Children's National Hospital
Division of Nursing & Patient Services

# Nursing Practice Guideline
# Chest Tube Management

Chapter: Respiratory 1

Date Effective: 08/03
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## I. Definitions/Explanations

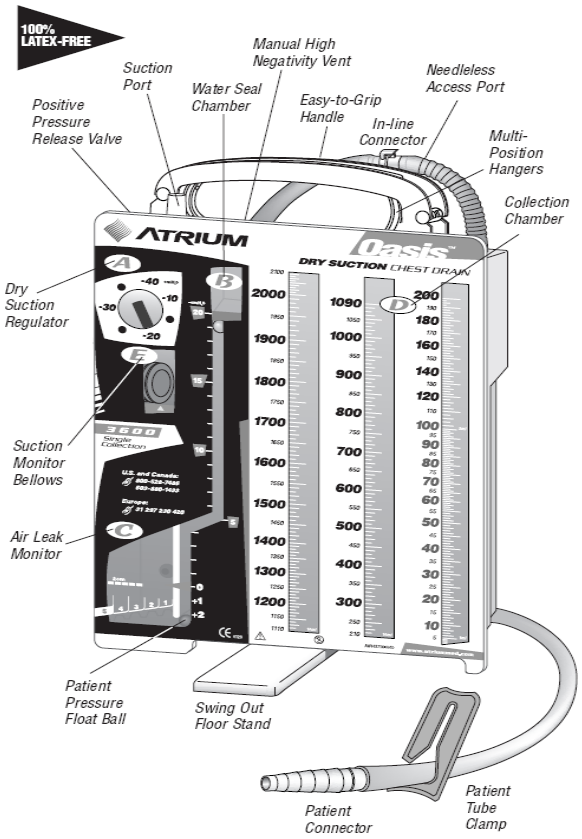
**A.** The primary purpose of a chest tube is to evacuate air, fluid, or blood from the pleural space. Placement is confirmed on CXR film. The chest drainage system

removes air or fluid from the pleural space and prevents the backflow of air and fluid into the pleural space. All connection points are banded to ensure that the system remains airtight.

**B.** Closed chest tube drainage systems use gravity or suction to restore intrapleural negative pressure. Chest tubes are connected to an underwater seal drainage system so that air can only escape from and not enter the pleural space. The triple-chamber systems consist of (1) a drainage collection chamber to (2) a water-seal chamber connected to (3) a vacuum-control chamber. All three are positioned side by side in a molded plastic disposable unit. The drainage unit should be placed below chest level even while the patient is being transported.

## II. Chest Tube Drainage System

**A.** Dry Chest Tube Drainage System



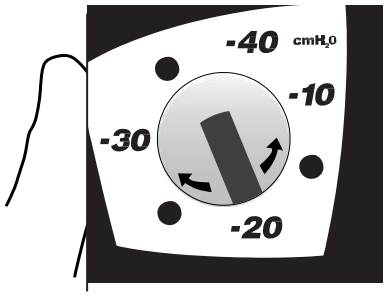

**1.** System Setup/Change

a. <u>Open floor stand for set-up.</u> Always place chest drain below the patient's chest in an upright position. To avoid accidental knock over, open the floor stand for secure placement on floor (for additional security, the floor stand

may be taped to floor) or hang the system on the bedside with the hangers provided.

b. Fill Water Seal with sterile water to the 2-cm line. Fill water seal chamber with the 45ml pre-packaged water container located on the back of the Atrium Oasis chest drain unit. The water seal chamber must be filled to 2cm mark prior to use and should be checked regularly.

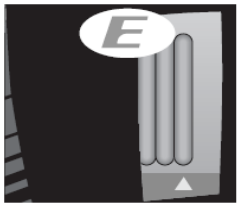
c. Adjust suction dial to prescribed pressure level. The suction dial comes preset at -20 cmH20. To adjust the suction pressure below -20 cmH20 adjust the rotary dry suction control dial located on the side of the drain. **Dial down to lower** suction pressure and **dial up to increase** suction pressure.




d. Connect chest tube drain to patient. Remove patient tube connector cap(s) and insert stepped tube connector(s) into patient catheter(s). Ensure all connections between patient and suction source are secure. Connect chest drain to patient prior to initiating suction.

e. Turn suction source on. The suction source should provide a minimum vacuum pressure of -80mmHg at 20 liters of air flow per minute (**set suction at med/high).**

f. Suction monitor bellows. **The bellows (E) will expand only when suction is operating.** When the suction control regulator is set at -20cmH20 or higher the bellows must be expanded to the ▲ or beyond when suction is operating. If the bellows is observed to be expanded, but less than the ▲ mark, the suction source vacuum pressure must be increased to -80mmHg or higher. For a regulator setting less than -20cmH20 (-15cmH20), any observed bellows expansion across the monitor window will confirm suction operation. The bellows does not need to be expanded to the ▲for pressures less than -20cmH20, just visibly expanded to confirm suction operation.



