

• NGN NCLEX • 2026 TEST PLAN • CARDIOVASCULAR PHARMACOLOGY

ACE Inhibitors

Angiotensin-Converting Enzyme Inhibitors · the “-pril” drugs

SYSTEM • RAAS / CARDIOVASCULAR

HIGH-YIELD

BLACK-BOX: PREGNANCY

RX: CAPTOPRIL • ENALAPRIL • LISINOPRIL • RAMIPRIL • BENAZEPRIL • FOSINOPRIL • QUINAPRIL

01 DRUG OVERVIEW Why we give it

- ◆ **Hypertension** — first-line, especially in diabetics & CKD
- ◆ **Heart failure (HFrEF)** — reduces mortality & hospitalization
- ◆ **Post-MI** with left-ventricular dysfunction — prevents remodeling
- ◆ **Diabetic nephropathy** — ↓ proteinuria, slows renal decline
- ◆ **Chronic kidney disease** — renoprotective (proteinuric CKD)
- ◆ **Stroke prevention** in high-risk vascular patients

CLINICAL PEARL ACE inhibitors are the **gold standard** for HTN in a patient with diabetes +

02 MECHANISM OF ACTION How the physiology shifts

Angiotensin I → **BLOCKED at ACE** → × Angiotensin II

↓ Angiotensin II → Vasodilation · ↓ SVR · ↓ Blood pressure

↓ Aldosterone → ↓ Na⁺ / H₂O retention · ↑ K⁺ retention (hyperkalemia risk)

↑ Bradykinin → Dry cough · Angioedema (the ACE-specific SEs)

Efferent arteriole dilation →

↓ Intraglomerular pressure · **renal protection** · ↓ proteinuria

ACE VS ARB — KNOW THE SPLIT ARBs block the **receptor** (not the enzyme) and do **not** raise bradykinin — that's why ARBs cause *far less* cough & angioedema. Both still raise K⁺ and both are teratogenic.

proteinuria. If the stem mentions a diabetic with protein in the urine, think **-pril**.

03 THERAPEUTIC EFFECTS

What tells you it's working

BLOOD PRESSURE

↓ SBP & DBP

Goal BP typically < 130/80
(diabetics, CKD)

HEART FAILURE

↑ Exercise tolerance

↓ Dyspnea · ↓ edema · ↓ weight · ↓
readmissions

KIDNEYS

↓ Proteinuria

Urine albumin/creatinine ratio
improves

HEART / VESSELS

↓ Remodeling

↓ Preload & afterload · improved EF
over time

04 SIDE EFFECTS & ADVERSE REACTIONS

From “report it” to “stop it now”

• Common — expected & reportable

- ◆ **Dry, hacking, non-productive cough** (10–20%) — *bradykinin*; #1 reason for discontinuation
- ◆ **First-dose hypotension** · dizziness · orthostasis
- ◆ **Hyperkalemia** (mild, early)
- ◆ Headache · fatigue
- ◆ Dysgeusia (altered taste) — especially **captopril**
- ◆ Mild ↑ serum creatinine (up to ~30% is **acceptable**)
- ◆ Rash (captopril > others)

🚨 Serious — life-threatening

- ◆ **ANGIOEDEMA** — swelling of lips, tongue, face, larynx → *airway obstruction & death*. Higher risk in Black patients. Can occur on the 1st dose or after years of use.
- ◆ **Severe hyperkalemia** → peaked T waves, widened QRS, cardiac arrest
- ◆ **Acute kidney injury** — especially bilateral renal artery stenosis, volume depletion, NSAID co-use
- ◆ **Fetal injury / death** — teratogenic in *all* trimesters
- ◆ Neutropenia / agranulocytosis (captopril)
- ◆ Severe symptomatic hypotension · syncope
- ◆ Hepatotoxicity (rare)

05 PRIORITY NURSING CONSIDERATIONS

Assess • Monitor • Hold • Notify

→ ASSESS / MONITOR

- **BP** before & after dose (orthostatics at start)
- **Serum K⁺**, BUN, creatinine, eGFR
- **CBC** (esp. captopril — neutropenia)
- Daily **weight** & I/Os in HF patients
- **Cough**, tongue/lip swelling each visit

→ HOLD / NOTIFY PROVIDER

- × **SBP < 90 mmHg** (or per parameter)
- × **K⁺ > 5.0–5.5 mEq/L**
- × **Creatinine ↑ > 30%** from baseline
- × **ANY** facial/lip/tongue swelling → STOP & never rechallenge
- × Suspected / confirmed **pregnancy**

