

PAEDIATRIC NURSING PRACTICE MANUAL  
SECTION 7

CARE OF THE CHILD WITH A RESPIRATORY CONDITION

7.3 INTERCOSTAL CATHETER CARE

7.3.2 MANAGEMENT OF AN INTERCOSTAL CATHETER

**Aims**

1. To maintain drainage of air or fluid from pleural cavity.
2. To prevent air entering the pleural cavity.

**Background<sup>1, 2</sup>**

The water seal drainage system comprises three chambers;

**1. Fluid Collection chamber:**

The chamber collects pleural fluid from the patient and allows measurement of drainage volume.

**2. Under water seal:**

A one way seal allows air/fluid to drain from the patient and acts as a manometer to measure intrathoracic pressure. The floatation valve protects the patient from extreme negative pressures.

**3. Suction control:**

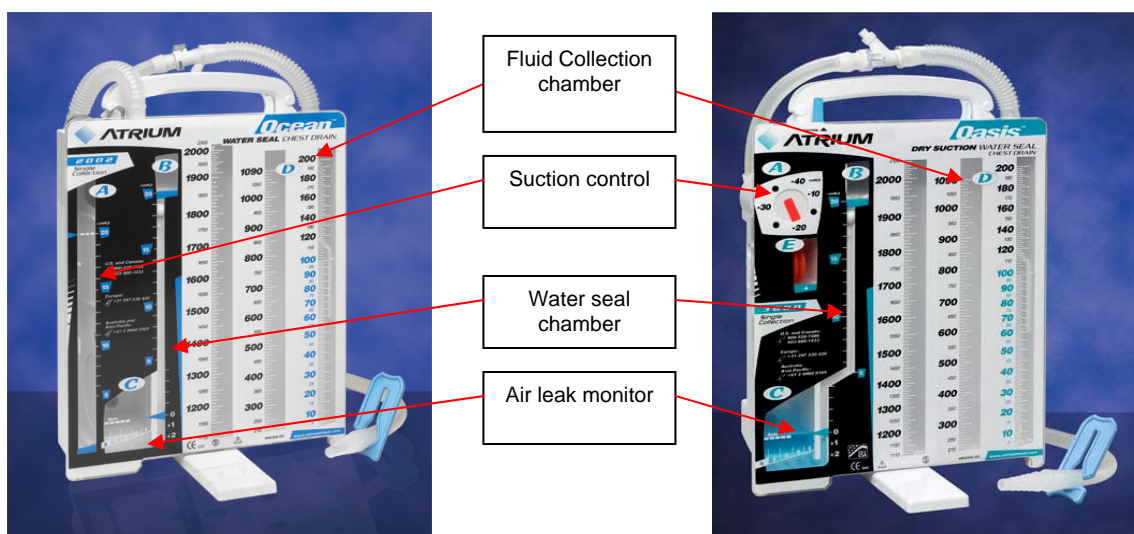
Improves the rate of fluid or air evacuation.

*Oasis™*: Dry suction water seal chest drain is controlled by the suction regulator (-10 to -40cmH<sub>2</sub>O) which ensures a consistent suction pressure is maintained. Requires wall suction to be set to at least -80mmHg.

*Ocean™*: Wet under water seal chest drain suction is regulated by the height of the water column in the chamber.

**Note:** the choice of drainage unit is determined by the treating physician.

Typical suction/pressure settings for infants is -5 to -15cmH<sub>2</sub>O. Extra caution should be implemented if using the Oasis™ system for infants, as inadvertent pressure regulator settings greater than -20 cmH<sub>2</sub>O may be poorly tolerated.<sup>3</sup>






