Chest Drainage and Chest Tube Management

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GUIDING PRINCIPLES

Chest tubes are inserted to remove air and/or fluid from the pleural space, and to re-establish normal intrapleural pressure. Chest tubes are inserted into the mediastinal space at the end of open heart or mediastinal surgery to facilitate removal of blood and clots and prevent cardiac tamponade.

DEFINITIONS

Intrapleural: The potential space between the visceral and parietal pleura, which is filled with approximately 4 mls of lubricating fluid.

Intrapulmonic: Pertaining to, or affecting, the spaces within the lungs.

Fluctuation/Tidaling: A normal gentle rocking of fluid in the chest tube water-seal system, indicating that the system is functioning properly. There is no fluctuation in the mediastinal drainage system because the tube is not placed in the lung cavity and therefore does not reflect intrapleural changes.

Mediastinal Space: A space in the center of the chest between the sternum and the spine, and between the lungs, which contains the heart and great vessels.

Subcutaneous Emphysema: The presence of free air or gas in the subcutaneous tissues. Often described as feeling like “Rice Krispies” under the skin.

Tension Pneumothorax: A life-threatening complication which occurs when air accumulates in the pleural space causing intrapleural pressure to increase leading to collapse of the lung, a shift in the mediastinum, and severely impedes venous return and cardiac output.

A. ASSISTING WITH CHEST TUBE INSERTION (RN)

POLICY

1. Insertion of a chest tube is performed by a physician, or physician delegate.
2. Obtain baseline vital signs, O₂ saturation and respiratory assessment prior to chest tube insertion.
3. Monitor vital signs, O₂ saturation, pulmonary status, amount and type of drainage and insertion site dressing every 15 minutes for the first 2 hours post insertion, then every 4 hours, or as determined by patient status.

GUIDING PRINCIPLES

1. Intra-thoracic pressure is negative or less than atmospheric pressure. Drainage of air or fluid from the pleural or mediastinal space requires a seal or valve which permits drainage but prevents air from entering the chest cavity.
2. The Heimlich valve (a one way valve system) is used to evacuate air only.
3. An underwater seal is used to facilitate drainage of both air and fluid from both the pleural and mediastinal spaces; and is incorporated in both commercially available chest drainage units (CDUs) and institutionally specific drainage systems (glass bottle systems used post CABG).

4. Chest drainage units are available for both one chest tube (single CDU) and two chest tubes (double CDU). Refer to manufacturer’s guidelines for specific instructions regarding set-up. Double CDUs should not be used for a single chest tube.

5. All chest drainage units (CDUs) have three basic components:
   5.1. Collection Chamber in which fluid that drains through the chest tube is collected.
   5.2. Water-Seal Chamber which acts as a one-way valve so air can exit from the pleural space but cannot return to the patient.
   5.3. Suction-Control Chamber which is water-filled or dry suction. The CDU’s vacuum line tubing is connected to wall suction and the CDU suction is set to the ordered level.

6. The suction source is via wall vacuum outlet. Suction is controlled at the wall outlet by connecting a chest suction adaptor (e.g. a vacuum bayonette) and setting it to create a “gentle bubbling” in the suction chamber. The degree of suction is controlled by the level of water in the suction chamber of system.

7. A petrolatum-impregnated gauze dressing, such as Jelonet, is used at the chest tube insertion site.

8. Patients often experience pain during chest tube insertion. Administer analgesics, as ordered, prior to procedure.

**EQUIPMENT**


**PROCEDURE**

2. **Exception:** Nurses do not “milk” or “strip” a pleural chest tube.
3. Incorporate the above guiding principles

*For Quick Reference Guide on Insertion of a Chest Tube, Refer to Appendix A.*

**B. CARE OF THE PATIENT WITH A CHEST TUBE (RN/LPN)**

**POLICY**
1. The RN retains overall responsibility for monitoring of chest drainage and assessment of the CDU. The LPN may assist in caring for the patient with a chest tube, but should notify the RN of any complications or abnormal findings.

