

PHARM • HIGH-YIELD • NGN 2026

NCLEX-RN • CARDIOVASCULAR PHARMACOLOGY • HIGH-YIELD REVIEW

Vasodilators

Drugs that relax vascular smooth muscle — lowering BP, reducing preload and/or afterload, and rescuing hypertensive emergencies. Small errors → big consequences.

SYSTEM • CARDIOVASCULAR

CLASS • VASODILATOR

HIGH-ALERT MEDICATIONS

NGN CLINICAL JUDGMENT

01

■ DRUG OVERVIEW

Why we give them

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- **Hypertension** — chronic control & hypertensive emergencies
- **Angina / Acute Coronary Syndrome** — relieve myocardial ischemia
- **Heart Failure** — reduce preload & afterload → ↑ cardiac output
- **Pulmonary hypertension** — specific agents (not covered here)
- **Preeclampsia / severe HTN in pregnancy** — hydralazine is first-line IV
- **Controlled hypotension during surgery** — nitroprusside

BIG IDEA

Vasodilators **preload** (venous side → either drop side → nitrates), **afterload** (arterial side → hydralazine, minoxidil), or **both** (nitroprusside). Know which one each drug hits — NCLEX loves this distinction.

02 MECHANISM OF ACTION How they change physiology



NITRATES → release nitric oxide (NO) → ↑ cGMP in smooth muscle → **VENOUS dilation** → ↓ preload → ↓ myocardial O₂ demand

HYDRALAZINE → direct arteriolar relaxation → ↓ SVR → ↓ **afterload**

NITROPRUSSIDE → NO donor, acts on **arteries + veins** → ↓ preload AND ↓ afterload

MINOXIDIL → opens K⁺ channels in arterioles → hyperpolarization → ↓ afterload

PRELOAD ↓ = VENOUS

Less blood returning to the heart → less stretch → less O₂ demand. Best for angina & pulmonary congestion.

AFTERLOAD ↓ = ARTERIAL

Less resistance the heart pumps against → easier ejection. Best for HTN & heart failure.

03 THERAPEUTIC EFFECTS What tells you it's working



- **BP trends down** toward target (MAP ≥ 65; individualized SBP goal)
- **Chest pain relieved** within 5 min of SL nitroglycerin
- **Improved breathing** — reduced pulmonary congestion, crackles, dyspnea
- ↑ **Cardiac output** / ↑ **urine output** in HF (better perfusion)
- **Warm, pink, well-perfused** extremities; improved capillary refill
- ↓ **JVD**, ↓ peripheral edema over days

04 SIDE EFFECTS & ADVERSE REACTIONS Common vs. life-threatening



COMMON (EXPECTED)

- **Throbbing headache** (nitrates — very common, treat with acetaminophen)
- Orthostatic hypotension, dizziness
- Facial flushing
- **Reflex tachycardia** (body compensates for BP drop)
- Palpitations
- Nausea
- Nitrate tolerance (needs 10–12 hr drug-free interval)

SERIOUS / LETHAL

- **Severe hypotension → shock** (#1 risk)
- Syncope → fall injury
- **Cyanide / thiocyanate toxicity** — nitroprusside >24–72 hr or high dose
- **Methemoglobinemia** — nitrates (cyanosis unresponsive to O₂; chocolate-brown blood)
- **Drug-induced lupus** — hydralazine (+ANA, joint pain, rash, fever)
- **Pericardial effusion / tamponade** — minoxidil
- **Fatal hypotension** when combined with PDE-5 inhibitors (sildenafil, tadalafil, vardenafil)
- Reflex tachy → MI in CAD patients

△ TOXICITY

Cyanide toxicity: **metabolic acidosis, confusion, seizures, "almond" breath, tachypnea, cardiovascular collapse.**

Stop nitroprusside immediately and treat with sodium thiosulfate + hydroxocobalamin.

05 PRIORITY NURSING CONSIDERATIONS Assess • Monitor • Hold • Notify



MONITOR

- **BP before AND 5 min after** every dose
- Continuous arterial BP if IV nitroprusside/NTG
- Heart rate (watch for reflex tachy >100)
- Chest pain character & relief after SL NTG
- Mental status, orthostatic vitals
- Urine output (perfusion marker)

HOLD & NOTIFY IF...

- **SBP < 90 mmHg** (or per protocol)
- HR > 100 or new arrhythmia
- Severe or unrelieved headache
- Signs of shock: cool, clammy, confused, ↓ UOP
- Cyanosis unresponsive to O₂ (methemoglobin)
- Joint pain/rash on hydralazine → suspect lupus

CONTRAINDICATED IN...