ABSOLUTE CONTRAINDICATIONS Pregnancy (all trimesters) · prior angioedema (from any cause) · bilateral renal artery stenosis · hypersensitivity · within **36 h** of

06 LABS & DIAGNOSTICS

What to trend & what it means

K⁺ · 3.5–5.0 mEq/L

K⁺ > 5.5 = HOLD

K⁺ > 6.0 = EMERGENCY

BUN · 7–20 mg/dL

Cr · 0.6–1.2 mg/dL

eGFR > 60 preferred

WBC · 5–10 K/μL (captopril)

Urine ACR · trend ↓

sacubitril/valsartan (Entresto) · concurrent aliskiren in diabetics.

DANGEROUS COMBINATIONS **K⁺ supplements / salt substitutes (KCl)**, K⁺-sparing diuretics (spironolactone, eplerenone, triamterene), **ARBs** (dual RAAS blockade = AKI + hyperK), **NSAIDs** (↓ effect + AKI), lithium (toxicity).

TIMING Baseline labs before starting · repeat **1–2 weeks** after initiation or dose change · then periodically. Expect a small **Cr bump (~20–30%)** — reflects intended efferent dilation, not injury.

RED-FLAG VALUES K⁺ > 5.5 · Cr ↑ > 30% from baseline · WBC < 3.5 · ANC < 1,500 · eGFR drop > 25%.

07 ADMINISTRATION & SAFETY

Route · timing · high-alert

- ◆ **Route:** PO for all (enalapril has IV form — **enalaprilat**)
- ◆ **Captopril:** empty stomach (1 h before / 2 h after meals); 2–3×/day
- ◆ **Lisinopril / ramipril / enalapril:** once daily, with or without food
- ◆ **First dose at bedtime** — minimizes first-dose hypotension
- ◆ Rise slowly from lying/sitting (orthostatic risk)
- ◆ **36-hour washout** required before starting sacubitril/valsartan (Entresto) — overlap → fatal angioedema risk
- ◆ Do **not** combine routinely with ARBs
- ◆ Do not stop abruptly — rebound HTN

PREGNANCY — ABSOLUTE Stop immediately if pregnancy is detected/planned. Counsel women of

08 PATIENT EDUCATION

What they MUST know before discharge

TEACH THEM

- ✓ **Dry cough** is common & not dangerous — report if bothersome (may switch to ARB)
- ✓ Rise slowly · stay hydrated · monitor BP at home
- ✓ Same time daily · don't double up if missed
- ✓ Use **effective contraception** — stop & call if pregnant
- ✓ Report weight gain > 2–3 lb/day (HF) or muscle weakness / irregular heartbeat (K⁺)

AVOID

- ✗ **Salt substitutes** — they contain *potassium chloride*
- ✗ Large amounts of high-K⁺ foods (bananas, oranges, potatoes, spinach, tomatoes, avocado)
- ✗ **NSAIDs** (ibuprofen, naproxen) — blunt effect + AKI
- ✗ OTC K⁺ supplements
- ✗ Abrupt discontinuation

CALL 911 / GO TO ER Swelling of lips, tongue, face, or throat · difficulty breathing or swallowing · hoarseness · chest pain · syncope · decreased urine output.

childbearing age about effective contraception.

09 NCLEX TEST TRAPS ⚠️ Where students lose the point

- #1 **“-pril” = ACE inhibitor.** “-sartan” = ARB. Don’t confuse the mechanisms — only ACEi raises bradykinin (cough, angioedema).
- #2 **Do NOT combine ACEi + ARB** routinely → dual RAAS blockade = AKI + hyperkalemia.
- #3 **Salt substitutes trap:** they contain KCl → hyperkalemia. Classic teaching-outcome item.
- #4 **Angioedema is STOP FOREVER.** Never rechallenge — not with another ACEi, cautious with ARB.
- #5 **Angioedema = IM epinephrine FIRST** (not Benadryl, not steroids alone). Airway is the priority.
- #6 **Pregnancy = contraindicated in ALL trimesters** (not just 2nd/3rd, as older resources may say).
- #7 **First-dose hypotension** → give at bedtime, especially for the very first dose.
- #8 **Creatinine ↑ up to 30%** from baseline after starting = *expected*, not a reason to stop.
- #9 **36-hour washout** before starting Entresto (sacubitril/valsartan) — overlap is lethal.
- #10 **Dry cough** is a bradykinin effect — it is NOT an infection; don’t treat with antibiotics.
- #11 **Black patients:** lower BP response as monotherapy + higher angioedema risk — NCLEX may test this as a cultural/pharm competency item.

