Thunder Bay Regional Health Sciences Centre Policies, Procedures, Standard Operating Practices	No. PAT-5-123
Title: Chest Tube - Care of the Patient (Neonate / Paediatric /Adult)	☒ **Policy** ☒ **Procedure** ☐ **SOP**
Category: Patient Care **Sub-category:** Patient Related: Patient Care	**Distribution:** All patient care areas
Endorsed: EVP, In-Patient Care Programs **Signature**: **Endorsed:** Chief Nursing Executive **Signature**:	**Approval Date:** March 7, 2006 **Reviewed/Revised Date:** Apr. 6, 2021 **Next Review Date:** Apr. 6, 2024

1. PURPOSE

Assist staff in all aspects of chest tube care for patients who require a chest tube.

2. POLICY STATEMENT

Chest tubes are inserted to remove air and/or fluid from the pleural space, and to re-establish normal intrapleural pressure. Appropriate chest drain management is required to ensure patient safety and to minimize the risk of infection, damage, displacement and other complications associated with the care and use of chest tubes.

3. SCOPE

Registered nurses (RN) may provide all aspects of care for all patients with a chest tube. Registered practical nurse (RPN) may provide all aspects of care for stable patients with a chest tube.

4. DEFINITIONS

Atrium Pneumostat Chest Drain Valve: A disposable single patient use chest drainage valve for thoracic drainage with a 30 mL capacity collection volume; primary use is for drainage of air, mobility, transfers and home use.

High Negativity Relief Valve: A valve located at the top of the Underwater Seal Chest Drainage System that filters air into the system to maintain the water level at the ordered suction.

Large Bore Chest Tube: A large flexible plastic tube inserted through the chest wall into the pleural space to drain air or fluid and allow re-expansion of the lung; 20 Fr or greater (**Neonate Consideration:** 8 to 12 Fr; **Paediatric Consideration:** 16 to 24 Fr).

Small Bore Chest Tube (luer-lock): A small flexible catheter inserted through the chest wall into the pleural space to drain air or non-viscous fluid and allow re-expansion of the lung; can also be used to flush or instill medications; usually a pigtail drain; smaller than 20 Fr (**Neonate/Paediatric Consideration:** Pigtail tip catheters with smaller diameters than traditional chest tubes (as small as 5 Fr); usually softer and more flexible than large bore).

Subcutaneous emphysema: When gas or air is trapped in the layer under the skin that has a characteristic crackling feel to the touch.

Underwater Seal Chest Drainage System: A system that allows draining of the pleural space using an air tight system to maintain sub atmospheric intrapleural pressure; available in Adult/Pediatric and Infant systems.

5. PROCEDURE

The Thunder Bay Regional Health Sciences Centre uses two types of chest drainage systems: Underwater Seal Chest Drainage System and Pneumostat Chest Drain Valve systems.

A. Assessment

1. At the beginning of each shift, the nurse will ensure the following supplies are available at the patient's bedside:
    a. Two rubber tipped forceps (available from Medical Device Reprocessing Department)
    b. 500 mL bottle of sterile water
    c. Petroleum gauze
    d. 4X4 sterile gauze
    e. A spare unopened chest drainage system must be available on the unit (in supply room).

These items must be available at all times in case of accidental dislodgment or disconnection with either the Underwater Seal Chest Drainage System or the Pneumostat

