RESPIRATORY · CRITICAL CARE · NGN NCLEX 2026

Chest Tubes & *Pleural Drainage*

Restoring negative intrapleural pressure, re-expanding the lung, and recognizing the complications that make this the most tested skill in respiratory critical care. Includes the NCJMM clinical judgment framework, priority interventions, and emergency management.

Pneumothorax | Hemothorax | Water Seal System | Tension Pneumothorax | Emergency Management

DEFINITION & OVERVIEW

01 What Is a Chest Tube?

A **chest tube (thoracostomy tube)** is a flexible drainage catheter inserted into the **pleural space** to remove air, blood, fluid, or pus — restoring the negative intrapleural pressure the lung needs to stay inflated.

Why It Matters

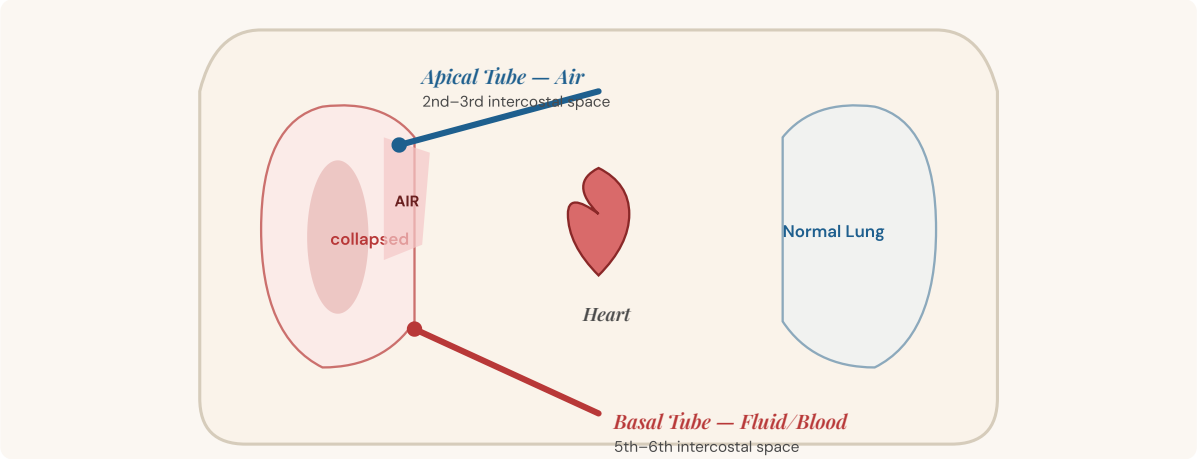
- Restores negative pleural pressure
- Re-expands a collapsed lung
- Prevents mediastinal shift
- Relieves tension physiology

Placement Sites

- **Apical (2nd–3rd ICS):** air rises → pneumothorax
- **Basal (5th–6th ICS):** fluid falls → hemothorax / effusion
- **Mediastinal:** post-cardiac surgery

Common Indications

- Pneumothorax (air)
- Hemothorax (blood)
- Pleural effusion (fluid)
- Empyema (pus/infection)
- Post-thoracotomy / cardiac surgery



Apical tubes drain air (rises); basal tubes drain fluid (falls). Placement depends on what needs to come out.

