

NGN NCLEX 2026 • CARDIOPULMONARY EMERGENCY

# Pulmonary Embolism

SYSTEM • Respiratory / Cardiovascular • Hematology / Coagulation

A life-threatening obstruction of the pulmonary vasculature — most often a dislodged DVT — producing acute V/Q mismatch, hypoxemia, and right-heart strain. Time-critical recognition and anticoagulation save lives.

**Source transparency:** This topic is not present in Diane's uploaded reference notes. Content compiled from **Saunders Comprehensive Review for the NCLEX-RN (2026)**, **ATI RN Pharmacology Made Easy 5.0**, **Lippincott Illustrated Reviews: Pharmacology**, **AHA Scientific Statement on Massive & Submassive PE (2023 update)**, and **CHEST/ACCP Antithrombotic Therapy Guidelines (2021)**.



## Definition & Overview

WHAT IT IS • WHY IT MATTERS

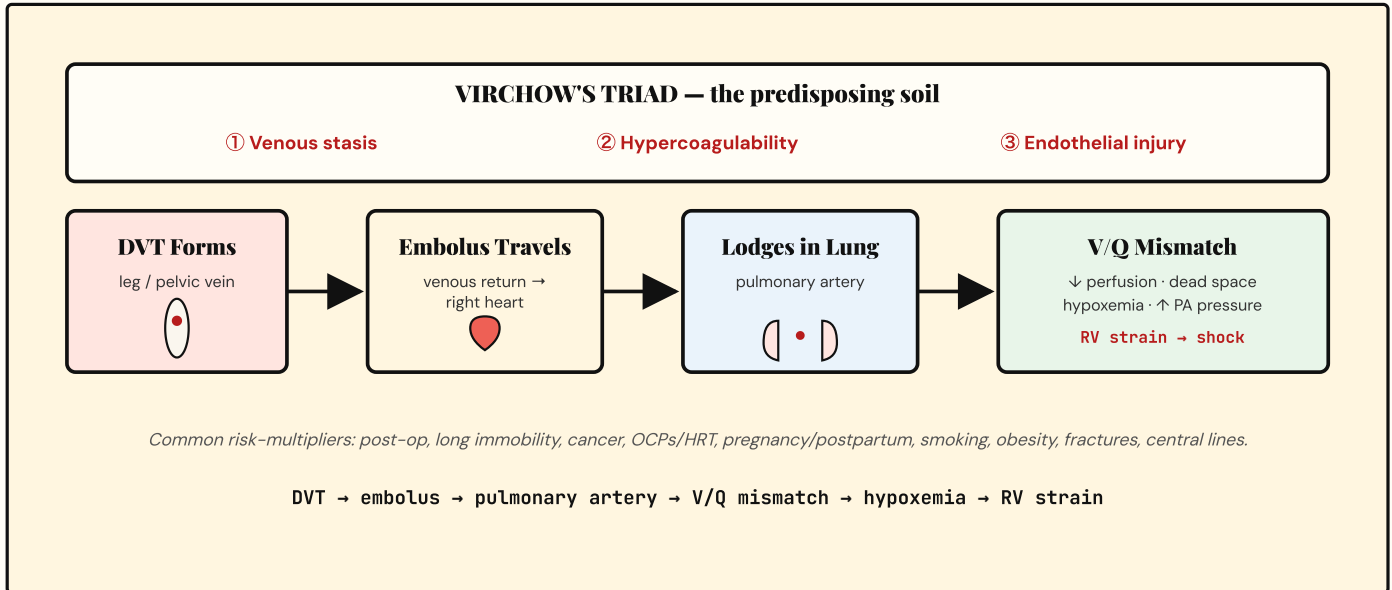
- ▶ **Pulmonary embolism (PE):** obstruction of a pulmonary artery or one of its branches by a thrombus, fat globule, air, amniotic fluid, or tumor cell — most commonly a thrombus that broke off a deep vein thrombosis (DVT) in the leg or pelvis.
- ▶ **Why it matters:** 3rd leading cause of cardiovascular death in the U.S. Mortality is highest in the first hour; recognition + anticoagulation is time-critical.
- ▶ **Spectrum:** ranges from small subsegmental (often subtle) → submassive (right-heart strain) → **massive** (sustained hypotension, cardiogenic shock, arrest).



