



| | | | |
|--------------------------|-------------------------------------|-------------------------|------------------|
| Department: | Neonatal Intensive Care Unit (NICU) | | |
| Document: | Departmental Policy and Procedure | | |
| Title: | Thoracentesis in Neonates | | |
| Applies To: | All NICU Staff | | |
| Preparation Date: | January 12, 2025 | Index No: | NICU-DPP-050 |
| Approval Date: | January 26, 2025 | Version : | 2 |
| Effective Date: | February 26, 2025 | Replacement No.: | NICU-DPP-050 (1) |
| Review Date: | February 26, 2028 | No. of Pages: | 4 |

1. PURPOSE:

- 1.1 Temporary evacuation of life-threatening air accumulations in the pleural space (tension pneumothorax) while preparing for permanent chest tube placement.
- 1.2 Evacuation of fluid from the pleural space for therapeutic or diagnostic purposes.

2. DEFINITIONS:

- 2.1 It is an invasive procedure to evacuate air or fluid from the intra-pleural space, via a hollow needle, in a symptomatic infants for diagnostic or therapeutic purpose.
- 2.2 Tension pneumothorax: As air accumulates in the pleural space, intrathoracic pressure rises, there is decreased lung volume, mediastinal shift, compression of the large intrathoracic veins, and increased pulmonary vascular resistance. The net effect is an increase in central venous pressure, a decrease in preload, and, ultimately, diminished cardiac output.

3. POLICY:

- 3.1 Indications:
 - 3.1.1 To evacuate air from the pleural space in infants with pneumothorax and rapidly deteriorating respiratory clinical status. Thoracentesis may confirm the diagnosis of tension pneumothorax and be therapeutic.
 - 3.1.2 It can aid in the diagnosis of pleural effusion; transudative, exudative effusions, chylothorax.
 - 3.1.3 Therapeutic removal of fluid in selected cases with pleural effusion.
- 3.2 Contraindications:
 - 3.2.1 Infants who have no underlying lung disease or complicating therapy (such as mechanical ventilation), are in no significant respiratory distress, and have no continuous air leak. These should be closely observed as pneumothorax may resolve spontaneously.
 - 3.2.2 When patient's vital signs are stable enough to allow placement of permanent thoracostomy tube without prior emergency evacuation.
- 3.3 Maintain aseptic technique throughout the procedure to minimize the risk of infection.
- 3.4 A pneumothorax should be considered in mechanically ventilated infants who develop unexplained alterations in hemodynamics, pulmonary compliance, or oxygenation and ventilation.

4. PROCEDURE:

- 4.1 Explain procedure to parents if available and if patient condition allows.
- 4.2 Provide none-pharmacologic and/or pharmacologic pain management for non-emergency cases.
- 4.3 Assistant nurse:
 - 4.3.1 Performs hand hygiene.
 - 4.3.2 Assembles equipment on the same side as the proposed puncture site.
 - 4.3.3 Ensures thermoregulation.
 - 4.3.4 Connects the baby to vital signs monitor.

- 4.3.5 Places the baby in the supine position and gently restrain him/her.
- 4.4 Functioning resuscitation equipment should be at bedside.
- 4.5 Perform hand hygiene and wear sterile gloves.
- 4.6 For evacuating air: Disinfect skin of second and third intercostal spaces with 70% alcohol (then clean it with sterile normal saline in extremely low birth weight neonates).
- 4.7 Use either:
 - 4.7.1 22 or 24-gauge intravenous catheter (according to infant size); connected to intravenous extension tubing to a three way stopcock that is previously fitted with a 10-20 ml syringe.
 - 4.7.2 23-gauge butterfly needle; attach the 3-way stopcock and a syringe directly to the hub of the butterfly tubing.
- 4.8 Insert the needle for approximately 1-2 cm, perpendicular to the chest wall, into the second intercostal space in the midclavicular line just above the top of the third rib. This will minimize the chance of lacerating an intercostal artery, as these vessels are located on the inferior surface of the ribs. Once the angio-catheter enters the pleural space, withdraw the stylet and attach the hub to the extension tubing and 3-way stopcock syringe setup. If a butterfly needle is used, do not advance it further once the pleural space is entered to avoid puncturing vessels or lung.
- 4.9 As the needle is inserted, apply continuous suction with the syringe. A rapid flow of air into the syringe occurs when the needle enters the pleural space. Once the pleural space has been entered, stop advancing the needle. This will reduce the risk of puncturing the lung while the remaining air is evacuated as follows:
 - 4.9.1 Ensure that the stopcock is in the open position between the syringe and the patient.
 - 4.9.2 Simultaneously, upon needle insertion, pull back on syringe creating a negative pressure effect. Advance the needle until air can be aspirated (approximately 1-2 cm).
 - 4.9.3 Aspirate air into syringe until resistance is met or the syringe is full of air.
 - 4.9.4 Evacuate air by turning the stopcock in the open position to the environment (off is to the patient)
 - 4.9.5 To avoid accidental reinjection of air or fluid into the chest cavity, care should be taken in manipulating the stopcock. Maintain accurate records of amount of air or fluid aspirated.
- 4.10 Continue evacuation as patient's condition warrants while preparing for permanent tube placement. After evacuation in the case of a tension pneumothorax, the inserted thoracentesis needle hub can be attached to extension tubing that is connected to an underwater seal (sterile water bottle) until the chest tube is inserted.
- 4.11 Slowly remove needle and cover with sterile 2"x 2" gauze pads for 1 minute then apply an airtight dressing (vaseline gauze and small dressing).
- 4.12 For aspirating fluid: select insertion site in anterior or mid axillary lines below breast tissue for diffuse pleural collections. Direct catheter posteriorly after penetrating into pleural space. Keep system closed to prevent leakage of air into pleural space.
- 4.13 The assigned nurse disposes equipment appropriately.
- 4.15 Both physician and nurse document on the progress notes the date and time of the procedure, tolerance of the baby and amount of air or fluid evacuated, color of fluid, any problem encountered and result of chest X-Ray.
- 4.16 Post-procedure: Observe the infant for:
 - 4.16.1 signs of re-accumulation of pneumothorax, continuous monitoring of vital signs