2. Pain management, respiratory status, chest tube dressing, connections, kinks in tubing, drainage and CDU are to be assessed at the beginning of each shift and then every 4 hours, or more frequent as indicated by patient status. **An obstructed chest tube can result in a tension pneumothorax.** Assessment is to be documented on the Nursing Flow Sheet.

3. Document the amount of chest tube drainage on the In/Out Record at the end of each shift.

4. It is the responsibility of the RN to change the CDU.

5. Chest tubes are clamped briefly (i.e. for less than one minute) to check for an air leak or to change the CDU. Clamping of a chest tube for indications other than stated, is by a physician order only.

6. Never clamp a chest tube when a patient is ambulating or being transported, unless ordered by a physician.

7. Nurses **do not** “milk” or “strip” a pleural chest tube.

8. The CDU is to remain upright and below level of tube insertion.

9. Chest tube drains are not to be pinned to clothing or linen for stabilization.

**GUIDING PRINCIPLES**

1. In a non-mechanically ventilated patient, fluid in the water-seal chamber should rise with inspiration and fall with expiration. The opposite occurs in a mechanically ventilated patient.

2. Fluctuation tells you the drainage system’s tubing is patent. The absence of fluctuation indicates that either the lungs have re-expanded, or there is a kink or obstruction in the tubing.

**PROCEDURE**


*For Quick Reference Guide on Chest Tube Care and Management refer to Appendix B*

**C. CHANGING THE CHEST TUBE DRESSING (RN/LPN)**

**POLICY**
1. The RN is responsible for performing the initial dressing change to the chest tube insertion site. Subsequent dressing changes may be delegated to the LPN.

**Exception** - 6A Thoracic Surgery where LPNs can perform the initial dressing change.

1.1. The RN is responsible to assess the patient for any special considerations prior to delegating the procedure and may be required to assess the site during the dressing change. The LPN is responsible to notify the RN of any complications or abnormal findings.

2. Chest tube dressings are to be changed every three days, or more frequently if soiled or loose.

**EQUIPMENT**

- Sterile Dressing Tray
- Sterile Normal Saline
- Dressings:
  - Petrolatum-impregnated gauze (e.g. Jelonet)
  - Drain dressings (2)
  - Abdominal dressing (1)
  - Elastoplast
- 1 Pair of Clean gloves
- 1 Pair of Sterile gloves

**PROCEDURE**

1. Assemble supplies on sterile dressing tray at the patient’s bedside.
2. Position patient so can easily access dressing.
3. Apply disposable gloves.
4. Loosen Elastoplast
5. Carefully remove dressing, one layer at a time, while anchoring chest tube.
6. Note characteristic of drainage on dressing.
7. Inspect skin around tube insertion site for redness, edema, drainage, and signs of subcutaneous empysema.
8. Remove disposable gloves.
9. Apply sterile gloves.
10. Cleanse around insertion site with Sterile Normal Saline and dry with sterile gauze.
11. Apply petrolatum-impregnated gauze (Jelonet) dressing around chest tube at insertion site.
12. Slide drain dressings around tube at insertion site.
13. Apply abdominal dressing.
15. Document dressing change on Nursing Flow Sheet, and notify physician of any abnormal findings.

**D. CHANGING THE CHEST DRAINAGE UNIT (RN)**

**POLICY**

1. It is the responsibility of the RN to change the CDU.
2. CDUs are changed when the collection chamber is full, or if there is a problem detected in the CDU (e.g. leak in the drainage system).

**EQUIPMENT**

- CDU (Refer to manufacturer’s directions for specific set-up instructions).
- Sterile Rubber-tipped hemostats.
- Water-proof tape for connections.
- Clean Gloves

**PROCEDURE**

1. Set up new CDU.
2. Disconnect existing CDU from suction.
3. Apply clean gloves.
4. Remove water-proof tape from connections.
5. Clamp chest tube at insertion site with rubber-tipped hemostats.
6. Promptly remove existing CDU tubing from chest tube and apply new CDU.
7. Unclamp chest tube.
8. Apply water-proof tape to connection sites.
9. Tie off tubing on old CDU and discard.