## Pathophysiology

MECHANISM · SIMPLIFIED FLOW

- ▶ **Virchow's triad** sets the stage: **venous stasis + hypercoagulability + endothelial injury**.
- ▶ A clot forms in a deep vein (typically lower extremity or pelvis), dislodges, travels through the venous system → right atrium → right ventricle → pulmonary artery, where it lodges.
- ▶ Result: **V/Q mismatch** (ventilated but not perfused alveoli = dead space) → hypoxemia, respiratory alkalosis (from tachypnea), pulmonary hypertension, right-heart strain → potentially shock and death.





## Signs & Symptoms

EARLY/CLASSIC VS LATE/MASSIVE · RED FLAGS

### ● Early / Classic

- **Sudden-onset dyspnea** (most common symptom)
- **Pleuritic chest pain** (sharp, worse with deep breath)
- Tachypnea (RR > 20)
- Tachycardia (HR > 100)
- Cough, sometimes blood-tinged sputum (hemoptysis)
- Apprehension · anxiety · "sense of impending doom"
- Low-grade fever
- SpO<sub>2</sub> falling — often the earliest objective cue

### ● Late / Massive PE

- **Hypotension** (sustained SBP < 90) — defines *massive* PE
- Syncope or near-syncope
- Cyanosis (lips, nailbeds)
- JVD, accentuated P<sub>2</sub> heart sound
- S3 / S4 gallop · right-heart strain
- Altered mental status from hypoxia
- Crackles, pleural friction rub
- Cardiogenic shock · PEA arrest

### 🚨 RED FLAG findings — escalate now

- 🚨 Sudden severe dyspnea + sustained hypotension = **massive PE** (consider thrombolytics / embolectomy)
- 🚨 Hemoptysis with chest pain
- 🚨 Acute right-heart failure: JVD + clear lungs + hypotension
- 🚨 Altered LOC, cyanosis, SpO<sub>2</sub> < 90% despite supplemental O<sub>2</sub>
- 🚨 Post-op or post-immobility patient with abrupt anxiety + tachycardia — treat as PE until ruled out

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## Priority Nursing Interventions

ABC FRAMEWORK • NCLEX PRIORITIZATION

| Priority                    | Action                                                                                                                                                                                                                                               |
|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>A — Airway</b>           | Assess airway patency; suction if needed. Prepare for intubation if SpO <sub>2</sub> unresponsive or LOC declining.                                                                                                                                  |
| <b>B — Breathing</b>        | <b>HIGH-Fowler's</b> position (NOT Trendelenburg). Administer <b>high-flow O<sub>2</sub></b> via non-rebreather; titrate to SpO <sub>2</sub> ≥ 92%. Monitor RR, ABGs (expect respiratory alkalosis + hypoxemia early). Encourage slow, deep breaths. |
| <b>C — Circulation</b>      | Establish 2 large-bore IVs. Continuous cardiac + BP monitoring. Anticipate IV fluids cautiously for hypotension (avoid overload → worsens RV strain). Vasopressors (norepinephrine) for shock.                                                       |
| <b>Anticoag</b>             | Initiate <b>IV heparin drip</b> per protocol; monitor aPTT (goal 1.5–2.5× control, ~60–80 sec). Bridge to oral anticoagulant (warfarin or DOAC).                                                                                                     |
| <b>Thrombolysis</b>         | For <b>massive PE</b> with hemodynamic instability: prepare <b>alteplase (tPA)</b> ; verify no absolute bleeding contraindications. Surgical embolectomy or catheter-directed thrombolysis if tPA contraindicated.                                   |
| <b>Comfort &amp; Safety</b> | Maintain bed rest initially; manage pain (avoid IM injections on anticoagulants); reduce anxiety with calm, simple explanations. Monitor for bleeding (gums, urine, stool, neuro changes).                                                           |
| <b>Prevent</b>              | Identify DVT risk; apply <b>sequential compression devices (SCDs)</b> to unaffected limb; pharmacologic prophylaxis (LMWH) for at-risk patients; early ambulation when safe.                                                                         |

