated to the clinicians via Tiered Neonatal Network/Newborn Services and Children Young People and Families Services, and the Women’s Health and Maternity Network.
- Made available on the intranet (PPG) and HNEKidshealth website.
- Presented at facility units meetings and tabled for staff to action.

MONITORING AND AUDITING PLAN

- The person or leadership team who has approved the clinical guideline is responsible for ensuring timely and effective review of the guideline.
- Evaluation will require a review of the most current evidence as well as consideration of the experience of HNELHD staff in the implementation of the clinical guideline.
- Data derived from monitoring and evaluation should inform the review of the clinical guideline either as required or scheduled.
- Implementation, education support and monitoring compliance be completed by local Clinical Educators and Managers.
- Amendments to the guideline will be ratified by the Manager and Head of Newborn Services and WHaM Networks prior to final sign off by the Children Young People and Families Services Network.

CONSULTATION WITH KEY STAKEHOLDERS

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CONSULTATION: HNELHD Maternity and Newborn Services Steering Committee
HNELHD Tiered Neonatal/Newborn Services Network
Women’s Health and Maternity Services Network
Children, Young People and Family Services Network
District Quality use of Medicines Committee

APPROVED BY: District Quality use of Medicines Committee
Sinead Redman, Manager Newborn Services, NICU JHCH
Dr Larissa Korostenski, Acting Head of Newborn Services, NICU JHCH
Dr Paul Craven, Executive Director, CYPFS

OTHER USEFUL LINKS
1. Level 2 Procedure Checklist forms
2. NSW Health Policy Directive PD 2014_024 Patient Identification Bands

APPENDICES
1. Abbreviations & Glossary
2. Level 2 Procedure Checklist
3. Consent to Medical Treatment form
4. N-PASS tool
REFERENCES

5. ATRIUM EXPRESS Dry Seal Chest Drain System Product Information leaflet.

FEEDBACK

Any feedback on this document should be sent to the Contact Officer listed on the front page.
### ABBREVIATIONS & GLOSSARY

<table>
<thead>
<tr>
<th>Acronym or Term</th>
<th>Definition</th>
</tr>
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<tbody>
<tr>
<td>CPAP</td>
<td>Continuous Positive Airway Pressure</td>
</tr>
<tr>
<td>CXR</td>
<td>Chest X-Ray</td>
</tr>
<tr>
<td>HNELHD</td>
<td>Hunter New England Local Health District</td>
</tr>
<tr>
<td>ICC</td>
<td>Inter-costal Catheter</td>
</tr>
<tr>
<td>JHCH</td>
<td>John Hunter Children's Hospital</td>
</tr>
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<td>MO</td>
<td>Medical Officer</td>
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<tr>
<td>NICU</td>
<td>Neonatal Intensive Care Unit</td>
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<tr>
<td>NNP</td>
<td>Neonatal Nurse Practitioner</td>
</tr>
<tr>
<td>N-PASS</td>
<td>Neonatal Pain and Sedation Score</td>
</tr>
<tr>
<td>PEEP</td>
<td>Positive End Expiratory Pressure</td>
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<tr>
<td>RDS</td>
<td>Respiratory Distress Syndrome</td>
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<td>RN</td>
<td>Registered Nurse</td>
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<tr>
<td>SCU</td>
<td>Special Care Unit</td>
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<tr>
<td>TNP</td>
<td>Transitional Nurse Practitioner</td>
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<tr>
<td>VAN Bundle</td>
<td>Venous-Arterial-Nerve Bundle</td>
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<tr>
<td>WOB</td>
<td>Work of Breathing</td>
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APPENDIX TWO

LEVEL 2 PROCEDURE CHECKLIST

<table>
<thead>
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<th>Family Name</th>
<th>MHN</th>
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<tr>
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<td></td>
<td>MALE</td>
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<td>D.O.B.</td>
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<tr>
<td>Address</td>
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<tr>
<td>Location / Ward</td>
<td>COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE</td>
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**PROCEDURAL SAFETY CHECKLISTS**

**LEVEL 2 PROCEDURE CHECKLIST**

Level 2 procedure definition (Reference: PD2017_032 Clinical Procedure Safety)
- Procedureist often supported by an assisting procedureist(s)
- Requires written consent in HNELHD
- Usually performed in wards, emergency departments, clinics, imaging departments, interventional suites
- e.g., lumbar puncture, insertion of chest tube, ambulatory surgery, stress test, Nuclear Medicine therapies, biopsies, IV or IT administration of chemotherapy, centrally inserted line
- Does NOT involve procedural sedation or general/regional anaesthesia