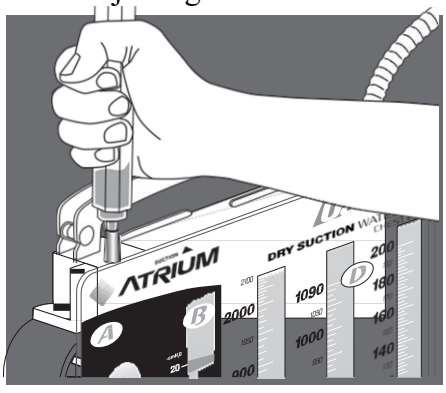
*Bellows expanded to ▲ mark or beyond confirms adequate suction operation.*

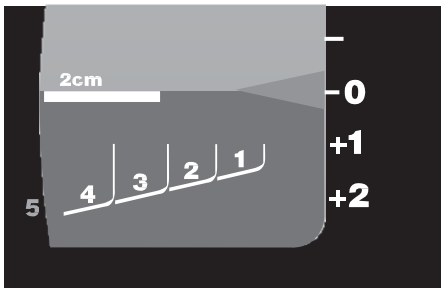
g. Avoid dependent loops (occurs when tubing forms a U-shape that requires fluid in the tube to flow against gravity to reach the distal end of the tube).
h. <u>For gravity drainage</u>: the drain should be placed below the patient's chest in an upright position. Disconnect the suction source vacuum line from the suction port. (**The bellows will not expand during gravity drainage).**
i. Anchor Chest Tube drainage tubing to prevent dislodgment and skin integrity issues (no safety pins)

**B.** Recording Drainage Volume

**1.** Single Collection Model: The first collection section is calibrated in 1 mL increments up to 100mL and 2mL increments up to 220mL. Subsequent collection sections are calibrated in 5mL increments up to a maximum capacity of 2000mL. (** Dual/infant/peds/ATS)
**2.** On arrival to floor, level of drainage should be dated and timed.
**3.** Every 4 hours, the level should be marked, dated and timed.
**CICU/PICU/PACU** – Q1h x first 12 hours, then Q2h until removal of chest tube or per provider discretion.

**C.** Adjusting Water Level to Match the Physician's Order:

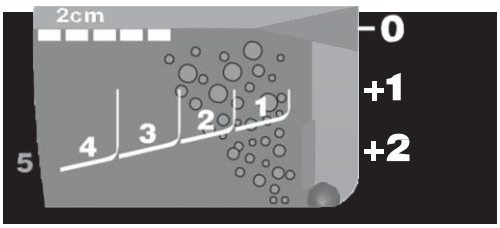



<u>Water seal chamber</u>: If the water falls below the 2-cm mark in the water-seal chamber, sterile water or sterile saline may be added via the suction port located on top of the drain. Once filled, water becomes tinted blue for improved visibility of air leaks and convenient monitoring of patient pressures.

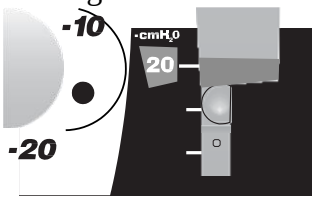
**D.** Observe Water Seal for Patient Air Leaks

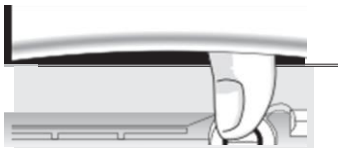
1. When checking for air leak, temporarily stop suction for 5 seconds or less to assess water levels and assess for air leak.
2. A patient air leak is confirmed when air bubbles are observed going from right to left in the air leak monitor.
3. Continuous bubbling in the water seal air leak monitor will confirm a persistent air leak.
4. Intermittent bubbling with float ball oscillation will confirm the presence of an intermittent air leak.
5. No bubbling will indicate no air leak is present.




