# Chest Drains

## Purpose
To provide guidelines for drainage of air or fluid from the pleural space and ongoing care of any indwelling device.

## Applicability
All Covenant Health Neonatal Intensive Care staff.

## Policy Statement
Drainage of air and fluid from the pleural space is often needed to maintain adequate lung function. Intrapleural aspiration is undertaken to drain air (pneumothorax) in situations of cardio-vascular compromise pending chest tube insertion or to remove fluid accumulations in the thorax. Chest tubes are used for longer term drainage. Positioning of the infant and the location of the procedure will be determined by the type of drainage expected.

## Needle Aspiration

### Equipment
- #16, 18 or 20 gauge over-the-needle catheter
- Three-way stopcock
- 10 mL and 20 mL syringes
- Macrobore extension tubing (not microbore)
- Skin antiseptic

### Procedure

<table>
<thead>
<tr>
<th>ACTION</th>
<th>RATIONALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Consult with the Neonatologist/Designate who will perform the aspiration regarding the need for patient analgesia.</td>
<td>Ensures correct patient and correct site to minimize medical errors.</td>
</tr>
<tr>
<td>2. Identify patient using two patient identifiers. Confirm correct site by reviewing CXR with Neonatologist/Designate who will insert catheter unless insertion is prompted by severe hemodynamic compromise or transillumination.</td>
<td></td>
</tr>
<tr>
<td>3. Perform hand hygiene and assemble required equipment. Attach syringe to female end of a stopcock and extension tubing to the male end. The other end of the extension tubing is attached to the over-the-needle catheter after it is inserted and the introducer is removed.</td>
<td></td>
</tr>
</tbody>
</table>
4. Position the infant supine.  
Gravity positions air anterior and fluid posterior in the chest when supine.

5. Ensure continuous heart rate and oxygen saturation monitoring.  
Monitor beneficial or deleterious effects of the procedure.

6. Restrain infant's limbs.

7. Ensure that the volume of air/fluid removed is recorded.

8. Restrain infant until procedure is completed.

9. Prepare for chest tube insertion and underwater seal drainage if necessary.

10. Document procedure including name of Neonatologist/Designate who completed the procedure, number of attempts, the size of catheter used, volume of air/fluid removed and the baby's response.

Chest Tube Insertion – Assisting

Equipment

Pigtail Catheter Insertion

Cutdown tray  
Masks and hair covers  
Sterile gown and gloves X 2  
Sterile antiseptic swabs  
1% xylocaine without epinephrine  
#25 gauge needle and #18 gauge blunt needle  
1ml and 3ml syringe  
10ml vial of normal saline  
Pigtail catheter chest drain set which includes pigtail catheter, introducer needle, 3-way stopcock and occlusive cap, dilator, guide wire and chest tube connector  
2 x 2 gauze  
Transparent dressings x 3  
Steri-strips  
Mepilex Border Lite ® Dressing  
Analgesia as ordered

UNDERWATER SEAL DRAINAGE

Underwater seal drainage device (Atrium chest drain)  
Medical suction regulator  
2 Kelly forceps with plastic protectors  
Non-conductive connecting tube  
Waterproof tape
## ACTION

### Procedure

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<tr>
<th>Step</th>
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<tr>
<td>1.</td>
<td>Identify patient using two patient identifiers. Confirm correct site by reviewing CXR with Neonatologist/Designate unless insertion is prompted by severe hemodynamic compromise or transillumination.</td>
<td>Ensures correct patient and correct site to minimize medical errors.</td>
</tr>
<tr>
<td>2.</td>
<td>Monitor heart rate, blood pressure and oxygen saturations.</td>
<td>Severe cardiorespiratory compromise may occur with conditions requiring chest tube insertion and the insertion procedure itself.</td>
</tr>
<tr>
<td>4.</td>
<td>Administer analgesia as ordered.</td>
<td>Insertion is very painful.</td>
</tr>
<tr>
<td>5.</td>
<td>Restrain the baby while the Neonatologist/Designate cleanses the site with antiseptic, drapes the baby, injects the local anaesthetic, and with the assistance of a second staff member completes the insertion of the pigtail catheter.</td>
<td>The insertion of a pigtail chest tube requires a second staff member to don hat, mask, sterile gown and gloves to assist in the insertion.</td>
</tr>
<tr>
<td>6.</td>
<td>Attach the 3-way stopcock to the pigtail catheter. Connect the light blue graduated chest tube connector between the 3-way stopcock and the tubing of the underwater seal drainage device. Ensure the occlusive cap is on to keep the 3-way stopcock a closed system.</td>
<td>Waterproof tape is used to prevent breaks in suction and disconnection at joint points.</td>
</tr>
</tbody>
</table>
| 7.   | Secure the pigtail catheter by the following method:  
  - Criss crossing a steri strip around the catheter and securing to the skin.  
  - Use 2 pieces of tegaderm with small cuts in the side. Place one tegaderm on the skin with catheter in the center opening. Place the second tegaderm in an alternate fashion to overlap the first tegaderm and surround the catheter from the opposite side.  
  - Place a 2 x 2 sterile gauze under the catheter near the insertion site to prevent kinking and occlusion. Cover gauze and catheter with a tegaderm. | |
8. Secure the pigtail catheter to the skin. Tape the distal catheter on the abdomen with appropriate tape or dressing for gestational age.