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# Pharmacology

ANTICOAGULANTS · THROMBOLYTICS · KEY REVERSALS

| Drug / Class                                               | Mechanism                                                                                  | Monitoring                                                                        | Key Side Effects · Nursing Considerations                                                                                                                                                                                                                            |
|------------------------------------------------------------|--------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>HEPARIN</b><br>IV (acute)                               | Activates antithrombin III → inhibits thrombin (IIa) & factor Xa. Prevents clot extension. | <b>aPTT</b> q6h (goal 1.5–2.5× control, ~60–80 sec)<br>Platelets (HIT)<br>Hgb/Hct | Bleeding · <b>HIT</b> (heparin-induced thrombocytopenia: stop drug if platelets ↓ >50%) · osteoporosis (long-term).<br><b>Antidote: PROTAMINE SULFATE</b>                                                                                                            |
| <b>ENOXAPARIN (Lovenox)</b> – LMWH                         | Preferentially inhibits factor Xa. Subcutaneous; predictable kinetics.                     | Anti-Xa (rarely)<br>Platelets · renal fxn                                         | Deep-SQ in abdomen ("love handles"); do NOT expel air bubble; do NOT rub site. Lower HIT risk than heparin.<br><b>Partial reversal: PROTAMINE</b>                                                                                                                    |
| <b>WARFARIN (Coumadin)</b>                                 | Vitamin-K antagonist → inhibits factors II, VII, IX, X & protein C/S.                      | <b>PT/INR</b> (goal 2.0–3.0 for PE)<br>Onset 3–5 days — overlap with heparin      | Bleeding · teratogenic (pregnancy = contraindicated) · many drug/food interactions. Keep <b>vitamin K intake CONSISTENT</b> (don't avoid greens — keep steady).<br><b>Antidote: VITAMIN K (phytonadione)</b> · FFP / PCC for major bleed                             |
| <b>DOACs</b> (apixaban, rivaroxaban, dabigatran, edoxaban) | Direct factor Xa inhibitors (apix/riva/edox) · direct thrombin inhibitor (dabigatran).     | No routine labs · check renal function                                            | Bleeding · fewer interactions than warfarin · no dietary restrictions.<br><b>Andexanet alfa</b> (Xa inhibitors) · <b>Idarucizumab</b> (dabigatran)                                                                                                                   |
| <b>ALTEPLASE (tPA)</b> – thrombolytic                      | Converts plasminogen → plasmin → <b>dissolves existing clot</b> .                          | Continuous VS · neuro checks · bleeding survey · fibrinogen                       | <b>Massive PE only</b> . HIGH bleeding risk. <b>Contraindications:</b> recent (≤3 mo) hemorrhagic stroke, active bleeding, recent major surgery/trauma, severe uncontrolled HTN, intracranial neoplasm.<br><b>Support:</b> aminocaproic acid · cryoprecipitate · FFP |
| <b>NOREPINEPHRINE (supportive)</b>                         | α <sub>1</sub> -agonist → vasoconstriction → ↑ MAP & coronary perfusion in shock.          | BP q5min · MAP goal ≥ 65 · central line preferred                                 | Extravasation → tissue necrosis (antidote: <b>phentolamine</b> ). Use central line when possible.                                                                                                                                                                    |

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## NCLEX Test Traps

WRONG-VS-RIGHT • PRIORITY PITFALLS

✗ **WRONG**

Place the patient in Trendelenburg or supine flat to "improve circulation."

✓ **RIGHT**

**HIGH-Fowler's** — maximizes diaphragm excursion and oxygenation. Trendelenburg worsens dyspnea.

✗ **WRONG**

Massage the swollen, painful calf to "improve circulation."

