Chest Tubes: Management of Potential Complications

Site Applicability

All VCH & PHC Acute Care sites

Practice Level

Registered Nurses

- Registered Nurses (RN) are responsible for monitoring and managing patients with pleural chest tubes and chest drainage systems, with the Physician or Nurse Practitioner (NP).

Policy

1. Emergency equipment stays with the patient at all times and must accompany the patient on transport. See Emergency Equipment
2. Using their knowledge, skills and judgment, the RN assesses risk to patient stability during transport off the unit. The nurse collaborates with the Physician, NP and interdisciplinary team to identify staff with the appropriate skill set to accompany the patient on transport.

   VCH: **VA & Richmond:** D-00-07-30106: Transport for Test/Treatments: Patient Accompaniment
3. Use aseptic technique when accessing chest tubes, chest drainage systems (CDS), or insertion sites.
4. Patients with pleural chest tubes leaving the unit for diagnostic tests or treatments are accompanied by an RN (or have tests done portably) when:
   - Assessment of an air leak is between the range of 4 to 7 on the Pleur-Evac®
   - Chest Tube was inserted in the last 24 hours
   - Drainage exceeds these volumes:
     - Sanguinous drainage over 100 mL/hr
     - Serous fluid over 1000 mL/hr
   - Suction is required during transport (if ordered)

   Or with clinical conditions that require frequent nursing assessments or interventions of the:
   - Airway and respiratory system
   - Hemodynamic and cardiopulmonary system
   - Neurological system
     - Close or constant care
     - Elopement risk; risk to self or others
5. **PHC & Richmond Hospital**: Instillation of medication or other substances into a chest tube is a Physician or Nurse Practitioner responsibility.

   VCH: **VGH:** See PCG C-520: Pleurodesis
6. **PHC & Richmond Hospital:** Irrigation of chest tubes is a Physician or Nurse Practitioner responsibility, except when the skill is within the competency list of the unit/program, and after education from a Nurse Educator or delegate.

   VCH: **VGH:** See D-00-12-30008: Thoracic Percutaneous Pigtail Catheter (PPDC): Irrigation & Removal
7. Chest tube removal is a Physician or NP responsibility, except when the skill is within the competency list of unit/program, and after education from a Nurse Educator or delegate. See:

   PHC: NCS5431: Chest Tube Removal Post Cardiac Surgery (CSICU)

   VCH: VGH & LGH only: D-00-12-30007: Pleural Chest Tube Removal

Need to Know

1. An order is required from a Physician or Nurse Practitioner (NP) to apply or discontinue suction to a chest tube. See Preprinted Prescriber Orders where available.
2. Chest tubes must be attached to an approved chest drainage system (CDS). Consult with the Physician or NP before changing to a Pleur-Evac® or other approved chest drainage system. See Maintenance of the Pleur-Evac® Chest Drainage System.
3. Clamping chest tubes requires a Physician or NP order. Before clamping, assess the patient and chest drainage system for an air leak. If there is bubbling in the air leak meter with deep breathing or coughing, do **not** clamp the chest tube. Notify the Physician or NP for an order (unless changing the chest drainage system, assessing for an air leak, or other situations listed in Maintenance of the Pleur-Evac® Chest Drainage System.
4. Clamping a percutaneous pigtail drainage catheter damages the tubing lumen, occludes the catheter and complicates removal. Use the stopcock to occlude drainage on percutaneous pigtail drainage catheters. If there is no stopcock, double clamp **only** the soft end of the connecting tubing. See Maintenance of the Pleur-Evac® Chest Drainage System.
5. Do not clamp a chest tube (or close the stopcock on a percutaneous pigtail drainage catheter or small bore chest tube) during transport or while mobilizing, unless specifically ordered by the Physician or NP.
6. To prevent obstruction of a percutaneous pigtail drainage catheter or small bore chest tube, potential pneumothorax and other adverse outcomes, the stopcock **must** remain open, unless ordered closed by the Physician or NP.
7. The practice of manipulating a chest tube to dislodge a clot or drainage by milking is contraindicated without a Physician or Nurse Practitioner order, except in the Cardiac Surgery Intensive Care Units.
8. To prevent obstruction, potential pneumothorax and other adverse outcomes, do not occlude the distal end of the Heimlich valve. Occlusion can cause accumulation of air within the pleural space, preventing resolution and/or exacerbate a pneumothorax. See Heimlich valve.