**E. ASSISTING WITH CHEST TUBE REMOVAL (RN)**

**POLICY**

1. Removal of a chest tube is the function of a physician or Specialty Nurse Practitioner.
2. An air-occlusive dressing with petrolatum-impregnated gauze needs to be applied to site immediately upon removal of the chest tube.

3. Initial dressing applied after removal of the chest tube must remain in place for 48 hours, then replace with a bandaid if no drainage.

**EQUIPMENT**


**PROCEDURE**


**REFERENCES**


**RELATED CAPITAL HEALTH DOCUMENTS**

Quick Reference Guides:  
Pleural Chest Tube Insertion Checklist (Appendix A)  
Bedside Checklist: Chest Tube Care and Management (Appendix B)
HISTORICAL DATES

Integrated – September 2006. Replaces:
- TOMH - Chest Tubes with underwater seal drainage, Sep 1999, (I-w-10)
- QEII - Chest drainage and chest tube management, Mar 2001, (NC103090)
- DGH - Chest Tube insertion with Argyle (sentinel seal) chest drainage unit, Apr 1998,
- Hants - Chest Tubes, June 1995
APPENDIX A
Pleural Chest Tube Insertion Checklist

(Please note: This is a Quick Reference Guide and does not replace reviewing the Policy and Procedure for Chest Drainage and Chest Tube Management)

<table>
<thead>
<tr>
<th>EQUIPMENT</th>
<th>(Return to Assist with Insertion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRAINAGE SYSTEM – AS DIRECTED BY PHYSICIAN</td>
<td></td>
</tr>
<tr>
<td>• Chest Drainage Unit (CDU) – Fluid and Air (Instructions for Set-up Inside Package)</td>
<td></td>
</tr>
<tr>
<td>• Heimlich Valve – Air Only</td>
<td></td>
</tr>
<tr>
<td>CHEST TUBE – TYPE AND SIZE AS DIRECTED BY PHYSICIAN</td>
<td></td>
</tr>
<tr>
<td>• If using Heimlich Valve, Tube Comes in Package with Valve</td>
<td></td>
</tr>
<tr>
<td>CHEST TUBE INSERTION TRAY</td>
<td></td>
</tr>
<tr>
<td>• Need to be Accessible at All Times.</td>
<td></td>
</tr>
<tr>
<td>PROCEDURE CART</td>
<td></td>
</tr>
<tr>
<td>• Local Anesthetic, Gloves, Sutures, etc.</td>
<td></td>
</tr>
<tr>
<td>DRESSING</td>
<td></td>
</tr>
<tr>
<td>• Petroleum-impregnated Gauze (such as Jelonet), Drain Sponges, ABD Pads, &amp; Elastoplast Tape</td>
<td></td>
</tr>
<tr>
<td>*IF SUCTION ORDERED:</td>
<td></td>
</tr>
<tr>
<td>• Obtain Chest Suction Adaptor (e.g. a Vacuum Bayonet) and Suction Tubing</td>
<td></td>
</tr>
<tr>
<td>• Fill Suction Chamber of Drainage System to Suction Level Ordered</td>
<td></td>
</tr>
</tbody>
</table>

PROCEDURE: Assist Physician

MEDICATE SYSTEMICALLY AS ORDERED PRE-INSERTION

POSITION PATIENT AS APPROPRIATE FOR TUBE PLACEMENT:

• Air- Placement is Anterior, between 3rd and 5th Intercostal Spaces
• Fluid- Placement is Lateral or Posterior, between 5th and 8th Intercostal Spaces

LOCAL ANESTHETIC

INSERTION OF TUBE AND SUTURING

DRAINAGE SYSTEM APPLIED

AIR OCCLUSIVE COMPRESSION DRESSING

WATER-PROOF TAPE AT CONNECTION SITES

CHECK SYSTEM FOR LEAKS

*IF ORDERED- APPLY WALL SUCTION TO GENTLE BUBBLING IN SUCTION CHAMBER

POST INSERTION CHEST X-RAY

DOCUMENT IN CHART AND KARDEX

DOCUMENTATION – INSERTION, EVERY SHIFT AND PRN:

TUBE SIZE (ex: #32Fr.)