9. Secure drainage system tube to the bedding sheet with a clamp or a pin.

10. Once insertion is complete the underwater seal drainage device is prepared:
    - Fill water seal to 2cm line with sterile water provided. Add sterile water via the suction port located on top of the drainage device.
    - Attach connective tubing from suction port on top of underwater seal drainage device **DIRECTLY TO** the medical suction regulator. Suction canister is removed.
    - Regulator on underwater seal drainage device should be set at a starting pressure of”-10cm” H2O and adjusted as ordered.
    - Turn medical suction on and increase to 80mmHg. The orange suction bellows should expand but may not expand to the ▲ mark for settings less than 20cm H2O.

11. Observe the water seal chamber for air bubbles coming through the water seal.

Tension on the chest tube may dislodge it. The air and/or fluid will not drain from the chest tube if it is kinked or obstructed.

Suction should be attached to the chest tube as soon as possible to speed removal of the intrapleural air/liquid. Ensure the chest drain is connected to the patient prior to initiating suction. Excessive suction may draw tissue into the side holes of the chest tube and could be potentially harmful.

Placement of the chest tube is initially guided by the presence of air bubbles in the water seal chamber, indicating drainage of intrapleural air. When the air is resolved, bubbling will cease. Even without air bubbles the fluid within the chest tube or water seal chamber should fluctuate indicating that the chest tube is patent.

Intrapleural air may collect in a position where it cannot be drained by the tube and the position may need to be adjusted. Continuous, vigorous bubbling in the water seal chamber, with failure of pneumothorax resolution, may indicate perforation of the lung.

12. A chest x-ray is taken to confirm tube position.
13. Document procedure including name of Neonatologist/Designate who completed the procedure, number of attempts, the baby’s response, size of the chest tube and suction settings of the medical suction regulator and underwater drainage seal device.

**Equipment**

### Trocar Drain Insertion

- Cutdown tray
- #3 silk suture
- #8, 10 or 12 chest tube
- Disposable scalpel blade
- Sterile antiseptic swabs
- Sterile gown and gloves
- Masks and hair covers
- 1 mL and 3ml syringe
- #25 gauge needle and 18 gauge blunt needle
- 1% Xylocaine without epinephrine
- Mepilex Border Lite Dressing
- Analgesia as ordered

### UNDERWATER SEAL DRAINAGE

- Underwater seal drainage device (Atrium chest drain)
- Medical suction regulator
- 2 Kelly forceps with plastic protectors
- Non-conductive connecting tube
- Waterproof tape

**Procedure**

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<tr>
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<tr>
<td>1. Identify patient using two patient identifiers. Confirm correct site by reviewing CXR with Neonatologist/Designate who will insert chest tube unless insertion prompted by severe hemodynamic compromise or transillumination.</td>
<td>Ensures correct patient and correct site to minimize medical errors.</td>
</tr>
<tr>
<td>2. Monitor heart rate, blood pressure and oxygen saturation.</td>
<td>Severe cardio-respiratory compromise may occur with conditions requiring chest tube insertion and the insertion procedure itself.</td>
</tr>
<tr>
<td>3. Draw drapes around patient area. Mask, don cap and perform hand hygiene. Assemble sterile field using aseptic technique.</td>
<td>This is a semi-surgical procedure requiring aseptic technique.</td>
</tr>
<tr>
<td>4. Administer analgesia as ordered.</td>
<td>Insertion is very painful.</td>
</tr>
</tbody>
</table>
5. One person restrains the infant while the Neonatologist/Designate inserting the chest tube cleanses the site with antiseptic, drapes the entire patient, injects local anesthetic, inserts the chest tube, and attaches the connector from the underwater seal drainage device tubing into the chest tube.

6. Once insertion is complete the underwater seal drainage device is prepared:
   - Fill water seal to 2cm line with sterile water provided. Add sterile water via the suction port located on top of the drain.
   - Attach connective tubing from suction port on top of underwater seal drainage device \textbf{DIRECTLY TO} the medical suction regulator. Suction canister is removed.
   - Regulator on underwater seal drainage device should be set at a starting pressure of “-10cm” H$_2$O and adjusted as ordered.
   - Turn medical suction on and increase to 80mmHg. The orange suction bellows should expand but may not expand to the ▲ mark for settings less than 20cm H$_2$O.

   Suction should be attached to the chest tube as soon as possible to speed removal of the intrapleural air/fluid.

   Ensure the chest drain is connected to the patient prior to initiating suction.