Quick Links

1. Emergency Equipment List
2. Maintaining Patency of the Chest Tube and Chest Drainage System
3. Assessing for Air Leak (Patient or Chest Drainage System)
4. Chest Tube Disconnection (from Chest Drainage System)
5. Accidental Chest Tube Removal
6. Infection (Insertion site or Chest Drainage)

Practice Guideline

Management of Potential Complications

Emergency Equipment

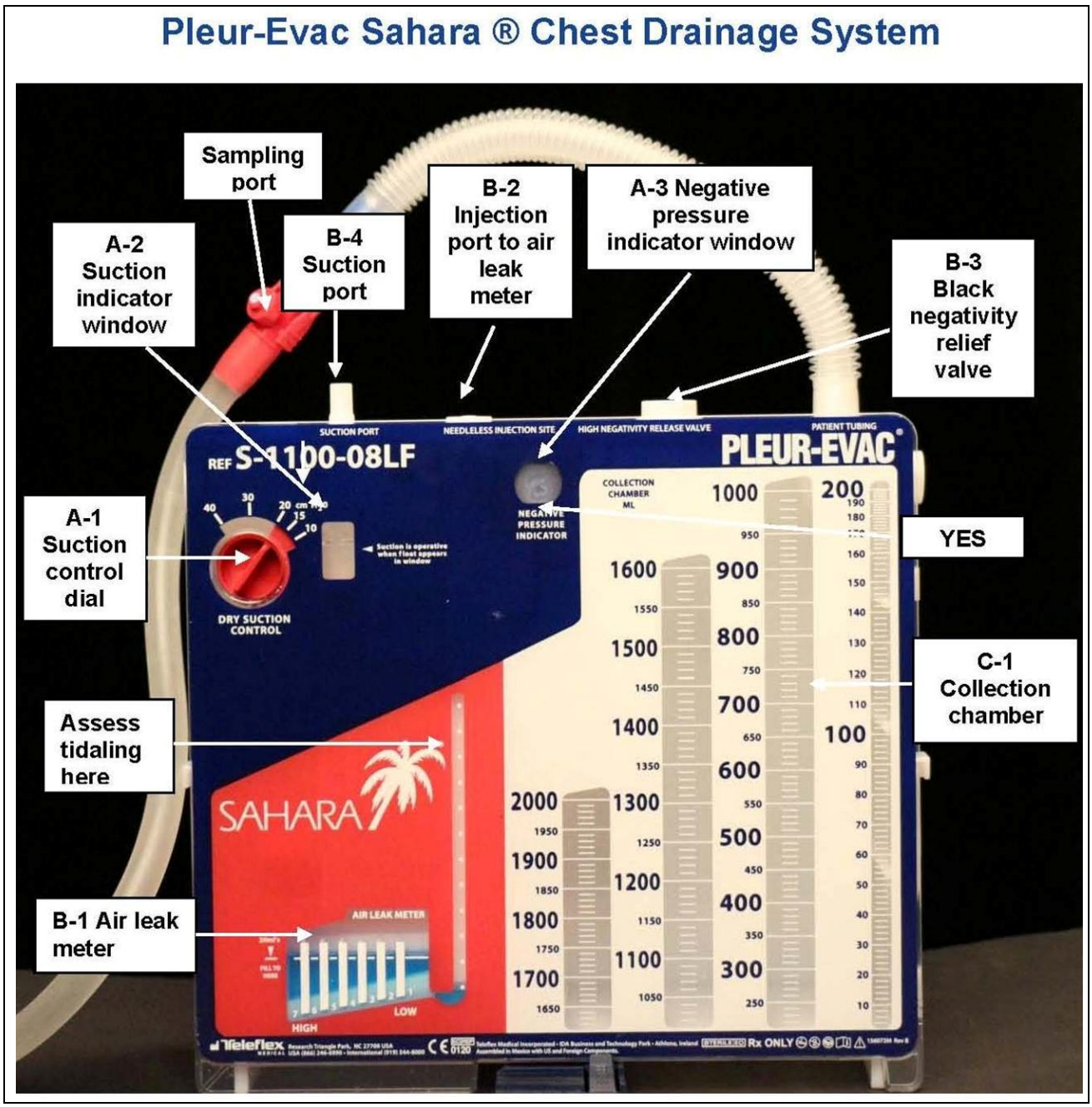
1. Assemble **Emergency Equipment** (if not already done) – **Must** be with the patient at all times and accompany the patient on transport. See Policy
   - Consider using a clear plastic bag to hang from the IV pole, or re-use the plastic bag on the back of the Chest Drainage System)