- **PDE-5 inhibitor use within 24–48 hr** (sildenafil 24h, tadalafil 48h)
- **Right ventricular / inferior MI** (preload-dependent)
- Severe aortic stenosis / HOCM
- Increased intracranial pressure
- Hypovolemia, cardiogenic shock
- Pericardial tamponade, constrictive pericarditis

KEY DRUG INTERACTIONS

- **PDE-5 inhibitors** — fatal hypotension (never combine)
- Other antihypertensives — additive hypotension
- Alcohol — additive vasodilation
- Riociguat (pulmonary HTN drug) — contraindicated with nitrates
- Tricyclics, antipsychotics — ↑ orthostatic drop

06 LABS & DIAGNOSTICS

What to monitor & critical values



LAB / TEST	WHY	CRITICAL / ABNORMAL
BP / MAP	Primary efficacy & safety	SBP <90 or MAP <65 → hypoperfusion
Thiocyanate level	Nitroprusside >24–48 hr	>10 mg/dL = toxic → stop drug
Serum lactate / ABG	Cyanide toxicity (nitroprusside)	↑ lactate + metabolic acidosis = toxicity
Methemoglobin	Cyanosis on nitrates unresponsive to O ₂	>10% symptomatic; treat with methylene blue
BUN / Creatinine	Renal function — nitroprusside clearance	↑ Cr → dose reduce, risk of toxicity
ANA / anti-histone Ab	Hydralazine lupus screen (long-term)	+ANA + symptoms → discontinue
CBC	Hydralazine → rare blood dyscrasias	↓ WBC, ↓ platelets
BNP / echo	HF therapeutic response	Trending down = improving
Liver enzymes	Long-term monitoring	↑ AST/ALT → investigate

07 ADMINISTRATION & SAFETY

Route, timing, high-alert precautions



NITROGLYCERIN (NTG)

- **SL tablet/spray:** 1 dose → if no relief in 5 min, call 911, then may repeat q5min × 2 more doses (AHA: call EMS after first unrelieved dose)
- Sit or lie down before taking — orthostatic drop
- **Burning/tingling = potent;** no burn = likely expired
- Store in **original dark glass bottle**, away from light/heat/moisture; replace every 3–6 months
- **Patch:** remove old patch before applying new one; rotate sites; **10–12 hr nitrate-free interval** to prevent tolerance
- **IV:** use **non-PVC (glass/polyethylene) tubing** — PVC absorbs drug
- Wear gloves when applying ointment (absorbed through skin)

SODIUM NITROPRUSSIDE (NIPRIDE)

- **ICU only** with continuous intra-arterial BP monitoring
- **Light-protective wrap** on bag + tubing; discard if blue/green/dark red
- Infuse via pump; starting 0.3 mcg/kg/min, max 10 mcg/kg/min (limit 10 min at max)
- Mix only in D5W
- **Taper off** — do not stop abruptly (rebound HTN)
- Check thiocyanate after 24–48 hr of use

HYDRALAZINE & MINOXIDIL

- **Hydralazine PO:** take with food (↑ absorption, consistency matters)
- **Hydralazine IV:** slow push; watch for reflex tachy — often given with a beta-blocker

→ **Minoxidil:** last-line; usually paired with a beta-blocker + diuretic to blunt reflex tachy and fluid retention

08 PATIENT EDUCATION What they **MUST** know at home



- **Change positions slowly** — sit 1 min before standing (orthostatic hypotension)
- **Carry NTG at all times;** keep in original dark bottle, NOT a pill organizer
- **Sit or lie down** before taking SL NTG
- **Call 911 after the first SL dose** if chest pain not relieved in 5 min; may take up to 3 doses total while waiting
- **Never combine with erectile dysfunction drugs** (sildenafil/Viagra, tadalafil/Cialis) — can cause fatal low BP
- Expect **headache** — treat with acetaminophen; usually improves with time. Don't stop the med.
- Avoid alcohol, hot tubs, saunas (additive vasodilation)
- **Remove old patch** before applying a new one; give a 10–12 hr patch-free window daily
- Report: fainting, severe dizziness, visual changes, chest pain unrelieved, joint pain/rash (hydralazine), blue lips (methemoglobin)
- Never crush extended-release forms
- Do not stop abruptly — taper per provider