**E.** Observe changes in Patient Pressure

1. Changes in patient pressure can be determined by observing the small patient pressure float ball in the calibrated water seal column.
2. When connected to suction, patient pressure will equal suction control setting (water level in the suction chamber) plus the float ball level. For gravity drainage, patient pressure will equal the float ball level only.
3. To manually lower the height of the water seal column (patient pressure when connected to suction), temporarily depress the filtered manual vent, located on top of the drain, until the water column lowers to the desired level. Do not lower water seal column when the patient is on gravity drainage.



Do not use when suction is not operating

**F.** Post Chest Tube Insertion Complications:

| Complication | Cause | Assessment Changes |
|---|---|---|
| | | |

| | | |
|---|---|---|
| Hemorrhage | Chest tube placement or other condition, e.g., hemophilia, DIC, etc. | • Pallor<br>• Tachycardia<br>• Hypotension<br>• Agitation<br>• Altered level of consciousness<br>• Excess blood in chest drainage device<br>** Greater than 3 mL/kg/hour for 3 hours or 5 mL/kg in one hour constitute **significant** hemorrhage. Notify physician and monitor Intake and Output closely. |
| Dehydration | Inadequate fluid replacement | • Tachycardia<br>• Dry mucous membranes<br>• Pallor<br>• Altered level of consciousness (late sign)<br>• Hypotension (late sign) |
| Suspected drainage failure | Chest tube leak, disconnection, displacement, removal, occlusion, kinking, or tipping of the chest drainage system container. | • Labored/rapid breathing<br>• Decreased breath sounds<br>• Asymmetrical chest expansion<br>• Subcutaneous emphysema/crepitus<br>• Tachycardia/ bradycardia<br>• Hypertension/hypotension<br>• Desaturation with or without cyanosis<br>• Drainage decreased or absent<br>• Signs/symptoms of cardiac tamponade (muffled heart sounds, distended neck veins, deviated trachea, tachycardia, hypotension, increased central venous pressure) |
| Air leak in system | Leak in thoracic cavity or poor chest tube connections | Water seal bubbles excessively and continuously. If bubbles stop when the chest tube is clamped close to the exit site from the patient, suspect air leak in thoracic cavity. If bubbling continues, suspect air leak in the system. |
| Excessive negative pressure in water seal chamber | Coughing, labored breathing, cry, vigorous chest tube stripping | Sudden increased water level in the seal chamber. |

## III. Care of the Patient with a Chest Tube

### A. Report:

1. Age/admitting diagnosis
2. Reason for /date of chest tube placement
3. Size, suction type and number and location of chest tubes.
4. Drainage (amount, color, etc.)

**B. Bedside equipment**: Bedside supplies to be kept at the bedside and travel with the patient at all times.

1. Sterile Vaseline gauze (or lubricating jelly with gauze)
2. Sterile gauze
3. Tape (x2)
4. Chest tube clamps (2); CICU/PICU – One clamp at beside for EACH chest tube

**C. Unit equipment**: Equipment to be readily available on nursing units **at all times.**

1. Sterile 4 x 4s
2. Suture removal kits
3. Petroleum Gauze
4. Y connectors for suction connecting tubing (ICUs)

**D. Transport**

1. Patient must be escorted by an RN.
2. Obtain order from LP to remove patient from continuous suction and place to water seal for transport. If chest tube must remain to suction, use portable suction. **DO NOT CLAMP CHEST TUBE UNLESS ORDERED BY LP.**
3. Patient should travel with all bedside equipment (see B above).
4. Drainage system should be kept at level lower than chest wall.

**E. Changing set-up from suction to water seal**

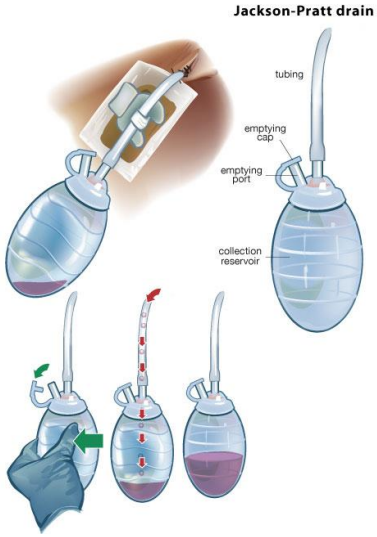
1. Disconnect suction tubing from chest drainage unit.

**F. Dressing Change**

1. Leave chest tube dressing intact unless soiled or loose. See recommendations for loose or soiled dressing changes under trouble shooting below.