Emergency equipment list:

- 2 non-toothed forceps for each chest tube (plastic or stainless steel)

 OR 

- 250 mL bottle sterile water
- Petroleum impregnated gauze
- 4x4 gauze dressings
- If a Heimlich valve, for replacement if disconnected from chest tube. See Heimlich valve.



Chest Tubes and Chest Drainage Systems: Patient Assessment and Interventions

Nursing interventions aim at maintaining patency and sterility of the chest drainage system, monitoring for complications and evaluating the effectiveness of medical treatments and/or nursing care.

If the patient is in respiratory distress at any time despite interventions, call the Physician or NP immediately, or call a code

1. **Maintaining Patency of the Chest Tube and Chest Drainage System:**
   Assessment:

   Assess for unexpected outcome of potential (tension) pneumothorax. Signs include, (not limited to):

   - Respiratory distress
   - Hypoxemia or decreased oxygen saturation (SpO_2 less than 92%)
   - Tachypnea
   - Asymmetric chest expansion
   - Decreased or absent breath sounds on affected side
   - Chest pain
   - Tachycardia, hypotension, dysrhythmias
   - Subcutaneous emphysema
   - Distended neck veins
   - Tracheal deviation to unaffected side
   - Fever

   Prevention:

   - Keep the Pleur-Evac® suction port (B-4) open to air and unobstructed
   - If suction is ordered by the Physician or NP, ensure suction is operational and suction tubing is not obstructed or kinked e.g. bed wheels
   - If a percutaneous pigtail drainage catheter (or small bore chest tube), the stopcock **must** remain open, unless ordered closed by the Physician or NP
   - Coil or hang the drainage tubing horizontally on the bed, to avoid obstructing the flow of drainage with dependent loops
   - Ensure there are no kinks in the chest tube, connections, or drainage tubing
   - Instruct the patient to avoid lying on the chest tube or drainage tubing
   - Clamping chest tubes requires a Physician or NP order. See Need to Know and Maintenance of the Pleur-Evac® Chest Drainage System: Clamping.
   - For a Heimlich valve, keep the distal end open and free of any potential obstructions. The arrow on the side of the device points away from the patient. If attached incorrectly, the valve will block air flow out of the chest tube, exacerbating or causing a pneumothorax. See Heimlich valve guideline.
   - **VCH**: **VA:** for Pneumostat drains, ensure the air vent remains clean and dry, kept upright, and the collection chamber is emptied when half full. See Pneumostat Chest Drain Valve - Mgmt in Acute Care.

   Immediate Interventions:

   - Assess the patient's response to the obstruction and seek immediate medical assistance if patient is in distress. If patient in not distressed assess the chest drainage system for cause of obstruction
   - If a percutaneous pigtail drainage catheter (or small bore chest tube), assess for kinks:
     - If kinked, remove the Tegaderm™ dressing PRN. See Patient Assessment and Interventions
     - Straighten the kinked catheter, if possible
     - Replace the Tegaderm IV™ dressing
     - Secure with the appropriate size Statlock Fixation device PHC Guideline for size of percutaneous pigtail drainage catheter/small bore chest tube (or use other securement device).

- If the obstruction cannot be resolved immediately, notify the Physician or NP and prepare for chest tube and/or chest drainage system change. See Maintenance of the Pleur-Evac® Chest Drainage System.