## Key Points

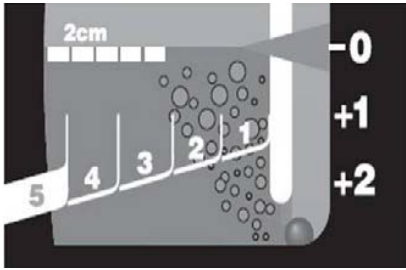
1. The drainage system must be secured in an upright position and at a level **below** the child's chest at all times.
2. Gravity drainage, vacuum assisted (suction) and the required pressure level setting is to be documented in the child's medical records.
3. Clamping the drain in the presence of a pneumothorax with an active air leak can lead to a **tension pneumothorax and is contraindicated**. Exceptions occur when the drainage system requires replacement or when testing the system for air leaks. Seek assistance from an experienced senior nurse or medical officer.
4. The patient tube clamp provided with *in-line* connector models must be kept open when system is connected to patient. The tube clamp must be closed prior to in-line connector separation.
5. The patient pressure float ball (chamber B) should fluctuate up with inspiration and down with expiration near the bottom of the water seal column. For positive airway assisted ventilation however movement of the ball will be the opposite i.e. down with inspiration, up on expiration. Movement of the ball helps to confirm patency of the catheter.
6. Change the chamber when  $\frac{3}{4}$  full or the sterility of the system has been compromised.

### Equipment at bedside:

1. Two guarded artery forceps (for each drain); easily accessible and kept with the child at all times in the event of accidental disconnection.
2. Spare sterile drainage system.
3. Sterile occlusive dressing and gauze.
4. 2%Chlorhexidine/70% isopropyl alcohol wipes.
5. Bottle of sterile water for irrigation.
6. Emergency resuscitation equipment.

PROCEDURE	ADDITIONAL INFORMATION
<p><b>VITAL SIGNS:</b></p> <p>Document a full CEWT score post insertion.</p> <p>Document pulse, respiratory rate and effort, BP, O<sub>2</sub> saturations, temperature and <b>pain assessment</b> at least 4 hourly.</p> <p>Assess the chest drain insertion site and system tubing as below if any of the above symptoms present.</p> <p>Report <b>immediately</b> any change in the child's condition:</p> <ul style="list-style-type: none"> <li>• Increase respiratory rate</li> <li>• Shallow breaths</li> <li>• Asymmetrical chest movement</li> <li>• Cyanosis/increasing oxygen requirements</li> <li>• Subcutaneous emphysema</li> <li>• Sudden increase in drainage</li> <li>• Signs of haemorrhage</li> </ul> <p>Blocked drain</p>	<p>Refer to <a href="#">PNPM 3.1.1</a> General Observations and Respiratory Assessment</p> <p>The frequency of observations will be determined by the patient's condition.<sup>3</sup> More frequent observations are required for less stable patients.</p>

PROCEDURE	ADDITIONAL INFORMATION
<p><b>DRAIN INSERTION SITE:</b></p> <p>Maintain an airtight seal around the sight with a transparent occlusive dressing.</p> <p>Observe the site for signs of infection: redness, swelling, discharge.</p> <p>Change the dressing if loose, soiled or wet.<sup>4</sup></p>	
<p><b>ASSESSMENT OF CHEST TUBE AND SYSTEM TUBING:</b></p> <p>Ensure the drainage system is below the level of the child's chest in an upright position.</p>	
<p>Check the tubing regularly to confirm:</p> <ul style="list-style-type: none"> <li>there are no kinks or large fluid filled dependent loops.</li> <li>the site dressing is intact with no leaks.</li> </ul>	Impedes drainage.
<ul style="list-style-type: none"> <li>the positive pressure relief valve is not obstructed.</li> </ul>	Prevents accumulation of positive pressure and potential tension pneumothorax.
<ul style="list-style-type: none"> <li>all connections are secure</li> </ul>	Cable ties should be in place and tubing anchored to prevent tension/pulling on the drain.
<p><b>SUCTION:</b></p> <p>Gravity drainage or suction will be ordered by the treating medical officer.</p>	<p><b>Note:</b> With the suction on, patient pressure will equal suction control setting A (regulator or height of water column) plus the height of water seal column B.</p> <p>For gravity drainage (no suction) patient pressure will equal the height of the calibrated water seal column B level only.</p>
<p><b>OASIS™</b></p> <p>Set the control regulator to the prescribed level (default setting is -20cmH<sub>2</sub>O).</p> <p>Set the wall suction to minimum of -80mmHg for pressure settings -20cmH<sub>2</sub>O or above.</p> <p>Observe the bellows on the drainage unit (E):</p> <p>For regulator pressures set at -20cmH<sub>2</sub>O, until the bellows expand to or beyond the arrow mark.</p> <p>For regulator settings less than -20cmH<sub>2</sub>O, any visible expansion of the bellows will confirm suction operation.</p> <p>When lowering the pressure setting: turn the dial to the prescribed level and temporarily depress the manual negativity vent to reduce excess vacuum.</p>	