**G. PICU/CICU/HKU: Jackson Pratt (JP) Drain without bulb reservoir**

1. Definition: A white silicone drain, which is smaller with multiple side holes and more flexible than the original rigid chest tube and allows patients more ease with mobility and less discomfort with removal. The JP is attached to the closed system chest drainage unit.
2. Ensure tube is not kinked between patient and closed system chest




drainage unit.
3. Keep sharp, pointed instruments away from the JP tubing. The JP tubing should not be sutured or cut in any way.

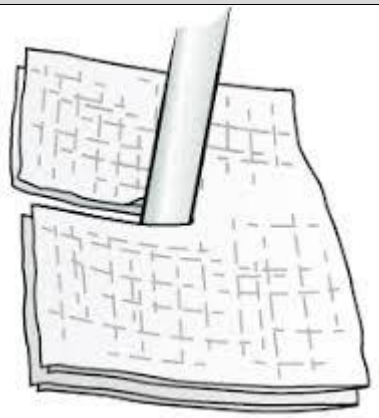
## IV. Routine Assessments/Interventions

| Frequency | Perform | Rationale |
|---|---|---|
| At change of shift and PRN | • Ensure bedside/unit equipment is available (see Section III: B & C)<br>• Validate that chest tube settings match orders. | • Emergency preparedness |
| Q 1 to 4hrs and PRN | • Inspect chest tube system to assure that:<br>1. Tubing connections are secure without air leaks<br>2. Tubing/chest drainage system is draining freely below chest level<br>3. Significant change in amount of drainage<br>4. Bellows on the **dry chest collection** system is visible when connected to suction | • Ensure continued pleural drainage |
| Q 2 hrs x 4, then Q 4 (and PRN) (Q1hr in ICU) | • Assess vital signs<br>• Assess breathing pattern, chest symmetry, breath sounds/quality | • Identify potential complications |

| | | |
|---|---|---|
| | • Critical Care units as per protocol | |
| Q 2- 4 hrs | • Reposition patient<br>• Complete pain Assessment, Intervention, Reassessment (AIR) cycle<br>• Encourage deep breathing/coughing while awake (i.e. use of IS and bubbles) | • Maintain comfort<br>• Control pain<br>• Improve chest tube function/lung aeration |
| Q 4hrs | • Palpate the area around tube insertion site<br>• Check water level in suction and seal chambers. Ensure that water has not risen to the level of the filter valve<br>• Refill chambers with sterile water as necessary<br>• Document chest tube output. | • Assess for subcutaneous emphysema<br>• Maintain optimal chest tube function<br>• Identify fluid need |
| Only per LP order | • Stripping or milking of chest tubes should be practiced only in critical care setting due to increase in negative pressure induced by stripping practice, which may case discomfort, inflict tissue trauma, and may cause bleeding. (Do not use alcohol based products to aid in the stripping process)<br>• Clamping chest tubes is also not advised because trapped air and fluid can accumulate in the pleural space, and a tension pneumothorax may result. | • Promote drainage<br>• Trying to identify an air leak |

## V. Trouble shooting Assessments/Interventions

| Problem | Perform | Rationale |
|---|---|---|
| Air leak | Air leak source suspected **from patient:**<br>• Clamp chest tube close to chest --if bubbling stops, air leak stems from patient<br>• If still bubbling, unclamp tube and apply palmar pressure around insertion site with both hands- if bubbling decreases, notify MD<br>Air leak source suspected **from system:**<br>• Clamp chest tube close to chest – if bubbling continues, air leak stems from system<br>• Secure and tape all connections between- if bubbling decreases, air leak stems from connections or tubing.<br>• If still bubbling, clamp tubing at intervals to identify leak area<br>• If unable to identify leak, replace drainage system. | Air leak source may be coming from the patient or the chest tube system. |
| Loose, soiled dressing | Change chest tube dressing using <u>aseptic</u> technique<br>• First change should be done by LP. Any change thereafter requires a LP order.<br>• Position patient with affected side up<br>• Remove old dressing using adhesive remover if needed to maintain skin integrity<br>• Examine insertion site for erythema/drainage<br>• Cleanse site with Chlorhexidine swabs<br>• Place Vaseline gauze around site **only if ordered.**<br>• Apply non-adherent dressing (e.g. telfa) around chest tube, can be slit and placed in "Y" technique (see images below). | Prevent site contamination |