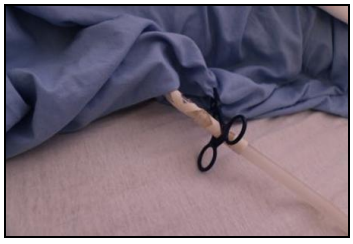
2. Assessing for Air Leak (Patient or Chest Drainage System):
Assessment:

- Assess for new or increasing bubbling in the air leak meter, with or without respiratory distress.
- A patient air leak is typically observed in the air leak meter intermittently: during expiration with or without coughing.
- If continuous bubbling is observed, suspect a chest drainage system leak or punctured drainage tubing.
- Monitor the insertion site and surrounding skin for subcutaneous emphysema (feels like crispy rice cereal). See Patient Assessment and Interventions #4.

Prevention:

- Spiral tape all connections with white cloth zinc tape (PeopleSoft #00023539) or secure with nylon cable ties (if used)
  - Tear tape in half lengthwise, spiral taping over connections in both directions (similar to a candy cane or DNA helix)
  - Leave connector unobstructed to allow visualization of drainage
  - Tape over the ends to reinforce

- Secure the chest tube to the patient below the dressing to prevent accidental removal.
- To prevent pulling on the chest tube site, consider securing the drainage tubing to the patient's gown with a blue clamp, an elastic band and pin, or clip supplied (on Pneumostat device). Ensure the securing device does not kink or obstruct the chest tube or drainage tubing.



- Do **not** take samples from the drainage tubing – it is not self sealing. Use the sample port on the chest drainage system. See Maintenance of the Pleur-Evac® Chest Drainage System.

Immediate Interventions:

To locate and correct the air leak (if possible), begin assessment at the patient's insertion site:

a. Percutaneous Pigtail Drainage Catheter or small bore chest tube:

- Do **not** clamp a percutaneous pigtail drainage catheter, use the stopcock to occlude drainage. If there is no stopcock, double clamp **only** the soft end of the connecting tubing. See Need to Know and Maintenance of the Pleur-Evac® Chest Drainage System.
- Turn off suction momentarily (less than one minute), if ordered
- Turn the stopcock off to the patient or closed

- For the remainder of the percutaneous pigtail drainage catheter/small bore chest tube procedure, see directions for a large bore chest tube below

If a ***new*** air leak occurs at the percutaneous pigtail drainage catheter/small bore chest tube insertion site:

- Assess for pain, holes in the chest tube or excess catheter/eyelets protruding from the chest wall
- Reinforce the dressing with Tegaderm IV™
- Pinch the end of the dressing around the tube (to provide an occlusive seal)
- If subcutaneous emphysema is present, mark the edges with an indelible marker and monitor for increase in size
- When the assessment for air leak is completed, open the stopcock (if present), or remove the plastic clamps on the soft end of the connecting tubing
- Turn suction back on, if ordered
- If the air leak remains unresolved, notify the Physician or NP, and prepare for chest tube change or repositioning

b. Large bore chest tube:

- Use 2 non-toothed forceps to double clamp the chest tube in opposite directions, close to the insertion site (to completely occlude the chest tube). See Maintenance of the Pleur-Evac® Chest Drainage System.
- If bubbling stops when initially clamped, the most likely source is the lung
- If continuous bubbling is observed, suspect a chest drainage system leak or punctured drainage tubing
- Continue briefly clamping the drainage tubing at consecutively lower intervals, moving from the insertion site to the chest drainage system. Observe the air leak meter each time the clamps are moved.
- When clamped between the source of the air leak and the air leak meter, the bubbling will stop. Ensure the connections in these sections are secure and observe for any visible damage in the tubing.
- If bubbling does not stop or the source of the air leak is punctured drainage tubing, replace the chest drainage system. See Maintenance of the Pleur-Evac® Chest Drainage System.
- When the assessment for air leak is completed, remove the non-toothed forceps on the chest tube or open the stopcock on the percutaneous pigtail drainage catheter/small bore chest tube, if present
- Turn suction back on, if ordered
- If the air leak remains unresolved, notify the Physician or NP, and prepare for chest tube change or repositioning

If a ***new*** air leak occurs at the large bore chest tube insertion site:

- Remove the dressing
- Assess the chest tube for holes or catheter eyelets protruding from the chest wall. Notify the MD or NP if this occurs.
- Reinforce the petroleum impregnated gauze over the insertion site, and replace the dressings. See Patient Assessment and interventions #3.
- If subcutaneous emphysema is present, mark the edges with an indelible marker and monitor for increase size

