RESPIRATORY · EMERGENCY · TRAUMA

Tension Pneumothorax

A life-threatening respiratory and cardiovascular emergency. Air trapped in the pleural space collapses the lung and shifts the mediastinum — diagnose clinically, decompress immediately.

⚠ CLINICAL DIAGNOSIS · DO NOT WAIT FOR CHEST X-RAY · NEEDLE DECOMPRESS NOW ⚠

SOURCE DISCLOSURE

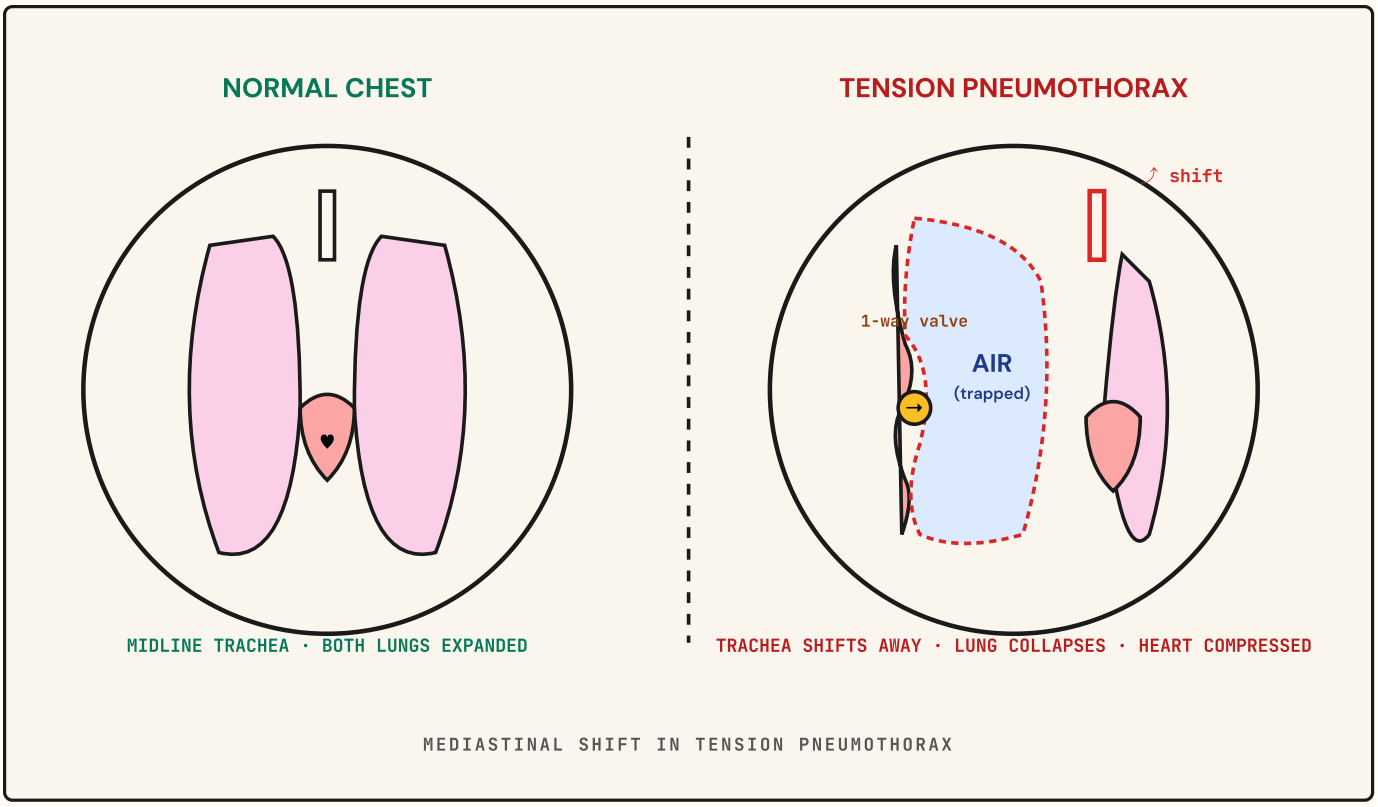
This topic is *not* present in Student's uploaded reference notes. Content has been compiled from external NCLEX-aligned sources: SAUNDERS COMPREHENSIVE REVIEW FOR THE NCLEX-RN EXAMINATION (2026), ATI ADULT MEDICAL-SURGICAL NURSING, LIPPINCOTT MANUAL OF NURSING PRACTICE, ATLS GUIDELINES (10TH ED., 2018+), and current AACN critical care standards.