✓ **RIGHT**

**Never massage** a suspected DVT — risks dislodging the clot. Elevate, immobilize, notify provider.

✗ **WRONG**

Give vitamin K to reverse a heparin overdose.

✓ **RIGHT**

**Protamine sulfate** reverses heparin / LMWH. Vitamin K is the warfarin antidote.

✗ **WRONG**

Teach the warfarin patient to *avoid* green leafy vegetables completely.

✓ **RIGHT**

Maintain a **consistent** intake of vitamin-K foods. Sudden change in either direction destabilizes INR.

✗ **WRONG**

Use aPTT to monitor warfarin therapy.

✓ **RIGHT**

**aPTT → heparin; PT/INR → warfarin.** Memorize this pair — frequently tested.

✗ **WRONG**

Choose "administer thrombolytics" first for every PE patient.

✓ **RIGHT**

Thrombolytics (tPA) are reserved for **massive PE** with hemodynamic instability. Routine PE = anticoagulation.

✗ **WRONG**

Encourage the post-op patient on bed rest to "stay still and rest."

✓ **RIGHT**

**Early ambulation**, SCDs, and ankle pumps PREVENT DVT/PE. Immobility is the enemy.

✗ **WRONG**

Give IM injections for pain in a patient on a heparin drip.

✓ **RIGHT**

**Avoid IM injections** while anticoagulated — hematoma risk. Use IV or PO route; hold pressure if SQ unavoidable.



## Patient & Family Education

DISCHARGE · SELF-CARE · PREVENTION

### Bleeding precautions

- ✓ Soft-bristle toothbrush; electric razor only
- ✓ No NSAIDs/aspirin without provider OK
- ✓ Report black/tarry stool, pink urine, nosebleeds, bruising
- ✓ Apply firm pressure 5–10 min after blood draws/injections
- ✓ Wear medical-alert ID stating "anticoagulant"

### Warfarin specifics

- ✓ Take same time daily; do not double up missed doses
- ✓ Keep vitamin-K intake **consistent** (don't quit greens — keep steady)
- ✓ Avoid grapefruit, cranberry juice, & alcohol binge
- ✓ Regular INR labs — bring list of all meds, herbals (ginkgo, garlic, ginger ↑ bleed)

### Symptoms to report

- ✓ New chest pain, sudden SOB, cough with blood
- ✓ Calf pain, redness, warmth, swelling (recurrent DVT)
- ✓ Severe headache, vision changes, confusion (intracranial bleed)
- ✓ Fall with head impact — go to ED even if you "feel fine"

### DVT/PE prevention

- ✓ Walk every 1–2 hours on long flights/car trips
- ✓ Hydrate well; avoid alcohol during travel
- ✓ Ankle pumps, calf stretches when seated
- ✓ Wear graduated compression stockings as prescribed
- ✓ Stop smoking · maintain healthy weight
- ✓ Discuss estrogen-containing contraceptives with provider

### Enoxaparin injection

- ✓ Inject deep SQ into abdomen ≥ 2 inches from umbilicus
- ✓ Do NOT expel air bubble — it seals the dose
- ✓ Do NOT rub site after injection (bruising)
- ✓ Rotate sites; record date/site each dose

### Follow-up

- ✓ Duration of anticoagulation typically 3–6 months minimum; longer if unprovoked or persistent risk
- ✓ Keep all lab and provider appointments
- ✓ Notify ALL providers (including dentist) about anticoagulant before procedures
- ✓ Inform female patients: warfarin = teratogenic; use reliable contraception



## Memory Boosters & Mnemonics

PATTERN RECOGNITION • QUICK RECALL

### P • E

#### Classic PE Presentation

- P** Pleuritic chest pain
- U** Unexplained dyspnea – sudden
- L** Low SpO<sub>2</sub>
- M** Mental anxiety / impending doom
- O** Oh look – tachycardia + tachypnea
- N** Nonproductive cough → hemoptysis