If the air leak remains unresolved, notify the Physician or NP

- If the air leak is at the insertion site, the incision may require suturing, or
- If the eyelets are visible, the chest tube may require replacing

3. Chest Tube Disconnection (from Chest Drainage System):

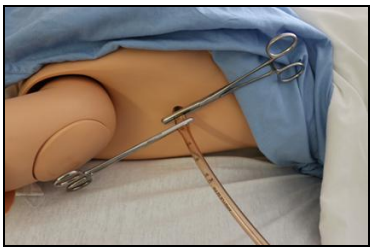
Prevention:

- Ensure all connections are spiral taped with white cloth zinc tape or secured with nylon cable ties (or other securement device)

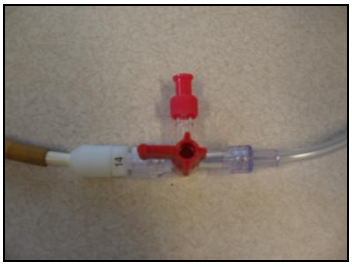
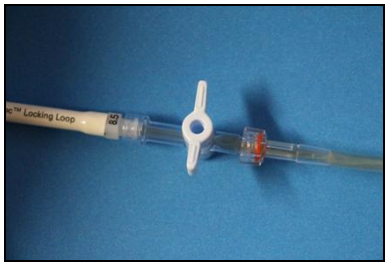
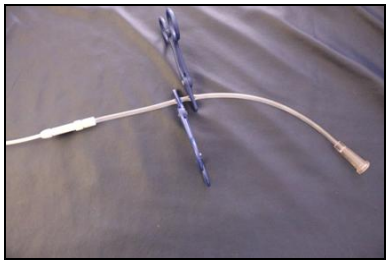
- To prevent pulling on the chest tube connections, consider securing the drainage tubing to the patient's gown with a blue clamp, an elastic band and pin, or clip supplied (on Pneumostat device). See Maintenance of the Pleur-Evac® Chest Drainage System
- Assess and treat restlessness and confusion; intervene appropriately
- If taping a Heimlich valve, leave the connector and flutter valve unobstructed by tape (to assess valve fluttering)

Immediate Interventions

- Call for assistance (or call a code if the patient is unstable)
- Immerse the chest tube 5 cm below the surface of the 250 mL bottle of sterile water. This establishes a water seal, allowing escape of air and preventing re-entry into the pleural space
- Instruct the patient to exhale forcefully or to cough, to facilitate air removal
- Ask another RN to assist and prepare a new chest drainage system. See Assisting with Large Bore Chest Tube Insertion: Setting up the Pleur-Evac® or replacing a Heimlich valve.
- When the new chest drainage system is ready (and before removing the chest tube from the sterile water), use 2 non-toothed forceps to double clamp the chest tube (less than one minute) in opposite directions, close to the insertion site.



- Do **not** clamp a percutaneous pigtail drainage catheter/small bore chest tube; use the stopcock to occlude drainage. If there is no stopcock, double clamp **only** the soft end of the connecting tubing.

Stopcock (with a port) Turned off to the patient	Stopcock (without a port) Closed	If no stopcock, double clamp **only** the soft end of the connecting tubing
		

- Remove the chest tube from the bottle of sterile water
- Cleanse the end of the chest tube or connecting tubing to the chest drainage system vigorously for 15 seconds (at minimum) with an alcohol swab. Allow to dry.
- Promptly connect the new Pleur-Evac® drainage tubing (or other approved chest drainage system) to the chest tube or connecting tubing
- Unclamp the chest tube or open the stopcock
- Turn suction back on, if ordered
- Secure all connections with white cloth zinc tape, nylon cable ties or other securement device
- Notify the Physician or NP PRN

Replacing a Heimlich Valve

If the Heimlich valve requires replacement, order a new one from Epro: Heimlich valve Vendor Item ID G36370, or

PHC/VA: Call Radiology. The replacement valve is charged to the unit cost centre.