1 Definition & Overview

- Air enters the pleural space through a **one-way valve** mechanism — air goes *in* with each breath but *cannot escape*.
- Intrapleural pressure rises progressively, **collapsing the affected lung** and pushing the **mediastinum (heart, great vessels, trachea) toward the unaffected side**.
- Compression of the vena cava drops venous return → **obstructive shock** → cardiac arrest if untreated.
- **Tension pneumothorax is a clinical diagnosis** — recognize and treat *before* imaging confirmation.

Why it matters: Unlike a simple pneumothorax (lung collapse without tension), the pressure in tension pneumothorax compresses both the affected lung *and* the heart — making this both a respiratory *and* a cardiovascular emergency.

2 Pathophysiology



The Cascade:

Air enters pleural space (trauma, vent, rupture)	→	1-way valve traps air in	→	Pressure ↑ with each breath
Affected lung collapses	→	Mediastinum shifts AWAY	→	Vena cava compressed · ↓ venous return
↓ Cardiac output (obstructive shock)	→	Hypotension · Hypoxia	→	PEA / Cardiac arrest

Common Causes:

TRAUMATIC

- Blunt chest trauma (MVA)
- Penetrating wound (stab/GSW)
- Rib fractures puncturing pleura

IATROGENIC

- Mechanical ventilation (barotrauma — high PEEP/PIP)
- Central line insertion (subclavian)
- Thoracentesis / lung biopsy
- CPR (chest compressions)

SPONTANEOUS

- Ruptured bleb (tall, thin young males)
- COPD / emphysema bullae
- Severe asthma exacerbation
- Cystic fibrosis, TB

3 Signs & Symptoms

EARLY — RECOGNIZE

Compensating

- Sudden, sharp **pleuritic chest pain** (affected side)
- Dyspnea, tachypnea (RR > 24)
- Tachycardia (HR > 100)
- Anxiety, restlessness, agitation
- ↓ breath sounds on affected side
- **Hyperresonance** to percussion (affected side)
- ↓ chest wall movement on affected side
- Cough (may be dry)

LATE — DECOMPENSATING

Red Flag Findings 🚨

- **Tracheal deviation AWAY** from affected side
- **JVD** (jugular venous distention)
- **Hypotension** (obstructive shock)
- Cyanosis (lips, fingertips)
- **Absent** breath sounds on affected side
- Subcutaneous emphysema (*crepitus* — "Rice Krispies")
- SpO_2 < 90%, severe hypoxia
- ↓ LOC, confusion
- PEA, cardiac arrest

🚨 **HARD STOP — Three findings = call for immediate decompression: Tracheal deviation + Absent breath sounds + Hypotension. Do not wait for imaging.**

Direction matters: Trachea deviates **AWAY** from the affected side (pressure pushes it). On the affected side, expect **↓/absent breath sounds AND hyperresonance** (air, not fluid).

4 Priority Nursing Interventions

A
AIRWAY

- Assess patency — is the airway open?
- Anticipate intubation if LOC ↓
- Position upright if hemodynamically stable

B
BREATHING

- **High-flow O_2** via non-rebreather (100%)
- Prepare for **NEEDLE DECOMPRESSION** (emergent)
- Assist with **chest tube** insertion (definitive)
- Continuous SpO_2, ABG
- If on vent: notify provider — reduce PEEP

C
CIRCULATION

- Continuous cardiac monitor (watch for PEA)
- 2 large-bore IVs (16–18 ga)
- IV fluids for hypotension
- VS q5–15 min until stable
- Notify Rapid Response / HCP STAT

Needle Decompression — Emergency Procedure

ELEMENT	DETAIL
Site (Classic)	**2nd intercostal space, midclavicular line** on the affected side, just over the top of the 3rd rib (avoids the neurovascular bundle)
Site (Updated ATLS 2018+)	**4th–5th intercostal space, anterior axillary line** in adults (better chest wall depth penetration; lower failure rate)
Needle	14- to 16-gauge over-the-needle catheter, ≥ 8 cm length
Confirmation	Audible **rush of air**, improvement in hemodynamics & SpO_2
After	**Chest tube is definitive** — needle decompression is only a temporizing bridge to chest tube insertion (typically 4th–5th ICS, midaxillary line)

Chest Tube Drainage System — Key Nursing Care

SITUATION	NURSING ACTION
Tube falls out	Cover with **sterile petroleum (Vaseline) gauze**, taped on **3 sides only** (creates one-way valve — air escapes, none re-enters). Call HCP STAT.
Tube disconnects from drainage	Place the end in a bottle of **sterile water (water seal)**. Do NOT clamp. Notify HCP.