   Excessive suction may draw tissue into the side holes of the chest tube.

7. Observe the water seal chamber for air bubbles coming through the water seal.

   Placement of the chest tube is initially guided by the presence of air bubbles in the water seal chamber, indicating drainage of intrapleural air. When the air is resolved, bubbling will cease. Even without air bubbles the fluid within the chest tube or water seal chamber should fluctuate indicating that the chest tube is patent.

8. When the chest tube is placed, it may be sutured in place. A tape bridge may also be used to provide additional security of the chest tube.

   A tape bridge may be preferred over a clear adhesive dressing as chest tubes tend to function optimally when allowed to exit from the skin at as close to a 90-degree angle as possible. Waterproof tape is used to prevent breaks in suction and disconnection at joint points.
The site is covered with a soft silicone dressing and all connections are secured with waterproof tape.

9. Tubing is secured to the bed by placing tape around the tubing and pinning the tape to the bed. The chest drain must always be placed below the patient’s chest in an upright position. Prevent tubing kinks.

10. A CXR is taken to confirm tube position.

Tension on the chest tube may dislodge it. The air and/or fluid will not drain from the chest tube if it is kinked or obstructed.

Intrapleural air may collect in a position where it cannot be drained by the tube and the position may need to be adjusted. Continuous, vigorous bubbling in the water seal chamber, with failure of pneumothorax resolution, may indicate perforation of the lung.

11. Document procedure including name of Neonatologist/Designate who completed the procedure, number of attempts, the baby’s response, size of the chest tube and suction settings of the medical suction regulator and under water seal device.
Chest Drains

Date Approved: July 2017
Policy Group: Respiratory
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Chest Tube Care

- Kelly forceps (2 per chest tube) with plastic tip protectors are kept at the bedside in case the chest tube needs to be clamped. Chest tubes are not clamped for more than a minute unless there is an order because clamping may result in an accumulation of air and/or fluid. Do not use clamps on a pigtail catheter. Use the 3-way stopcock instead.

- Observe the chest tube dressing for drainage and securement at least every shift. Pigtail catheters are not sutured and may dislodge if the dressing is not secure. Dressing changes are only done on a prn basis.

- Observe the drainage collection chamber hourly for quantity and record volume. Consistent drainage greater than 2 mL/kg/hour is excessive unless chylous drainage.

- Observe the water seal chamber for bubbles which indicates air evacuation.

- Reposition the baby routinely to mobilize localized collections or air and fluid.

- When transporting an infant with a chest drain, disconnect the suction tubing of the underwater seal system from the medical suction. The underwater seal prevents air from entering the chest through the tube, but air may accumulate in the pleural space once suction is removed because babies may not generate enough pressure to overcome the pressure in the seal system. Be prepared to attach the chest tube to a syringe and a 3-way stopcock after clamping the chest tube and detaching the underwater system.

- Always keep the underwater seal collection system upright and below the level of the patient so that air and/or fluid do not enter the intrapleural space.

- If the chest tube becomes dislodged, the Neonatologist/Designate, charge nurse and respiratory therapist are notified AND
  a. If the patient is not ventilated, cover the chest tube insertion site with an air occlusive dressing.
  b. If the patient is ventilated, leave the site uncovered

Chest Tube Removal – Assisting

**Equipment**
- Sterile suture scissors and tweezers set
- 2 x 2 gauze
- Occlusive dressing
- Analgesia/anesthetic as ordered
- Procedure gloves

**Procedure**

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<tr>
<td>1. Perform hand hygiene. Identify patient using two patient identifiers.</td>
<td>Suction is stopped to reduce tissue damage.</td>
</tr>
<tr>
<td>2. Gather equipment and prepare dressing.</td>
<td></td>
</tr>
<tr>
<td>4. Administer analgesic as ordered.</td>
<td>Removal of a chest tube is very painful.</td>
</tr>
<tr>
<td>5. Assist Neonatologist/Designate who removes chest tube. An occlusive dressing is applied to the site.</td>
<td>An occlusive dressing is used to prevent air from entering through the chest tube opening.</td>
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<tr>
<td>6. Determine if CXR is needed after tube removal.</td>
<td></td>
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<tr>
<td>7. The dressing is removed in 24 hours. The suture is removed when the skin is healed together and after an order from the Neonatologist/Designate.</td>
<td></td>
</tr>
</tbody>
</table>
8. Document procedure including the name of the Neonatologist/Designate who completed the procedure and infant’s response.

Related Documents
Adapted with permission from:
Stollery Children’s Policy and Procedure Manual
http://www.intranet2.capitalhealth.ca/nicu/pages/policiesprocedures/policiesprocedures_new.htm
Chest Drains, August 2012
Stollery Children’s Hospital Specialized Clinical Competency For Insertion and Removal of Thoracostomy Tubes by Neonatal Nurse Practitioners.
August 2016

References

Revisions
April 2013
April 2002
Signing

Original Signed

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