PATHOPHYSIOLOGY

02 How the Lung Collapses & Re-Expands

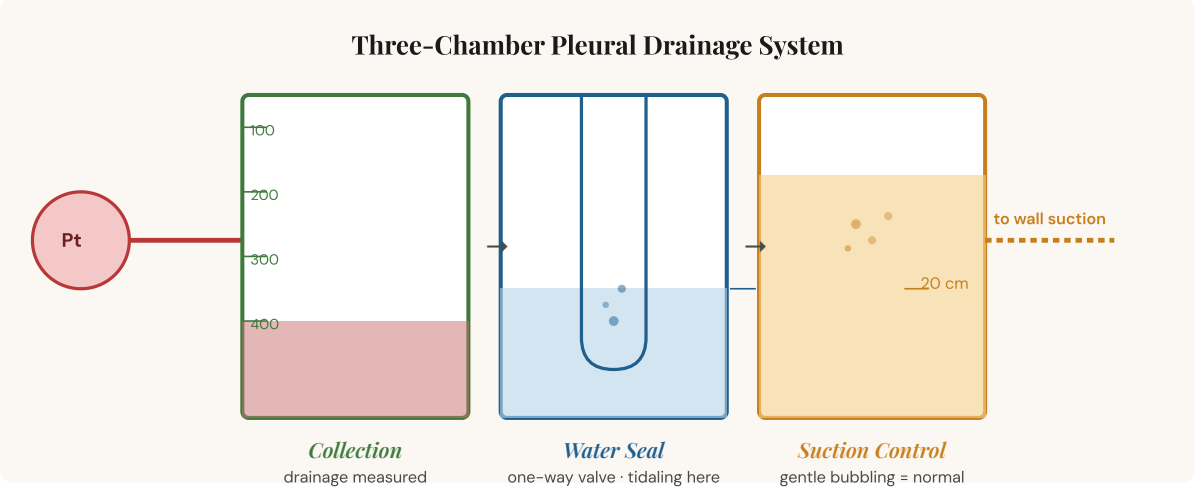
1. **Normal state:** negative pressure in pleural space keeps lung expanded against chest wall
2. **Injury/disease:** air or fluid enters pleural space (trauma, rupture, surgery)
3. **Pressure equalizes:** negative pressure is lost, lung recoils and collapses
4. **Chest tube inserted:** evacuates air/fluid, restores negative pressure
5. **Lung re-expands** and gas exchange is restored

🚨 Tension Pneumothorax — The Most Dangerous Progression

If air continues to enter the pleural space **but cannot escape** (one-way valve effect), pressure rises with every breath. The mediastinum shifts **away from the affected side**, compressing the heart and great vessels. Cardiac output collapses. **This is a medical emergency requiring immediate needle decompression.**

THE THREE-CHAMBER DRAINAGE SYSTEM

03 Understanding the Pleur-Evac



Drainage flows left → right. Chamber 1 collects; Chamber 2 seals (one-way valve); Chamber 3 controls suction strength.

1 Collection Chamber

- Closest to the patient
- Collects drainage from pleural space
- Measured in mL — mark level & time on container
- **Report >100 mL/hr bright red**

2 Water Seal Chamber

- One-way valve — air out, never in
- Filled to **2 cm H_2O** line
- **Tidaling** = normal fluctuation with breathing
- **Continuous bubbling = air leak** 🚨

3 Suction Control Chamber

- Regulates amount of suction (usually -20 cm H_2O)
- **Gentle continuous bubbling = normal**
- Vigorous bubbling → suction too high (evaporates water)
- No bubbling → not connected / not working

SIGNS & SYMPTOMS

04 Recognizing Pneumothorax & Chest Tube Complications

⚠ Early / Mild Findings

- Sudden, sharp, unilateral chest pain

🚨 Late / Severe — RED FLAGS

- **Tracheal deviation AWAY from affected side**

- Mild dyspnea & tachypnea
- Diminished breath sounds on affected side
- Tachycardia
- Restlessness, anxiety
- Subcutaneous emphysema (crepitus on palpation)

- **Absent breath sounds on affected side**
- Severe dyspnea, cyanosis, SpO_2 ↓
- Hypotension, JVD
- Mediastinal shift on X-ray
- Altered LOC → impending arrest

🚨 Tension Pneumothorax Triad

Tracheal deviation + absent breath sounds + hemodynamic collapse = emergency. Needle decompression (14–16 g angiocath, 2nd ICS, midclavicular line) precedes chest tube placement. Do not wait for chest X-ray confirmation if the patient is unstable.