- Cleanse the end of the chest tube or connecting tubing vigorously for 15 seconds (at minimum) with an alcohol swab. Allow to dry
- Promptly connect the new Heimlich valve to the chest tube or connecting tubing
- Ensure the valve is connected to the chest tube correctly. The blue end is attached to the chest tube; the clear distal end vents air and must remain open at all times

- The arrow on the side of the device points away from the patient. If attached incorrectly, the valve will block air flow out of the chest tube, exacerbating or causing a pneumothorax. See Heimlich valve guideline

- Unclamp the chest tube or open the stopcock (if present)

4. Accidental Chest Tube Removal:

Prevention:

- Assess the chest tube for sutures or other securement device
- Notify the Physician or NP if sutures are absent or dislodged from the insertion site
- Assess and treat restlessness and confusion; intervene appropriately
- Secure the chest tube to the patient below the dressing to prevent accidental removal
- To prevent pulling on the chest tube site, consider securing the drainage tubing to the patient's gown with a blue clamp (see picture), an elastic band and pin, or clip supplied on Pneumostat device (VCH only)

Immediate Interventions:

- Immediately apply petroleum impregnated gauze and 4 x 4 over the insertion site (or any sterile dressing). **Do not tape.**
- Call for assistance from another RN, or call a code if the patient is unstable
- Ask them to call the Physician or NP stat
- If the patient had an air leak or is developing respiratory distress, release the dressing on expiration (to allow air to escape) and reapply the dressing on inspiration (to prevent re-entry of air). Continue intervening until the Physician or NP arrives
- Prepare to assist with insertion of a new chest tube as needed.

5. Infection (insertion site or pleural infection: empyema):

Assessment:

Assess the insertion site, surrounding tissue, and drainage once per shift, with each dressing change and PRN for:

- Redness, swelling, discomfort or purulent discharge at the insertion site
- New or increasing purulent drainage from the chest tube

Assess the patient each shift and PRN for signs and symptoms of a pleural infection: dry cough, chest pain with respirations, shortness of breath, fever, chills and malaise.

Prevention:

Use aseptic technique when accessing chest tubes or chest drainage systems (CDS). See Maintenance of the Pleur-Evac® Chest Drainage System.

Using aseptic technique:

- Cleanse the chest tube insertion site with the appropriate solution
- Change dressings at the appropriate time. See Patient Assessment and Interventions
- Change the chest drainage system every 7 days and PRN (with new purulent or cloudy drainage). Chest tubes left in place over 7 days increase the risk of infection along the insertion tract. See Maintenance of the Pleur-Evac® Chest Drainage System

Immediate Interventions:

Report signs and symptoms of infection to the Physician or NP:

- Redness, purulent drainage or other signs of infection (around the insertion site or in drainage)
- Fever, chills and malaise, dry cough, chest pain with respirations, shortness of breath

Documentation

PHC:

- Chest Tube Assessment Flowsheet (PHC NF-224)
- 24 Hour Flowsheet
- Interdisciplinary Progress Notes
- Clinical Pathway document
- 24 Hour Fluid Balance Record

VCH:

- Tube/Drain Flowsheet
- Patient Care Flowsheet
- 24 Hour Fluid Balance Record
- Clinical Pathway document
- Interdisciplinary Progress Notes

Document on the Interdisciplinary Progress notes or unit specific documentation form:

- Date, time and details about potential or unexpected outcome
- Description of procedures and patient tolerance
- Assessments and vital signs
- Prevention measures and nursing interventions
- Patient and family education

Related Documents

- Chest Tubes and Chest Drainage Systems: Maintenance of the Pleur-Evac® Sahara
- Chest Tubes: Large Bore; Assisting with Insertion
- Chest Tubes: Large Bore: Assisting with Removal
- Chest Tubes: Patient Assessment and Interventions: Large Bore and Percutaneous/Small Bore Chest Tubes, Chest Drainage System: Pleur-Evac® Sahara
- Chest Tubes: Thoracic Percutaneous Pigtail Drainage Catheter or Small Bore Chest Tube - Assisting with Insertion
- Chest Tubes: Thoracic Percutaneous Pigtail Drainage Catheter or Small Bore Chest Tube - Assisting with Removal
- Chest Tubes and Chest Drainage Systems: Heimlich Valve

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Health Authority Profession Specific Advisory Council Chairs (HAPSAC)
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Operations Directors
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PHC: Professional Practice Standards Committee

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Vice President Professional Practice and Chief Clinical Information Officer, VCH

Professional Practice Standards Committee, PHC

Date of Approval/Review/Revision

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