LOCATION

PATIENT ASSESSMENT:

• Vital Signs including SpO₂
• Respiratory Assessment Including Breath Sounds
• Pain Management
• Dressing: Site Assessment with Change

DRAINAGE SYSTEM ASSESSMENT:

• Amount and Colour of Drainage
• Fluid Level in Underwater Seal Chamber
  ➢ At 2cm Level
  ➢ Tidaling with Respiration and No Air Bubbles
• Wall Suction in CM H₂O Pressure
APPENDIX B
Bedside Checklist: Chest Tube Care and Management

(Please note: This is a Quick Reference Guide and does not replace reviewing the Policy and Procedure for Chest Drainage and Chest Tube Management)

Return to ‘Care of the Patient with a Chest Tube’

Routine Patient Assessment

- Vital signs including SpO2
- Respiratory Assessment including Breath Sounds
- Pain Assessment and Management
- Dressing- site assessment Q3 days with change or PRN
- Drainage System (Underwater Seal System)
  - Connections and tubing
  - Amount and colour of drainage
  - Underwater seal level @2cm
  - Fluctuation with respirations
  - Leak check
  - Suction tubing connection- if suction is not ordered, tubing should remain unclamped and uncapped.

- Wall suction (*if ordered)
  - Confirm water level in suction chamber is as ordered
  - Confirm chest suction adaptor (e.g. vacuum bayonet) is in place
  - Adjust suction to gentle bubbling
  - If patient leaving unit for test, remove wall suction tubing from suction tubing connection on top of drainage system and leave unclamped and uncapped.

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vital signs including SpO2</td>
<td>- Obtain baseline</td>
</tr>
<tr>
<td>Respiratory Assessment including</td>
<td>- Encourage DB&amp;C</td>
</tr>
<tr>
<td>breath sounds</td>
<td></td>
</tr>
<tr>
<td>Pain Assessment and Management</td>
<td>- Patients with a chest tube will often experience discomfort; appropriate pain management will promote the patients ability for mobilization and DB&amp;C</td>
</tr>
<tr>
<td>Chest Tube</td>
<td>- Tube- check all connections are secured with waterproof tape</td>
</tr>
<tr>
<td></td>
<td>- Ensure tube is free of kinks and</td>
</tr>
<tr>
<td><strong>CHEST TUBE DRESSING</strong></td>
<td>DEPENDENT LOOPS THAT WILL INTERFERE WITH DRAINAGE</td>
</tr>
<tr>
<td>-------------------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>- ROUTINE DRESSING CHANGE Q3DAYS, PRN</td>
<td></td>
</tr>
<tr>
<td>- DRESSING- OCCLUSIVE DRESSING (JELONET) @ EXIT SITE, DRAIN SPONGES, COMPRESSION DRESSING AND TAPE TO SECURE</td>
<td></td>
</tr>
<tr>
<td>- MAY USE “NO STING BARRIER SPRAY” TO PROTECT SKIN PRIOR TO TAPE FOR PATIENTS WHO MAY BE SENSITIVE TO THE ADHESIVE</td>
<td></td>
</tr>
</tbody>
</table>

| **CHEST TUBE SITE** | - DURING DRESSING CHANGE, CHECK THAT TUBE IS SECURED WITH SUTURE, NO VISIBLE TUBE EYELETS AT EXIT SITE, ASSESS AND DOCUMENT PRESENCE OF SUBCUTANEOUS EMPHYSEMA |