PRIORITY NURSING INTERVENTIONS

05 ABCs · Safety · What to Do and What Never to Do

🩺 Assess (q2–4h)

- Respiratory status: rate, effort, SpO_2, breath sounds bilaterally
- Insertion site: dressing intact, crepitus, drainage around site
- Drainage: color, amount, consistency — mark & time hourly
- Water seal: tidaling present? bubbling pattern?
- Suction chamber: gentle bubbling?
- Pain level (use scale) · VS · LOC

✓ Do

- Keep drainage system **BELOW chest level** always
- Position patient **semi-Fowler's (30–45°)**
- Coil excess tubing on bed — no dependent loops
- Secure all connections with tape
- Encourage deep breathing, coughing, incentive spirometry q1–2h
- Keep **2 padded clamps, sterile water, occlusive dressing** at bedside
- Medicate for pain before activity & coughing

✗ Do NOT

- **Do NOT clamp** routinely — causes tension pneumothorax
- **Do NOT strip or milk** tubing — excessive negative pressure
- Do NOT raise system above chest

📋 Report to HCP

- Drainage >100 mL/hr (or sudden ↑)
- Bright red bleeding after drainage was serosanguineous
- Continuous bubbling in water seal → air leak
- Sudden absence of tidaling

- Do NOT empty or change the collection chamber
- Do NOT let tubing kink or loop dependently
- Do NOT disconnect unless ordered

- Increased subcutaneous emphysema
- Respiratory distress or ↓ SpO_2
- Tracheal deviation

COMPLICATIONS & EMERGENCY MANAGEMENT

06 When Things Go Wrong — What the Nurse Does FIRST

Complication	Recognize	Priority Action (Nurse's FIRST Move)
Tube dislodged from chest wall Emergency	Tube visibly out of chest; patient gasping; air rushing at site	Apply **sterile occlusive dressing taped on 3 sides only** (creates flutter valve — air escapes, can't re-enter). 4 sides → tension pneumothorax. Notify HCP STAT.
Tube disconnected from drainage system Emergency	Open end of tubing exposed to air; bubbling/hissing sound	**Submerge the end of the tube in sterile water or saline** (creates water seal). Do NOT clamp. Replace system ASAP.
Continuous bubbling in water seal Air leak	Constant bubbling (not just with cough/exhalation)	Briefly clamp tubing progressively from chest wall outward. When bubbling stops, the leak is *distal* to that clamp. If it never stops — leak is at insertion site → notify HCP.
No tidaling	Water level in seal chamber does not rise/fall with breathing	Check for kinks, clots, or dependent loops. Reposition patient, have them cough. If clear — could mean lung has **fully re-expanded** (good). Assess respiratory status & notify HCP.
Drainage >100 mL/hr bright red Hemorrhage	Sudden increase in bright red blood; ↓ BP, ↑ HR	Notify HCP immediately. Monitor VS, H&H. Prepare for possible return to OR. Ensure IV access and blood available.
Subcutaneous emphysema	Crepitus (crackling) around insertion site, neck, face	Mark borders with marker & time. Small areas self-resolve. Rapid spread → notify HCP (air leaking around tube).
Tension pneumothorax Life-threat	Tracheal deviation, absent BS, severe dyspnea, ↓ BP, JVD	Call rapid response. High-flow O_2. Prepare for **needle decompression** (2nd ICS, midclavicular line) followed by chest tube.

Complication	Recognize	Priority Action (Nurse's FIRST Move)
Drainage system breaks/cracks	Visible damage; loss of water seal	Submerge end of tube in sterile water until new system is set up. Brief clamping is acceptable *only* during replacement.