| Problem | Perform | Rationale |
|---|---|---|
| |  <br>• At insertion site, cover with another 4X4 gauze<br>• Apply transparent dressing to secure dressing to chest<br>• Place date/time/initial on dressing | |
| Chest drainage system is full | Change chest drainage system using aseptic technique<br>• Prepare new drainage system container<br>• Clamp the chest tube **PRIOR** to disconnecting at the in-line connector<br>• Disconnect full drainage system at the in-line connector<br>• Connect to the new drainage system and unclamp chest tube | Ensure continued drainage |
| Chest tube dislodgement | • Immediately place a sterile occlusive dressing on the site and tape it on three sides.<br>• Call for help<br>• Remain with patient, observe for respiratory status changes<br>• Provide ventilatory support as indicated by patient condition<br>• Prepare to assist physician as indicated with insertion of new chest tube<br>• In the event that a chest tube needs to be placed/replaced on a patient and procedural sedation will be used, please refer to the Moderate, Procedural and Deep Sedation for Non-Anesthesiologists for Diagnostic/Therapeutic Procedures | Stabilize respiratory status |

| Problem | Perform | Rationale |
|---|---|---|
| | Policy. Procedural Sedation should only be done in the ICU or ED setting. | |
| Chest tube becomes disconnected | • Immediately clamp chest tube as close to patient as possible<br>• **DO NOT** clamp tube if patient on positive pressure ventilation<br>• Call for help<br>• Remain with patient; observe for respiratory status changes.<br>• Scrub exposed tubing ends with Chlorhexidine<br>• Replace connector using aseptic technique<br>• Replace connector AND drainage system if gross contamination occurs (i.e. stool, urine, vomitus, the floor, etc.)<br>• Reconnect tubing and secure connection with fresh tape | Stabilize respiratory status |
| Chest drainage system tips over | • Return chest drainage system to upright position and secure<br>• Note drainage level(s)<br>• Assess for changes in respiratory status<br>• Change system as indicated | Stabilize respiratory status<br>Drainage can spill over into other chambers. |
| Malfunctioning chest tube drainage system | • Assess for and remove dependent loops in drainage tubing<br>• Ensure all connections between patient and suction source are secure.<br>Change the drainage system if:<br>• The collections chambers are full.<br>• Notify physician/LP for all other system malfunctions | Maintain optimal chest tube function, promote drainage, and identify potential problems |

## VI. Reportable Conditions:

**A.** Air leak
**B.** Absent, excessive, or sudden change in chest tube drainage
**C.** Loose or absent sutures
**D.** Chest tube becomes disconnected, displaced or removed
**E.** Total output exceeds total intake
**F.** Signs of:
  **1.** Hemorrhage
  **2.** Accumulation of fluid and air in chest
  **3.** Dehydration
  **4.** Respiratory distress

**VII. System Disposal:** Handling and disposal of discarded chest drain should be in accordance with CNHS policy for infectious waste. (Red BIO trash bag/can)

**VIII. Patient/Family Education**

- **A.** Review the functions of the chest tube and reasons for having it
- **B.** Review the signs and symptoms of respiratory distress and infection and use teach back for validation of learning. Instruct patient/family on who to report these signs to.
- **C.** Instruct patient/family to report signs and symptoms of pain and review options for pain relief.
- **D.** Contact resources as appropriate, i.e. Child Life, etc.

**IX. Documentation**

- **A.** Identify chest tube site, suction amount, presence/absence of air leak, drainage, and dressing condition. Chest tube output is documented every 2 to 4 hours on the acute care units and 1 to 2 hours in the critical care areas.
- **B.** Assessment of patient status, troubleshooting, and/or development of reportable conditions.
- **C.** Patient/Family education regarding chest tube.

**X. References**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## XI. Reviewers

**A.** Pulmonary Team
**B.** Cardiac Surgery Team
**C.** General Surgery Team
**D.** Shared Nursing Leadership Practice Council – SCU
**E.** Shared Nursing Leadership Practice Council – 7 East
**F.** Shared Nursing Leadership Practice Council – CICU/PICU
**G.** Shared Nursing Leadership Quality & Safe Practice Council – Systems Level

## XII. Legal Statement

The nursing practice guidelines are intended to serve as a reference for the nurses in their practice. The compilation of information provided is drawn from relevant literature research from juried, reliable and respected sources. The guidelines are not intended to replace individual judgment but instead to inform decision making. The material is updated approximately every 12- 24 months.

## XIII. Approval

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Senior Vice President & Chief Nursing Officer Date

Original Date: 08/03
Revised Dates: 08/03, 03/04, 07/06, 11/06, 12/06, 06/08, 06/09, 12/10, 1/12, 2/13, 3/15, 06/17, 01/19, 1/21, 1/22, 9/23