SITUATION	NURSING ACTION
Tidaling (water-seal chamber moves with breath)	**EXPECTED** — confirms patency. Lost tidaling = tube blocked OR lung re-expanded.
Continuous bubbling in water-seal chamber	**ABNORMAL = air leak.** Locate by briefly clamping closer to patient stepwise.
Bubbling in suction-control chamber	**NORMAL** (gentle, continuous) — confirms working suction.
Drainage > 100 mL/hr (or > 200 mL/hr per most current guidelines)	Notify HCP — possible hemorrhage.
Drainage system position	Always **below chest level** (prevents backflow). Never raise above the patient.
Clamping	**Do NOT clamp** a chest tube on a patient — risks creating tension pneumothorax. Only clamp briefly to change drainage unit or per HCP order.

5 Pharmacology

DRUG / CLASS	PURPOSE / MECHANISM	NURSING CONSIDERATIONS
Oxygen (Respiratory support)	↑ PaO_2; speeds reabsorption of pleural air	High-flow non-rebreather initially. Titrate to SpO_2 ≥ 94% (88–92% in COPD).
Morphine / Fentanyl (Opioid analgesics)	Pain control; ↓ respiratory effort (good for splinting from pain)	Watch for respiratory depression, hypotension. Have naloxone (Narcan) available. Monitor RR & LOC.
Lidocaine 1% (Local anesthetic)	Numbs site before chest tube insertion	Confirm allergy. Check max dose (4.5 mg/kg).
Midazolam / Propofol (Sedation)	Procedural sedation; sedation for mechanical ventilation	Continuous cardiopulmonary monitoring. Propofol: monitor triglycerides; "milky" infusion — never co-infuse with other meds.
Antibiotics (Per traumatic/open cause)	Prophylaxis for traumatic/open pneumothorax (typically 1st-gen cephalosporin)	Check allergies, give on schedule, monitor for reaction.
Tetanus toxoid / Td	If traumatic cause & last dose > 5 yr	Verify immunization status.
IV crystalloids (0.9% NS or LR)	BP support for obstructive shock — but definitive fix is decompression	Monitor for fluid overload, especially in elderly/CHF.

Pharm priority: No drug treats tension pneumothorax — the cure is **decompression**. Oxygen + analgesia + IV access are supportive only.

6 NCLEX Test Traps

✕ COMMON WRONG ANSWER

"Get a STAT chest X-ray to confirm before treating."

✓ CORRECT PRIORITY

Tension pneumothorax is a **clinical diagnosis**. Decompress first; image later. Waiting kills.

✕ TRAP

"Trachea deviates *toward* the affected side."

✓ RIGHT

Trachea deviates **AWAY from affected side** in tension pneumothorax. (It only deviates toward in atelectasis / lobar collapse.)

✕ TRAP

"Clamp the chest tube before transport."

✓ RIGHT

Never clamp a chest tube — risks creating tension. Keep drainage below chest, keep moving.

✕ TRAP

"Tube fell out — cover with sterile gauze and tape all 4 sides."

✓ RIGHT

Petroleum gauze, taped on 3 sides only. The open side acts as a flutter/one-way valve so air escapes without re-entering.

✕ TRAP

"Continuous bubbling in the water-seal chamber is normal."

✓ RIGHT

Continuous bubbling in the **water-seal** chamber = **air leak**. Continuous bubbling in the **suction-control** chamber is what's normal.

✕ TRAP

"Lost tidaling means the system is broken."

✓ RIGHT

Lost tidaling can mean **lung re-expanded** (good!) OR tube is **kinked/clogged**. Assess the patient first.

✕ TRAP

"Hyperresonance + dullness — same side."

✓ RIGHT

Tension pneumothorax = **hyperresonance** (air). Hemothorax / pleural effusion = **dullness** (fluid). Don't confuse them.

✕ TRAP

"Patient on mechanical ventilation became hypotensive — give a fluid bolus and reassess in 30 min."

✓ RIGHT

In a ventilated patient, sudden hypotension + ↓ SpO_2 + ↑ peak airway pressures = **suspect tension pneumothorax**. Notify provider STAT — fluids won't fix obstructive shock.

7 Patient & Family Education

Activity restrictions: Avoid heavy lifting, straining, and strenuous activity for ~6 weeks after recovery.

Air travel: Avoid flying for at least 2–3 weeks after lung re-expansion (cabin pressure changes can trigger recurrence).

Scuba diving: Permanent restriction after spontaneous pneumothorax — pressure changes can cause re-rupture.

Smoking cessation: Smoking increases recurrence risk significantly. Refer to cessation programs.