PHARMACOLOGY

07 Medications Used with Chest Tubes

Drug / Class	Purpose	Key Side Effects	Nursing Considerations
Lidocaine 1–2% Local anesthetic	Anesthetize skin & pleura at insertion site	Burning at site, rare cardiac effects	Verify no allergy; injected by HCP at insertion
Morphine / Hydromorphone / Fentanyl Opioid analgesic	Control post-insertion & ongoing pleuritic pain	Respiratory depression, sedation, constipation	Assess RR & SpO_2 before & after. Premedicate before coughing / ambulation. Naloxone at bedside.
Ketorolac / NSAIDs	Adjunct pain control, opioid-sparing	GI bleed, renal impairment	Monitor renal function, GI status; avoid in bleeding pts
Lorazepam / Midazolam Anxiolytic	Reduce anxiety at insertion / procedure	Respiratory depression, sedation	Monitor LOC, airway; use cautiously with opioids
Antibiotics (cefazolin, etc.)	Prophylaxis (trauma) or treat empyema	Class-specific	Culture drainage before starting if infection suspected

NCLEX TEST TRAPS

08 Commonly Missed Distinctions

1 **"Should I clamp the tube when transporting?" — NO**
Clamping a chest tube during transport or routinely can cause **tension pneumothorax**. Clamping is only acceptable briefly when changing the drainage system, locating an air leak, or checking for readiness to remove (per HCP order).

2 **Stripping / milking tubing — AVOID**

Once considered standard, stripping creates dangerous **negative pressure** that can damage lung tissue. Do NOT strip unless specifically ordered (rare).

3 **Bubbling in water seal vs. suction chamber — know the difference**

Water seal: intermittent bubbling is NORMAL with a pneumothorax (air escaping). **Continuous** bubbling = air leak. **Suction chamber:** gentle *continuous* bubbling is NORMAL; vigorous bubbling = suction too high.

4 **Dislodged tube: 3 sides, NOT 4**

Cover with sterile occlusive dressing taped on **3 sides only**. This creates a flutter valve — air can escape but cannot re-enter. Taping all 4 sides traps air → tension pneumothorax.

5 **Disconnection from drainage system: water, not clamp**

Submerge the open end of the tube in sterile water to re-create a water seal. Clamping could cause tension pneumothorax.

6 **Tracheal deviation — which way?**

The trachea deviates **AWAY from the affected side** in tension pneumothorax (pushed by trapped air). This is opposite to atelectasis, where the trachea shifts *toward* the affected side.

7 **Sudden stop in drainage is not always good**

Could mean the tube is **clotted or kinked**. Assess the tubing, reposition the patient, have them cough. Do NOT strip. Notify HCP if obstruction suspected.

8 **Absence of tidaling — good OR bad**

Good: lung has fully re-expanded. **Bad:** tube is obstructed. You must differentiate by assessing respiratory status and looking at chest X-ray.

9 **"Keep the system below the chest" is absolute**

Raising the drainage system above the insertion site allows drainage to **flow back into the pleural space**. Even for a moment. Even during transport.

10 **Drainage volume that must be reported**

>100 mL/hr of bright red drainage — possible hemorrhage. Sudden increases, clots, or changes from serosanguineous to bright red also require notification.

11 **Chest tube removal: Valsalva or deep breath?**

Patient takes a **deep breath and holds (Valsalva)** or bears down during removal. This increases intrathoracic pressure and prevents air from entering the pleural space as the tube is pulled.

12 **Post-removal: occlusive dressing immediately**

Sterile **petrolatum gauze** applied immediately over site & covered with dry dressing. Chest X-ray within 1 hour. Monitor for recurrent pneumothorax.

NGN CLINICAL JUDGMENT · NCJMM FRAMEWORK

09 Recognize → Analyze → Prioritize → Evaluate

Scenario

A 65-year-old post-left-thoracotomy patient has a chest tube connected to -20 cm H_2O suction. At 0400, the nurse enters and finds the patient diaphoretic and anxious. **VS: BP 88/52, HR 132, RR 34, SpO_2 86% on 4 L NC.** Trachea is deviated to the right; breath sounds are absent on the left. Collection chamber shows 40 mL serosanguineous drainage this hour. The water seal chamber shows **continuous vigorous bubbling** and **no tidaling**.