### V • I • C

#### Virchow's Triad

- V** Venous stasis (immobility, surgery, travel)
- I** Injury – endothelial (trauma, central line, surgery)
- C** Coagulopathy / hypercoagulable (cancer, OCPs, pregnancy, smoking)

### H • I • G • H

#### First Actions for Suspected PE

- H** HIGH-Fowler's position
- I** IV access & fluids (cautious) + IV heparin
- G** Give O<sub>2</sub> via non-rebreather
- H** Heart & SpO<sub>2</sub> monitor + call HCP

### aPTT • PT

#### Lab-Drug Pairing

- a** aPTT → heparin → Protamine
- P** PT/INR → warfarin → Vitamin K
- ★ "Heparin Hates aPTT; Warfarin Wants PT"

### B • L • E • E • D

#### Anticoagulant Bleed Watch

- B** Bruising / petechiae
- L** Lab changes (↓Hgb/Hct, ↓platelets)
- E** Emesis – coffee-ground
- E** Excretion – tarry stool, pink urine
- D** Decreased LOC (intracranial bleed)

### D • V • T

#### DVT Clinical Cues

- D** Diameter ↑ (unilateral calf swelling >3 cm)
- V** Veiny + warm + erythematous
- T** Tenderness – never massage



## NCJMM Clinical Judgment Scenario

NEXT-GEN NCLEX • SIX-STEP MODEL

**Scenario:** A 58-year-old female, post-op day 2 from total hip arthroplasty, suddenly reports "I can't catch my breath." She is restless and clutching her right chest. Vitals: HR 124, RR 30, BP 96/58, SpO<sub>2</sub> 86% on room air, T 99.4 °F. Lungs reveal scattered crackles RLL. Right calf is swollen, warm, and tender.

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RECOGNIZE  
CUES

### Identify relevant data

**Relevant:** sudden dyspnea, pleuritic chest pain, SpO<sub>2</sub> 86%, tachycardia 124, tachypnea 30, hypotension 96/58, swollen warm calf, recent orthopedic surgery, immobility.

**Irrelevant:** low-grade temp alone, scattered crackles alone.

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ANALYZE  
CUES

### Connect the data to a hypothesis

Post-op + immobility = Virchow's stasis. Acute dyspnea + chest pain + hypoxia + unilateral swollen warm calf = **acute pulmonary embolism likely originating from a DVT**. Hypotension + RR 30 = early hemodynamic compromise → possible submassive/massive PE.

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PRIORITIZE  
HYPOTHESES

### What is most urgent?

Top priority: **oxygenation & perfusion** (Airway → Breathing → Circulation). Suspect PE > pneumonia, anxiety, or MI based on pattern recognition. Hemodynamic compromise is the imminent threat — act before confirmation.

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GENERATE  
SOLUTIONS

### What interventions could work?

Position HIGH-Fowler's; high-flow O<sub>2</sub> via non-rebreather; establish 2 large-bore IVs; continuous cardiac & SpO<sub>2</sub> monitor; notify rapid response + provider; anticipate stat CT-PA, D-dimer, ABG, troponin, BNP; prepare IV heparin per protocol; if hemodynamics worsen → tPA candidacy review.

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TAKE  
ACTIONS

### Implement priorities

Immediate: ① High-Fowler's, ② non-rebreather 100% O<sub>2</sub>, ③ call rapid response, ④ second IV, ⑤ obtain stat ABG & labs, ⑥ initiate continuous monitoring. **Do NOT massage** the swollen calf. Avoid IM injections. Hold any scheduled SQ enoxaparin until heparin protocol clarified.

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EVALUATE  
OUTCOMES

### Reassess and adjust

**Expected improvement (within 15–30 min):** SpO<sub>2</sub> ≥ 92% on O<sub>2</sub>, RR < 24, HR trending down, BP rising toward baseline, decreased anxiety, no new bleeding. **If worsening** (SpO<sub>2</sub> stays < 90%, SBP < 90 sustained): escalate to ICU for thrombolytic candidacy or catheter-directed therapy; prepare for possible intubation.