Warning signs to report: Sudden chest pain, shortness of breath, fever, chest tube site redness/drainage, or worsening cough.

Deep breathing & incentive spirometry: Practice 10× per hour while awake — promotes full lung re-expansion.

Wound/site care: Keep chest tube site clean & dry after removal; watch for signs of infection.

Follow-up imaging: Repeat chest X-ray as ordered to confirm lung remains expanded.

8 Memory Boosters & Mnemonics

🧠 "TENSION" — Red-Flag Findings

- **T** — **Tracheal deviation** AWAY from affected side
- **E** — **Engorged jugular veins** (JVD)
- **N** — **No breath sounds** on affected side
- **S** — **Shock** (hypotension, obstructive)
- **I** — **Increased HR & RR** (tachycardia, tachypnea)
- **O** — **Oxygen saturation drops** · cyanosis
- **N** — **"NOW"** — needle decompress immediately

🧠 "PNEUMO" — Quick Recognition

- **P** — **Pain** — sudden, sharp, pleuritic, affected side
- **N** — **No** breath sounds on affected side
- **E** — **Elevated** HR & RR
- **U** — **Uneven** chest rise (affected side lags)
- **M** — **Mediastinal** shift (trachea deviates AWAY)
- **O** — **Oxygen** + decompression — STAT

Quick Pattern Recognition

"Push AWAY" rule

Tension **PUSHES** the trachea **AWAY** from the affected side. Atelectasis **PULLS** the trachea **TOWARD** the collapsed side.

Sound rule

AIR = hyperresonant (drum). **FLUID = dull** (thud). Pneumothorax → hyperresonance. Hemothorax/effusion → dullness.

Tape rule (dislodged chest tube)

3 sides taped = one-way valve, air escapes, none re-enters. **4 sides sealed** = re-traps air → tension worsens.

Chamber rule

Continuous bubbling in **water seal** = **BAD** (air leak). Continuous bubbling in **suction control** = **GOOD** (working).

9 NCJMM Clinical Judgment Scenario

Scenario: A 22-year-old male is admitted to the trauma bay after a motorcycle collision. He is alert but anxious, complaining of severe right-sided chest pain. RR 32, HR 128, BP 92/58, SpO_2 87% on room air. You note diminished breath sounds on the right and the trachea appears slightly deviated to the left.

STEP 1 · RECOGNIZE CUES

What stands out?

Trauma mechanism + unilateral diminished breath sounds + tracheal deviation away + hypotension + hypoxia + tachypnea + tachycardia. Subjective cue: severe pleuritic chest pain & anxiety. **Classic tension pneumothorax cluster.**

STEP 2 · ANALYZE CUES

What do they mean together?

The cues cluster around a single problem: air is trapped in the right pleural space under pressure. The mediastinal shift (trachea to the left) and hypotension indicate that the heart and great vessels are already being compressed — this is decompensating obstructive shock, not a simple pneumothorax.

STEP 3 · PRIORITIZE HYPOTHESES

Most likely / most dangerous

#1 Tension pneumothorax (most likely, immediately life-threatening). Differential to keep in mind: hemothorax (would expect *dullness*, not deviation), cardiac tamponade (Beck's triad: hypotension + JVD + muffled heart sounds — without lung findings), flail chest, massive PE. **Treat the worst-case clinically** — don't wait for imaging.

STEP 4 · GENERATE SOLUTIONS

Plan of action

Call rapid response/trauma surgeon STAT. **Apply 100% O_2 via non-rebreather.** Establish two large-bore IVs. Place on continuous cardiac & SpO_2 monitor. Prepare equipment for **needle decompression** (14-ga, ≥ 8 cm catheter; 2nd ICS midclavicular OR 4th–5th ICS anterior axillary) and a **chest tube tray** for definitive management. Notify radiology for portable CXR *after* decompression.

STEP 5 · TAKE ACTION

Implement

Apply O_2 and establish IV access immediately. Assist the provider with needle decompression on the right side — listen for the rush of air, watch for rapid improvement in SpO_2 and BP. Hand off to surgical team for chest tube placement; secure chest tube to drainage system below chest level. Reassess vital signs every 5 minutes during the acute phase.

STEP 6 · EVALUATE OUTCOMES

Did it work?

Effective response: SpO_2 rises to ≥ 94%, BP normalizes, HR drops, breath sounds return on right, trachea returns to midline, tidaling appears in the water-seal chamber. **Ineffective:** persistent hypotension, ongoing tracheal deviation, or absent tidaling/continuous bubbling — reassess for chest tube malposition, persistent air leak, or hemothorax. Continue serial CXRs and monitor for re-expansion pulmonary edema.