STEP 1

Recognize Cues

- → Tracheal deviation to right (unaffected side)
- → Absent breath sounds on LEFT
- → Severe hypoxia (SpO_2 86%)
- → Hypotension + tachycardia
- → Continuous bubbling = air leak
- → No tidaling = obstruction or re-expansion

STEP 2

Analyze Cues

- → Classic tension pneumothorax on LEFT
- → Mediastinum shifting right → ↓ cardiac output
- → Likely large air leak overwhelming drainage system OR non-functioning tube
- → Hemodynamic compromise already present

STEP 3

Prioritize & Act

- → Call rapid response / notify HCP STAT
- → High-flow O_2 via non-rebreather
- → Assess tubing for kinks, disconnections, clamps
- → Prepare for needle decompression (2nd ICS MCL)
- → Position semi-Fowler's
- → Stay with patient; continuous VS monitoring

STEP 4

Evaluate Outcomes

- → Trachea returns to midline
- → Breath sounds return bilaterally
- → SpO_2 >92% on supplemental O_2
- → RR 12–20, HR <100, BP stable
- → Tidaling resumes in water seal
- → Patient reports ↓ pain & anxiety

PATIENT & FAMILY EDUCATION

10 Teaching Points Before Discharge

While the Tube Is In

After Tube Removal

- Keep drainage system **below chest** at all times — even when walking
- Do not pull, tug, or lie on the tubing
- Splint chest with a pillow when coughing
- Use incentive spirometer **10 breaths every 1–2 hours** while awake
- Sleep on back or non-affected side
- Ambulate as tolerated — staff will help carry the system
- Report immediately: shortness of breath, chest pain, fever, bleeding

- Keep occlusive dressing dry and intact for 48 hours
- Avoid lifting >10 lbs for 1–2 weeks
- Report: worsening pain, increased dyspnea, fever >101°F, site redness or drainage
- Gradual return to activity as tolerated
- Follow-up chest X-ray as scheduled
- No air travel or scuba diving until cleared
- Smoking cessation resources (if applicable)

MEMORY BOOSTERS

11 Mnemonics & Pattern Recognition

🔑 TIDAL — Water Seal Check

T **Tidaling** = fluctuation with breathing (NORMAL)

I **Intermittent** bubbling = OK with pneumothorax

D **Drainage** <100 mL/hr — report if higher

A **Apical** = Air · b**A**sal = Blood

L **Level** always BELOW chest

🔑 NO CLAMP Rule

N **Never** clamp routinely

O **Only** clamp to locate air leak or change system

C **Clamping** = risk of tension pneumothorax

L **Leak** finding: clamp progressively toward patient

A **Always** have padded hemostats at bedside — for emergency only

🔑 3-Ds of Emergency

D **Dislodged** from chest → **Dressing** taped on 3 sides

D **Disconnected** from system → **Dunk** in sterile water

D

🔑 BUBBLES — Troubleshoot

B **Bubbling** continuous in water seal = AIR LEAK

U **Use** clamping technique to locate the leak

B **Bubbling** gentle in suction = NORMAL

Deviation of trachea → **Decompression** (needle) needed NOW

B	**Big** vigorous bubbling in suction = too high
L	**Look** for tidaling with each breath
E	**Every** disconnection = sterile water dunk
S	**Stop** & notify if drainage >100 mL/hr

Critical Study Pearls

The #1 rule: Keep the system below the chest, the connections taped, and the emergency equipment at the bedside.

The #1 trap: Clamping a chest tube can kill the patient. Never clamp unless specifically instructed, and then only briefly.

The #1 priority sign: Tracheal deviation away from the affected side = tension pneumothorax = emergency needle decompression.

The #1 emergency distinction: Dislodged tube → 3-sided dressing. Disconnected tube → sterile water.