PROCEDURE	ADDITIONAL INFORMATION
<p><b>OCEAN™</b></p> <p>Check the water level in chamber <b>A</b> is at the prescribed level.</p> <p>Attach suction line to suction port on top of chest drain. Turn suction source on until constant, gentle bubbling occurs in chamber <b>A</b>.</p> <p>To <b>increase</b> pressure setting:</p> <ol style="list-style-type: none"> <li>1. Turn off suction source.</li> <li>2. Remove vent plug, pour water to prescribed level and replace plug.</li> <li>3. Resume suction until gentle bubbling observed.</li> </ol> <p>To <b>lower</b> the pressure setting:</p> <ol style="list-style-type: none"> <li>1. Turn off suction source.</li> <li>2. Remove water using syringe and needle to the desired pressure level via the grommet on the back of the unit.</li> <li>3. Resume suction.</li> </ol>	<p>The suction control stopcock can be adjusted to attain gentle bubbling in suction control chamber.</p> <p>Stopcock should be left in the OPEN or ON position at all times.</p>
<p><b>VERIFY WATER SEAL OPERATION:</b></p> <p>At regular intervals, check the water level in chamber B is filled to 2cm: Do not overfill above the 2cm line.</p> <p><b>Do not</b> obstruct the positive relief valve</p>	<p>Add or remove water from the water seal chamber via the back of the drainage unit set with a syringe and 20 gauge or smaller needle.</p>
<p><b>ASSESSING FOR AIR LEAK: Bubbling</b></p> <p>Intermittent or continuous air bubbles going from right to left in chamber <b>C</b> will confirm an air leak.</p> <p><b>Intermittent bubbling</b> in the water seal chamber can be seen when the child with a pneumothorax exhales or coughs.</p> <p><b>Continuous bubbling:</b> indicates large air leak between the drain &amp; the patient. Check drain for disconnection, dislodgement and loose connection, and assess patient condition. Notify medical staff immediately if problem cannot be remedied.</p> <p><b>No bubbling</b> indicates no air leak is present and either:</p> <ol style="list-style-type: none"> <li>1. The pneumothorax has resolved.</li> <li>2. The chest drain is not patent.</li> </ol>	<p><b>Do not clamp</b> a bubbling chest drain in the presence of a pneumothorax as this risks causing a tension pneumothorax.</p>  <p>5=large air leak      1=small air leak</p>
<p><b>ASSESSING DRAINAGE</b></p> <p>Monitor the colour and consistency of drainage.</p> <p>Notify medical staff if there is any change or if blood is suddenly present.</p>	