<table>
<thead>
<tr>
<th><strong>DRAINAGE</strong></th>
<th>- AMOUNT, COLOUR, AND CONSISTENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- DRAINAGE OF &gt; 100MLS /HR FOR MORE THAN 2 HOURS, NOTIFY PHYSICIAN- DUE TO RISK FOR HYPOVOLEMIA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>DRAINAGE SYSTEM</strong></th>
<th>- CHECK UNDERWATER SEAL LEVEL IS AT 2CM OFF SUCTION (INDICATED BY DOTTED LINE TO LEFT SIDE OF U COLUMN)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- IF LEVEL IS HIGHER:</td>
</tr>
<tr>
<td></td>
<td>* TROUBLE-SHOOT FOR KINKS/OBSTRUCTION,</td>
</tr>
<tr>
<td></td>
<td>* MAY NEED RELEASE OF EXCESSIVE NEGATIVE PRESSURE BY DEPRESSING RELIEF VALVE ON TOP OF DRAINAGE UNIT (** PRESSING RELIEF VALVE ADDS FILTERED AIR INTO THE SYSTEM, SO SHOULD NOT BE DONE TO EXCESS)</td>
</tr>
<tr>
<td></td>
<td>* MAY BE RE-EXPANSION OF LUNG</td>
</tr>
<tr>
<td></td>
<td>- IF LEVEL IS LOWER:</td>
</tr>
<tr>
<td></td>
<td>* FLUID MAY HAVE EVAPORATED; ADD STERILE WATER TO UNDERWATER SEAL CHAMBER BACK TO 2CM LEVEL</td>
</tr>
<tr>
<td></td>
<td>- ASSESS FOR TIDALING WITH RESPIRATIONS-FLUID LEVEL IN UNDERWATER SEAL WILL MOVE AND FLUCTUATE</td>
</tr>
</tbody>
</table>
- BUBBLING NOTED IN THE UNDERWATER SEAL COULD INDICATE A LEAK

<table>
<thead>
<tr>
<th>WALL SUCTION (requires Dr.’s order)</th>
</tr>
</thead>
<tbody>
<tr>
<td>- WALL SUCTION NEEDS TO HAVE A CHEST SUCTION ADAPTOR IN PLACE</td>
</tr>
<tr>
<td>* THIS CHEST SUCTION ADAPTOR ONLY REGULATES FLOW OF SUCTION ALLOWING THE CDU TO MAINTAIN REGULATION OF THE PRESSURES WITHIN THE SYSTEM AND THE THORAX.</td>
</tr>
<tr>
<td>- TURN SUCTION OFF TEMPORARILY TO DO CHECKS</td>
</tr>
<tr>
<td>- CONFIRM FLUID LEVEL IN SUCTION CHAMBER IS AT LEVEL ORDERED</td>
</tr>
<tr>
<td>* IF LOW, ADD STERILE WATER VIA OPENING AT TOP OF SUCTION CHAMBER THEN REPLACE PLUG</td>
</tr>
<tr>
<td>* IF WATER LEVEL HIGHER THAN SUCTION LEVEL ORDERED, REMOVE EXCESS VIA THE SELF-SEALING DIAPHRAGM ON THE FRONT OF THE SUCTION CHAMBER USING AN ALCOHOL PREP, NEEDLE AND SYRINGE.</td>
</tr>
<tr>
<td>- CHEST SUCTION ADAPTOR SHOULD BE TURNED ON TO A LEVEL THAT DELIVERS A GENTLE BUBBLING WITHIN THE SUCTION CHAMBER ONLY</td>
</tr>
<tr>
<td>- IF THE PATIENT LEAVES THE UNIT FOR TEST, ETC., REMOVE WALL SUCTION TUBING AND LEAVE SUCTION CONNECTION TUBE ON TOP OF DRAINAGE SYSTEM UNCAPPED AND UNCLAMPED TO ALLOW AIR TO EXIT AND TO MINIMIZE THE POSSIBILITY OF TENSION PNEUMOTHORAX</td>
</tr>
</tbody>
</table>