2. Document and perform vital signs as per each department's standard of care.
3. Conduct the following assessments a minimum of every 4 hours or more frequently, if indicated by a change in patient condition (**Neonate/Paediatric Consideration:** Conduct assessments a minimum of every hour for the first 4 hours and then every 2 hours or as patient condition warrants):
    a. Respiratory assessment
    b. Assess insertion site dressing, drainage system connections, tubing, prescribed amount of negative pressure, presence of air-leaks and patency of chest drainage system
    c. Palpate for the presence of subcutaneous emphysema around insertion site.
4. Reinforce chest tube dressing as needed; do not change for the first 24 hours post insertion; change dressing only if soiled, or no longer intact (see Section D: Chest Tube Dressing Changes).
5. Assess and document colour and quantity of drainage from chest tube:
    a. Every hour for the **first** 24 hours
    b. Every 4 hours thereafter or more frequently as patient condition indicates
6. Unless otherwise ordered, report to the physician:
    a. Drainage amounts greater than 250 mL per hour (**Neonate Consideration:** Consult with the Paediatrician**; Paediatric Consideration:** Drainage amounts greater than 5 to 10 mL per kg per hour)
    b. Drainage amounts greater than 1000 mL in 4 hours (**Neonate Consideration:** Consult with the Paediatrician; **Paediatric Consideration:** Drainage amounts greater than 3 mL per kg per hour for 2-3 consecutive hours)
    c. Unusual reoccurrence of bleeding
7. Record and date drainage level on drainage system, minimally once per shift or more frequently as patient condition indicates.
8. Assess the water level in the water-seal chamber once per shift:
    a. **If the water level is low (less than 2 cm):** add additional sterile water to the water-seal chamber through the suction port
    b. **If the water level is too high (greater than 2 cm**): remove excess water from the water-seal chamber using a syringe and needle to access the grommet located on the front of the chest tube unit, just above the air leak meter; aspirate until desired amount of water is removed
9. Ensure that the positive pressure valve located on top of the drainage system is not obstructed.
10. When able, instruct the patient to deep breath, cough and use incentive spirometry every 2 hours.
11. Encourage the patient to change position or reposition patient every 2 hours and ambulate as tolerated to maximize drainage and lung expansion.

B. Underwater Seal Chest Drainage System

- If suction is not ordered, do **not** attach the suction tubing to the suction port on the drainage system as this can mimic clamping the chest tube and will not allow appropriate air ventilation.
- A physician order is required to disconnect a patient from suction for any reason (e.g., tests, ambulation, and toileting).
- Always place the chest drainage system below the patient's chest and keep in an upright position:
  - To avoid accidental knock-over, place the unit on the floor (swing floor stand open).
  - Do not tape chest tube collection system to floor
- Do not depress the manual negativity release valve when the patient is on gravity drainage **(not on suction).**
- When using the dual collection chest drainage system, the potential for overflow of drainage from the yellow chamber to the white chamber exists:
  - To prevent overflow ensure that drainage in the yellow chamber does not exceed 950 mL. If this limit is reached, change the drainage system.
  - The white chamber has a 1900 mL capacity. If this limit is reached, change the drainage system.
  - Both the yellow and white chambers combined can fill to a maximum of 2850 mL. Once the drainage mixes, measuring output is inaccurate because you cannot differentiate the fluid from the appropriate chest tube.

Large Bore Chest Tubes to Underwater Seal System

For set-up and maintenance, maintaining system with or without suction and troubleshooting air leaks please refer to the manufacturer's instructions. For further information, refer to textbooks "Clinical Nursing Skills: Basic to Advanced Skills", "Wong's Nursing Care of Infants and Children" (Paediatric Department), and/or "Merenstein & Gardner's Handbook of Neonatal Intensive Care" (NICU).

Small Bore Chest Tube to Underwater Seal System

Equipment:

- Disposable Chest Drainage System x1
- Sterile Gloves x1
- Antiseptic Wipe (chlorhexidine gluconate 2% and isopropyl alcohol 70% [e.g., SoluPrep]) x2
- Injection Cap (e.g., Baxter one-link) x1
- Multipurpose Tubing Adapter (blue) x1
- Waterproof tape
- Sterile Dressing Tray x1
- 4-way stopcock x1

Procedure:

1. Ensure 4-way stopcock has been applied to small bore chest tube by physician. Nurses in Intensive Care Unit (ICU) may apply.
2. Ensure 4-way stopcock is off to the patient.
3. Open sterile dressing tray.
4. Place sterile equipment onto sterile field.
5. Perform hand hygiene.
6. Set up and prepare new chest drainage system. Refer to the manufacturer's instructions. For further information, refer to "Set-up and Maintenance" in the textbook "Clinical Nursing Skills: Basic to Advanced Skills", "Wong's Nursing Care of Infants and Children" (Paediatric Department) and/or "Merenstein & Gardner's Handbook of Neonatal Intensive Care" NICU.
7. Don sterile gloves.
8. Remove the pre-attached connector from the end of the patient tube of the chest drainage system.
9. Cleanse the top leur lock port on the stop cock with the antiseptic wipe. Scrub the connection site for 30 seconds.
10. Attach the injection cap to the top port of the stopcock.

11. Cleanse the luer lock port on the stop cock opposite the patient with the antiseptic wipe. Scrub the connection site for 30 seconds.
12. Attach the multi-purpose tubing adapter to the luer lock port on the stop cock opposite the patient.
13. Attach the patient tubing of the chest drainage system to the multi-purpose tubing adapter connected to the stopcock.
14. Secure the connection where the patient tubing meets the multi-purpose tubing adapter with water proof tape.
15. Turn the stop cock off to the injection port and open to drain from the patient to the chest drainage system.
16. Remove gloves. Perform hand hygiene.
17. If ordered, attach and turn on the wall suction to achieve desired suction.
18. Assess the patient and the drainage system for proper functioning and patient tolerance.

Changing Chest Tube Underwater Seal System

- Changing the drainage system is only required when the chest drainage system is full or damaged (e.g. broken, knocked over, or loss of underwater seal)

Equipment:

- Disposable Chest Drainage System x1
- Clean Gloves x1
- Rubber tipped forceps(clamp) x1

1. **Procedure:**Perform hand hygiene and don gloves.
2. Set up and prepare new chest drainage system, refer to the manufacturer's instructions. For further information, refer to "Set-up and Maintenance" in the textbook "Clinical Nursing Skills: Basic to Advanced Skills", "Wong's Nursing Care of Infants and Children" (Paediatric Department) and/or "Merenstein & Gardner's Handbook of Neonatal Intensive Care" NICU.
3. Aseptically, disconnect long length of the tubing (at the sampling port clamp) from new, prepared water seal drainage system and discard.
4. Clamp the drainage system tubing (connected to the patient) using rubber tipped forceps. Aseptically, disconnect the existing chest drainage system (connected to the patient) at the sampling port clamp and attach to the new prepared drainage system.
5. Unclamp the drainage system tubing.
6. Remove gloves and perform hand hygiene.
7. If ordered, attach and turn on the wall suction to achieve desired suction.
8. Assess the patient and the drainage system for proper functioning and patient tolerance.

Sampling Drainage Equipment for the Underwater Seal System

Equipment:

- Empty 10 mL syringe x1
- Antiseptic wipe (chlorhexidine gluconate 2% and isopropyl alcohol 70% [e.g., SoluPrep]) x1
- Specimen collection container (as per orders)
- Clean Gloves x1
- Face shield x1

Procedure

1. Perform hand hygiene and don gloves and face shield.
2. Cleanse the needless luer sampling port with the antimicrobial swab for 30 seconds. Allow to dry completely.
3. Attach syringe to the needless luer sampling port and collect the required amount of drainage.
4. Instill the collected sample into the specimen collection container.
5. Remove gloves and face shield and perform hand hygiene.
6. Label the specimen container with the Meditech generated label and add your initials, date and time.