09 ■ NCLEX TEST TRAPS ▲ Where students lose points



- **Updated 911 rule:** AHA recommends calling EMS after the first unrelieved SL NTG dose (older teaching said "after 3 doses" — that's the distractor)
- **NTG headache is EXPECTED** — not a reason to hold the drug. Distractor: "Stop the medication." Correct: "Give acetaminophen; continue therapy."
- **NTG that doesn't burn under the tongue** = likely expired, not "working better"
- **Sildenafil + nitrate = fatal.** Any scenario with ED drugs → rule out nitrates first
- **Inferior/RV MI** → nitrates are contraindicated (preload-dependent). Distractor: "Give SL NTG for chest pain." Correct: fluids first.
- **Reflex tachycardia** from vasodilators is expected with direct arterial agents — not "worsening MI"
- **Hydralazine + joint pain / malar rash / +ANA** = drug-induced lupus → discontinue
- **Minoxidil hair growth** is a cosmetic side effect, not a reason to hold an essential antihypertensive
- **Nitroprusside + new confusion + metabolic acidosis** = cyanide toxicity. FIRST action: stop the infusion
- **PVC tubing** with IV NTG = wrong (absorbs drug); use glass or non-PVC
- **Store SL NTG in purse/pocket in paper packet?** Wrong — dark glass bottle only
- **Patch rotation:** don't apply to old patch site; remove before placing new
- **Priority:** BP check before every dose, not just "with vitals q4h"

10

MEMORY BOOSTERS

Mnemonics & quick recall



MNEMONIC • 6 P's of Nitrates

***P**ounding headache • **P**ostural hypotension • **P**alpitations • **P**rotect from light • **P**ill in dark bottle • **P**DE-5 = **N**EVER*

MNEMONIC • Preload vs Afterload

"Nitrates drop PRELOAD (veins) • Hydralazine hits ARTERIES (afterload) • Nipride does BOTH"

MNEMONIC • Hydralazine

***"HYDRALAZINE causes SLE"** — drug-induced Lupus Erythematosus (joint pain, rash, +ANA)*

MNEMONIC • Nitroprusside Toxicity

***"CYAN-ide from NIPRIDE"** — cyanosis, confusion, acidosis, almond breath*

MNEMONIC • Minoxidil

***"MINOXIDIL → MORE HAIR, MORE FLUID"** — hirsutism + fluid retention + pericardial effusion*

PATTERN • Reflex Tachycardia Rescue

Direct arterial dilators → pair with a beta-blocker to blunt reflex tachycardia

11

CLINICAL JUDGMENT SNAPSHOT

Think like the NGN



1

#1 PRIORITY RISK

Severe hypotension leading to hypoperfusion, syncope, and shock — plus fatal hypotension if combined with PDE-5 inhibitors.

2

WHAT HARMS FIRST?

Orthostatic drop → syncope → fall injury. In ICU: under-detected trend of falling MAP before cardiovascular collapse.

3

FIRST NURSING ACTION

Check BP & HR before every dose. If SBP < 90 → hold, position supine with legs elevated, and notify provider. For IV nitroprusside with suspected cyanide toxicity: stop the infusion first.

RAPID RESPONSE

Hypotension after vasodilator: STOP/hold drug → supine + legs up → IV fluids → recheck BP q2–5 min → notify. Avoid Trendelenburg (worsens cardiac workload).

12 ★ MOST TESTED DRUGS IN THIS CLASS Key differences at a glance



DRUG	PRIMARY EFFECT	TOP USE	SIGNATURE RISK / PEARL
Nitroglycerin (Nitrostat, Nitro-Bid)	Venous >> arterial (↓ preload)	Angina, ACS, acute HF	Throbbing H/A · tolerance · non-PVC IV tubing · NEVER with PDE-5
Isosorbide (dinitrate / mononitrate)	Venous (↓ preload)	Chronic stable angina; HF (with hydralazine → BiDil)	Needs 10–12 hr nitrate-free interval daily to prevent tolerance
Hydralazine (Apresoline)	Arterial (↓ afterload)	HTN, preeclampsia, HF (combo)	Drug-induced lupus · reflex tachy · IV = first-line for preeclampsia severe HTN
Sodium Nitroprusside (Nipride, Nitropress)	Arterial + Venous (both)	Hypertensive emergency · controlled hypotension	ICU only · light-protect · cyanide/thiocyanate toxicity · continuous arterial line
Minoxidil (Loniten / topical: Rogaine)	Arterial (↓ afterload)	Refractory HTN	Hirsutism · fluid retention · pericardial effusion · pair with BB + diuretic

HIGH YIELD

BiDil (isosorbide dinitrate + hydralazine) = FDA-approved for heart failure, particularly studied in self-identified Black patients with NYHA III–IV HFrEF on standard therapy. Classic NCLEX combo question.