Date: __/__/____
Time: __/__/____

Procedure performed:

If procedure requires sedation or general/regional anaesthesia use Level 3 checklist over page

### Immediately pre-procedure

<table>
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<th>Procedureist / team introductions</th>
<th>Yes</th>
<th>No</th>
<th>N/A (Life threatening emergency)</th>
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<td>Written consent</td>
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<td>Patient identification verified (Name, D.O.B., MHN) against health record</td>
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<td>No</td>
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<td>Procedure verified (against health record)</td>
<td>Yes</td>
<td>No</td>
<td></td>
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<tr>
<td>Patient/sit/sts/sol level matched consent</td>
<td>Yes</td>
<td>No</td>
<td></td>
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<tr>
<td>Procedure verified (against health record)</td>
<td>Yes</td>
<td>No</td>
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<td>Patient/sit/sts/sol level matches consent</td>
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<td>Allergy/adverse reaction checked and documented</td>
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<td>No</td>
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<td>Antibiotics prescribed and/or administered</td>
<td>Yes</td>
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<td>Special medication(s) administered</td>
<td>Yes</td>
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<td>Essential imaging reviewed and present for patient/procedure</td>
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<td>No</td>
<td>N/A</td>
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<td>Patient position corrected for procedure</td>
<td>Yes</td>
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<td>Implants and special equipment</td>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
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<tr>
<td>Planned procedure, critical steps and anticipated events considered</td>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
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### Post procedure

| Advice for clinical handover (LSIHA) | Yes | No |
| Name of procedure and Procedureist documented in health record | Yes | No |
| Clinical management plan documented in health record (including post procedure investigations, altered calling criteria) | Yes | No |
| Equipment problems/issues documented/manager advised | Yes | No | N/A |
| Post procedure tests ordered | Yes | No | N/A |
| Specimen/images labeled correctly | Yes | No | N/A |

Proceduralist Signature: ____________________
Print name: ____________________
Designation: ____________________

Assistant Signature (if applicable): ____________________
Print name: ____________________
Designation: ____________________

Page 1 of 2
# APPENDIX FOUR

## N-PASS TOOL

### The Neonatal Pain and Sedation Score (N-PASS)

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
<th>Sedation</th>
<th>Normal</th>
<th>Pain / Agitation</th>
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<tbody>
<tr>
<td></td>
<td>-2</td>
<td>-1</td>
<td>0</td>
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<tr>
<td><strong>Crying Irritability</strong></td>
<td>No cry with painful stimuli</td>
<td>Moans or cries minimally with painful stimuli</td>
<td>Appropriate crying</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Not irritable</td>
</tr>
<tr>
<td><strong>Behavior State</strong></td>
<td>No arousal to any stimuli</td>
<td>Aroused minimally to stimuli</td>
<td>Appropriate for gestational age</td>
</tr>
<tr>
<td></td>
<td>No spontaneous movement</td>
<td>Little spontaneous movement</td>
<td>Awakens frequently</td>
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<tr>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Facial Expression</strong></td>
<td>Mouth is lax</td>
<td>Minimal expression with stimuli</td>
<td>Relaxed</td>
</tr>
<tr>
<td></td>
<td>No expression</td>
<td></td>
<td>Appropriate</td>
</tr>
<tr>
<td><strong>Extremities Tone</strong></td>
<td>No grasping reflex</td>
<td>Weak grasp reflex</td>
<td>Relaxed hands and feet</td>
</tr>
<tr>
<td></td>
<td>Flaccid tone</td>
<td>Weak muscle tone</td>
<td>Normal tone</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>Vital Signs</strong></td>
<td>No variability with stimuli</td>
<td>+10% variability from baseline with stimuli</td>
<td>Within baseline or normal for gestational age</td>
</tr>
<tr>
<td>HR, RR, BP, So2</td>
<td>Hypoventilation or apnea</td>
<td></td>
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</tbody>
</table>

**Premature Pain Assessment**

- +3 if < 28 weeks gestation / corrected age
- +2 if 28-31 weeks gestation / corrected age
- +1 if 32-35 weeks gestation / corrected age