C. Atrium Pneumostat Chest Drain Valve

- Do not attach the Pneumostat to suction
- Not recommended for fluid collection
- Do not use this device after a pneumonectomy
- Do not obstruct the air leak well
- Do not leave syringe attached to the needless port
- Keep the Pneumostat in an upright position as much as possible and below the level of the chest
- Patient may shower if approved by physician, but do not submerge the Pneumostat (after showering, the Pneumostat must be dried off and the air leak well must be dried with a 2x2 gauze)

Set-up, Maintenance and Changing Equipment

Equipment:

- Pneumostat (chest drain valve) kit x1
- Rubber tipped Forceps x1
- Waterproof tape

Procedure:

1. Perform hand hygiene and don gloves.
2. Clamp chest tube with the rubber tipped forceps.
3. Insert the Pneumostat stepped connector end firmly into the chest tube:
   - The stepped connector fits chest tube sizes 24 Fr – 40 Fr.
   - The package contains a small stepped connector for chest tubes less than 24 Fr and also a Luer-lock connector for chest tubes requiring luer connection.
4. Tape connections as indicated previously in this procedure by referring to textbooks “Clinical Nursing Skills: Basic to Advanced Skills”, “Wong’s Nursing Care of Infants and Children” (Paediatric Department) and/or “Merenstein & Gardner’s Handbook of Neonatal Intensive Care” NICU.
5. Unclamp the chest tube by unclamping the rubber tipped forceps.
6. Remove gloves and perform hand hygiene.

Air Leak Detection

Equipment:

- 3 mL syringe x1
- Sterile water for injection vial x1
- Blunt needle x1
- 2x2 gauze x1

Procedure:

1. Draw up 1 mL of sterile water with a 3 mL syringe and blunt needle.
2. Remove blunt needle and dispose in sharps container.
3. Add 1 mL of sterile water to the air leak well.
4. Bubbling in air leak well will confirm that an air leak is present.
5. After observing the air leak, empty the air leak well using a 2x2 gauze to soak up the water.
6. If an air leak is present, refer to “Troubleshooting Chest Tube Air Leaks” in the textbooks “Clinical Nursing Skills: Basic to Advanced Skills”, “Wong’s Nursing Care of Infants and Children” (Paediatric Department) and/or “Merenstein & Gardner’s Handbook of Neonatal Intensive Care” NICU.

Sampling Drainage Equipment for the Atrium Pneumostat Valve System

Equipment:

- 10 or 30 mL luer-lock syringe
- Antiseptic wipe (chlorhexidine gluconate 2% and isopropyl alcohol 70% [e.g., SoluPrep]) x1
- Specimen collection container (as per orders)

Procedure:

1. Keep the Pneumostat in an upright position and make sure that it is firmly attached to the chest tube.
2. Perform hand hygiene and don gloves.
3. Swab the needless sampling port with the antiseptic swab for 30 seconds and allow to dry.
4. Firmly attach the syringe and withdraw the fluid. Occasionally, due to fibrin or clots, this is not possible. In this case, it may not be possible to obtain a sample and if the Pneumostat is full it needs to be replaced (rather than emptied).
5. After withdrawing the fluid, wipe the sampling port with an antiseptic wipe.
6. If specimen obtained:
   - Instill the collected sample into the specimen collection container
   - Remove gloves and perform hand hygiene
   - Label the specimen collection container with the Meditech generated label and add your initials, date and time
7. Discard the syringe into the biohazard disposal.

D. CHEST TUBE DRESSING CHANGES

- Do not change a chest tube dressing for the first 24 hours post insertion
- Reinforce chest tube dressing as needed; change dressing only if soiled, or no longer intact; a physician order is not required (**Neonate Consideration:** frequency of dressing changes will be ordered by the Paediatrician; **Paediatric Consideration:** leave dressing intact and only change with a physician's order when necessary)
- Small bore chest tube dressings must be changed at least every 7 days (**Neonate Consideration:** frequency of dressing changes will be ordered by the Paediatrician; **Paediatric Consideration:** leave dressing intact and only change with a physician's order when necessary)
- If physician orders for chest tube dressing differ from policy, follow physician orders

Large Bore Chest Tube

Equipment:

- Clean Gloves x1 pair
- Sterile gloves x1 pair
- Sterile Dressing tray x1
- Antiseptic applicator (chlorhexidine gluconate 2% and isopropyl alcohol 70% [e.g., ChloraPrep® One-Step]) x 1
- Sterile 4X4 Trach gauze x2
- Sterile 4X4 gauze x2
- Soft cloth surgical tape (e.g., Hypafix® or Medipore™)
- Anchoring securement device (if replacement required)