4.16.2 Signs of complications associated with needle aspiration of the chest

Complications of needle thoracentesis:

| Complication | Prevention/management |
|--|--|
| Pneumothorax Bronchopleural fistula Needle laceration (lung, liver capsule or spleen) | <ul style="list-style-type: none"> - Can be caused by improper placement of the needle. Ensure proper land marking to avoid puncturing the lung tissue. - Depth of needle insertion not to exceed 1-2 cm. - Proper patient positioning |
| Complication | Prevention/management |
| Hemothorax | Occurs when the needle punctures any vessel within the chest wall. <ul style="list-style-type: none"> - Insert the needle at the mid clavicular line to avoid the mammary artery. - Needle should be inserted over the top of the rib to avoid the intercostal artery and vein. - Blood return when the needle is inserted indicates a vessel has been punctured. |
| Infection | Avoid it by strict adherence to aseptic techniques |
| Subcutaneous emphysema | Occurs when released air becomes trapped within the subcutaneous tissue |
| Air embolism | Caused when the needle enters a great vessel within the chest wall and air is accidentally introduced into the central circulation |

5. MATERIALS AND EQUIPMENT:

- 5.1 23 g butterfly needle or #22 - 24 g lv catheter
- 5.2 Skin disinfectant; 70% isopropyl alcohol (follow by sterile water in very low birth weight infants)
- 5.3 IV extension tubing
- 5.4 3-way stopcock
- 5.5 10 or 20ml syringe
- 5.6 Small container of sterile water
- 5.7 Sterile gloves,
- 5.8 Sterile 2" x 2" gauze pads
- 5.9 IV extension tubing

6. RESPONSIBILITIES:

- 6.1 Physician
- 6.2 Nurse







7. APPENDICES:

N/A

8. REFERENCES:

- 8.1 College of Respiratory Therapists of Ontario, Canada. Chest needle and chest tube insertion. Clinical Best Practice Guideline. 2009. 1-44
- 8.2 American Academy of Pediatrics. Special considerations. Neonatal Resuscitation Program. Textbook. 6th edition. 2011. 242-245
- 8.3 Rais-Bahrami K et al. Thoracostomy Tubes. Atlas of Procedures in Neonatology. 2007

9. APPROVALS:

| | Name | Title | Signature | Date |
|--------------|---------------------------------|-----------------------------|---|------------------|
| Prepared by: | Ms. Afrah Saud Al Shammari | NICU Head Nurse |  | January 05, 2025 |
| Prepared by: | Dr. Falah Nabhan Al Shammari | NICU Quality Coordinator |  | January 05, 2025 |
| Reviewed by: | Mr. Sabah Turayhib Al - Harbi | Director of Nursing |  | January 07, 2025 |
| Reviewed by: | Dr. Sarhan Hamdan Al Shammari | NICU Head of the Department |  | January 08, 2025 |
| Reviewed by: | Mr. Abdullellah Ayed Al Mutairi | QM&PS Director |  | January 09, 2025 |
| Reviewed by: | Dr. Tamer Mohamed Naguib | Medical Director |  | January 12, 2025 |
| Approved by: | Mr. Fahad Hazam Al - Shammari | Hospital Director |  | January 19, 2025 |