PROCEDURE	ADDITIONAL INFORMATION
<p><b>ASSESSING DRAIN PATENCY:</b></p> <p>If suction being applied, turn off temporarily. Check for oscillation or 'swing' of the patient pressure float ball in the water seal chamber B coinciding with patient respiration.</p>	<p>The patient pressure float ball should fluctuate up with inspiration and down with expiration. Movement of fluid in the tubing should also coincide with patient respirations.</p>
<p><b>Failure to swing may be due to:</b></p> <ul style="list-style-type: none"> <li>• Kinking of the tube</li> <li>• Fluid filled dependent loops</li> <li>• Blockage by clots</li> <li>• Catheter displacement</li> <li>• Resolved pneumothorax and complete re-expansion of the lung</li> </ul> <p>If in any doubt about the patency, liaise with senior nurse or medical staff.</p>	<p>'Milking' or 'stripping' patient tubing is <b>not</b> recommended as this can cause an increase in intrathoracic pressure and risk tension pneumothorax.<sup>5</sup></p> <p>Only milk or strip a tube if obstruction is restricting drainage and then only the portion of tube that is blocked.<sup>6</sup></p>
<p><b>RECORDING DRAINAGE:</b></p> <p>Record the amount of drainage (collection chamber D) hourly on the fluid balance chart.</p> <p>Inform medical staff/ shift coordinator if sudden cessation of or excessive drainage.</p>	
<p><b>SPECIMEN COLLECTION</b></p> <p>Use PPE and aseptic non touch technique.<sup>7</sup></p> <p>Prior to sampling, swab the port or tubing with 2% chlorhexidine/alcohol wipe. Allow to dry.</p> <p>Two methods:</p> <ol style="list-style-type: none"> <li>1. Directly from the luer lock access port.</li> </ol>	
<ol style="list-style-type: none"> <li>2. Directly from the patient tubing <ul style="list-style-type: none"> <li>• Form a dependent loop in the patient tubing.</li> <li>• Insert a 20gauge needle or smaller at an oblique angle and withdraw fluid.</li> </ul> </li> </ol>	<p>Do not puncture the tube with an 18 gauge or larger needle.<sup>1,2</sup></p>
<p><b>CLAMPING THE CATHETER:</b></p> <p>Clamp catheter <b>only</b>:<sup>5,6,8</sup></p> <ul style="list-style-type: none"> <li>• If the drainage unit is to be moved above the level of the child's chest.</li> <li>• When changing the drainage set or on the instruction of a medical officer.</li> <li>• In an emergency if there is any break in the circuit.</li> </ul>	<p>Prolonged unnecessary clamping may cause a tension pneumothorax to develop.</p>

PROCEDURE	ADDITIONAL INFORMATION
<p><b>DOCUMENTATION:</b></p> <p>1-4 hourly patient observations on CEWT chart 1-4 hourly pain assessment One hourly:</p> <ul style="list-style-type: none"> <li>• Drainage volume &amp; appearance</li> <li>• Presence/absence of bubbling</li> <li>• Presence/absence of swinging</li> <li>• Pressure level setting (column A)</li> <li>• Water seal level (column B)</li> </ul> <p>Report any change in the child's condition immediately and document in patient records</p> <p>Document on the fluid balance/intercostal record charts.</p>	<p>Hourly observations if requiring oxygen or narcotic infusion. Refer to relevant protocols.</p>
<p><b>COMPLICATIONS AND PRECAUTIONS:</b></p> <p><b>Accidental drain removal</b> Apply pressure to the site. Seal with steri-strips and cover with an occlusive dressing. Immediately inform medical officer. Closely monitor the child's cardio-respiratory status.</p>	
<p><b>Accidental disconnection</b> Clamp tubing as close to the chest wall as possible. Clean the ends and reconnect to a new drainage system if contaminated. Check patient's vital signs and notify medical officer</p>	
<p><b>If the chest drain unit is knocked over</b> If the chest drain has been knocked over, set it upright. Check the fluid levels. If a significant amount of blood has entered the water seal, change the drainage system.</p>	<p>Adjust as necessary.</p>
<p><b>Manual high negativity vent</b> DO NOT use the manual negative pressure release valve when on gravity drainage.</p>	<p>The valve can be used to manually lower the height of the water seal column or patient pressure.</p>
<p><b>Positive pressure valve</b> DO NOT obstruct the positive pressure valve.</p>	<p>The valve automatically releases accumulated pressure.</p>


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