Procedure:

1. Perform hand hygiene.
2. Assemble necessary equipment.
3. Open dressing tray.
4. Place sterile equipment onto sterile field.
5. Open non-sterile equipment and have easily available.
6. Don clean gloves.
7. Ensure chest tube is secured to patient below the dressing with an anchoring securement device to prevent dislodgement of tube. Replace device if necessary.
8. Remove old dressing.
9. Assess exit site and confirm sutures intact.
10. Cleanse the insertion site with antiseptic applicator. Cleanse in a back-and-forth friction motion starting at the insertion site working outward. Clean an area larger than the size of the dressing. Contact time with the cleansing solution must be 30 seconds. Allow area to dry completely (do not fan area).
11. Remove gloves. Perform hand hygiene.

12. Don sterile gloves.
13. Apply sterile 4X4 trach gauze x2 around the catheter insertion site in opposite directions.
14. Apply sterile 4X4 gauze x2 over the trach gauze, ensuring to cover the insertion site and catheter tubing that will be sealed under the dressing.
15. Secure with soft cloth surgical tape (e.g., Hypafix® or MediporeTM) dressing enclosing all sides and securing the chest tube.
16. Apply light pressure over dressing and smooth edges.
17. Remove sterile gloves and perform hand hygiene.

Small Bore Chest Tube (luer-lock)

Equipment:

- Clean Gloves x1 pair
- Sterile gloves x1 pair
- Sterile Dressing tray x1
  - Soft cloth surgical tape (e.g., Hypafix® or MediporeTM)
- Antiseptic applicator (chlorhexidine gluconate 2% and isopropyl alcohol 70% [e.g., ChloraPrep® One-Step]) x 1
- Antiseptic wipe (chlorhexidine gluconate 2% and isopropyl alcohol 70% [e.g., SoluPrep]) x 1
- Skin protective barrier wipe (i.e., SUREPREP® NO-STING)
- Securement device (e.g., StatLock® Universal Plus Stabilization Device in appropriate size) x1
- Sterile 4X4 Trach gauze x1
- Sterile 4X4 gauze x1
- Tegaderm Film 1628 x1

Procedure:

1. Perform hand hygiene.
2. Assemble necessary equipment.
3. Open dressing tray.
4. Place sterile equipment onto sterile field.
5. Open non-sterile equipment and have easily available.
6. Don clean gloves.
7. Remove old dressing.
8. Assess exit site and confirm sutures intact if applicable.
9. Remove the old securement device. Open clamp on device and gently remove chest tube, ensuring not to pull on the chest tube. Secure the small bore chest tube to the patient using a strip of soft cloth surgical tape (e.g., Hypafix® or MediporeTM).
10. Lift the edge of securement device pad using antiseptic wipe, continue to stroke undersurface of the pad with wipe to dissolve adhesive pad away from the skin. Note: Do not pull or force pad to remove.
11. Cleanse the insertion site with antiseptic applicator. Cleanse in a back-and-forth friction motion starting at the insertion site working outward. Clean an area larger than the size of the dressing. Contact time with the cleansing solution must be 30 seconds. Allow area to dry completely (do not fan area).
12. Remove gloves. Perform hand hygiene.
13. Don sterile gloves.
14. Apply skin protective barrier wipe film to area the size of the dressing, avoiding the line insertion site and allow for adequate drying – approximately 60 seconds. Skin will feel sticky when touched.
15. Apply new securement device below the insertion site, remove strip of soft cloth surgical tape (e.g., Hypafix® or MediporeTM) and gently insert chest tube into securement device, ensuring not to pull on the chest tube. Close the clamp. The securement device must be changed every 7 days.
16. Apply sterile 4X4 trach gauze x1 around the catheter insertion site.
17. Apply sterile 4X4 gauze x1 over the trach gauze, ensuring to cover the insertion site and catheter tubing that will be sealed under the dressing.