10 MEMORY BOOSTERS Stick it, don’t re-study it

MNEMONIC · THE “CAPTOPRIL” SIDE EFFECTS

- C** Cough (dry, persistent)
- A** Angioedema (airway!)
- P** Potassium ↑ (hyperkalemia)
- T** Taste changes / dysgeusia
- O** Orthostatic hypotension
- P** Pregnancy — contraindicated
- R** Renal — protects *and* can injure
- I** Increased bradykinin
- L** Lowers BP & afterload

3-LETTER RECALL A — C — E · Angioedema · Cough
· Elevated K⁺. If you remember nothing else, remember these three.

PATTERN ACROSS RAAS **-pril** = ACE inhibitor · **-sartan** = ARB · **-iren** = direct renin inhibitor (aliskiren).

#12 NSAIDs blunt the antihypertensive effect AND ↑ AKI risk — a common teaching point.

+ BONUS • MOST TESTED DRUGS IN THIS CLASS
Know the differences before exam day

DRUG (GENERIC • BRAND)	ROUTE • DOSING	KEY DISTINGUISHING FEATURE	NCLEX POINT
Captopril • Capoten	PO • 2–3×/day • empty stomach	Shortest half-life; prototype drug	Most taste changes & neutropenia; watch CBC
Enalapril • Vasotec	PO & IV (enalaprilat)	Only ACEi with an IV form	Chosen for hypertensive urgency when PO not possible
Lisinopril • Prinivil • Zestril	PO • once daily • ± food	Most commonly prescribed; long-acting	Default “ACEi” on the NCLEX stem; renally excreted
Ramipril • Altace	PO • once daily	Strong CV outcomes data (HOPE trial)	Common post-MI & high CV-risk patients
Benazepril • Lotensin	PO • once daily	Often combined with amlodipine	Combo products → beware duplicate therapy
Fosinopril • Monopril	PO • once daily	Primarily hepatic elimination	Safer option in patients with renal impairment
Quinapril • Accupril	PO • once daily	Standard ACEi	Antacids ↓ absorption — separate by 2 h

★ FINAL SECTION • MANDATORY
Clinical Judgment Snapshot

#1 PRIORITY RISK

ANGIOEDEMA

Airway obstruction can develop in minutes.
Highest risk within first dose or first week — but

WHAT HARMS THE PATIENT FIRST

The airway

Tongue & laryngeal swelling → stridor → asphyxia. Second-tier killers: severe

FIRST NURSING ACTION (ANGIOEDEMA)

STOP the drug & assess the airway

can also occur years into therapy. Higher risk in Black patients.

hyperkalemia (arrhythmia) and symptomatic hypotension.

Then call rapid response and prepare **IM epinephrine** — the first-line, life-saving intervention. Antihistamines & steroids are adjuncts, not the priority.

NGN ACTION SEQUENCE • SUSPECTED ACEI ANGIOEDEMA

1. **Stop** the ACE inhibitor immediately — remove further exposure.
2. **Assess airway, breathing, circulation** — stridor, drooling, voice change, tongue size.
3. **Call Rapid Response** / notify provider; prepare for advanced airway.
4. **IM epinephrine 0.3–0.5 mg (1:1,000)** — the FIRST-line intervention.
5. Adjuncts: H1 + H2 antihistamines, corticosteroids, icatibant or C1-inhibitor if available.
6. Position upright; O₂ via non-rebreather; establish 2 large-bore IVs; continuous monitoring.
7. **Document & flag** the chart and allergy list — NEVER rechallenge with any ACEi; caution with ARB.

NGN ACTION SEQUENCE • ACUTE HYPERKALEMIA ($K^+ > 6.0$ OR ECG CHANGES)

1. **Calcium gluconate IV** — FIRST action to stabilize the cardiac membrane.
2. **Shift K^+ into cells:** insulin + D50, albuterol neb, sodium bicarb if acidotic.
3. **Remove K^+ :** loop diuretic, patiomer/SPS/SZC, dialysis if severe.
4. Hold the ACE inhibitor; remove all K^+ sources (supplements, salt substitutes).
5. Continuous cardiac monitoring; recheck K^+ & ECG.