18. Secure with tegaderm film dressing, enclosing all sides and securing the chest tube. A second film may be required to adequately enclose the dressing.
19. Apply light pressure over dressing and smooth edges.
20. Remove sterile gloves and perform hand hygiene.

E. DISLODGED OR DISCONNECTED CHEST TUBE (both devices):

If the chest tube dislodges:

1. Quickly apply pressure using occlusive dressing (petroleum gauze and sterile 4x4 gauze) secured with tape on all four sides.
2. Observe for signs of respiratory distress.
3. Notify physician STAT.

If chest tube disconnects from the chest drainage system:

1. Quickly double clamp the chest tube close to the insertion site with rubber tipped forceps.
2. Submerge the distal end of the chest tube 3 cm deep into a 500 mL bottle of sterile water then unclamp the chest tube. This will maintain an underwater seal.
3. Have another nurse obtain and set-up a new chest drainage system, refer to “Set-up and Maintenance” in the textbook “Clinical Nursing Skills: Basic to Advanced Skills”, “Wong’s Nursing Care of Infants and Children” (Paediatric Department) and/or “Merenstein & Gardner’s Handbook of Neonatal Intensive Care” NICU.
4. Clamp the chest tube and remove the distal end from the sterile water.
5. Connect to the new chest drainage system.
6. Unclamp the chest tube.
7. Assess for respiratory distress.
8. Notify the physician of the event.

F. CLAMPING THE CHEST TUBE

Clamping may only be performed under these circumstances:

- The chest tube becomes disconnected from the chest drainage system
- In order to change the chest drainage system
- Under a direct order from the physician for the purpose of determining whether the patient would be able to tolerate removal of the chest tube

G. FLUSHING A SMALL BORE CHEST TUBE

- Only flush a small bore chest tube if ordered by the physician
- Orders for flushing must include solution type, amount and frequency
- A 4-way stopcock must be in place prior to flushing; a physician must apply the 4-way stopcock except in the Intensive Care Unit ICU
- Nurses may not administer medications through a chest tube
- Nurses may not flush a large bore chest tube

Equipment:

- Glean Gloves x1
- Antiseptic Wipe (chlorhexidine gluconate 2% and isopropyl alcohol 70% [e.g., SoluPrep]) x1
- 10 mL Saline SP pre-filled syringe x1

Procedure:

1. Ensure 4-way stock cock has been applied to small bore chest tube by physician.
2. Ensure an injection cap is present on the top luer lock port of the stopcock.
3. Assemble equipment. Perform hand hygiene.
4. Don clean gloves.
5. Turn 4-way stopcock off to the patient.

6. Cleanse injection port with antiseptic wipe for 30 seconds and allow to dry.
7. Insert Saline SP pre-filled syringe into injection cap on top luer lock port.
8. Turn the 4-way stopcock off to the drainage bag (opposite to the patient) to be open to the patient
9. Flush the small bore chest tube with the amount of normal saline ordered by the physician using a gentle push-pause technique. Only a 10 mL syringe can be used on a small bore chest tube.
10. Turn the 4-way stopcock off the patient.
11. Remove the empty 10 mL syringe.
12. Return stopcock to required position depending on orders for chest tube drainage.
13. Remove gloves. Perform hand hygiene.

H. REMOVAL OF A CHEST TUBE

- Nurses may not remove chest tubes
- The chest tube insertion site should remain dressed as per physician orders until wound is closed
- When assisting with the removal of a chest tube, refer to "Clinical Nursing Skills: Basic to Advanced Skills", "Wong's Nursing Care of Infants and Children" (Paediatric Department) and/or "Merenstein & Gardner's Handbook of Neonatal Intensive Care" NICU

I. DOCUMENTATION

Document appropriately in Meditech and/or on the Progress Notes in the Emergency Department.

5. REFERENCES

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