RENAL SYSTEM · NGN NCLEX 2026

Chronic Kidney Disease

Progressive nephron loss → uremia → multi-system failure

GFR <60 for ≥3 months | Stages G1-G5 | Top causes: DM & HTN | ESRD at GFR <15

1 Definition & Overview

What it is · Why it matters

What Is CKD?

Progressive, irreversible loss of kidney function over months to years. Defined by **GFR <60 mL/min/1.73m²** for ≥3 months *OR* kidney damage markers (albuminuria, structural abnormalities) regardless of GFR.

Why It Matters

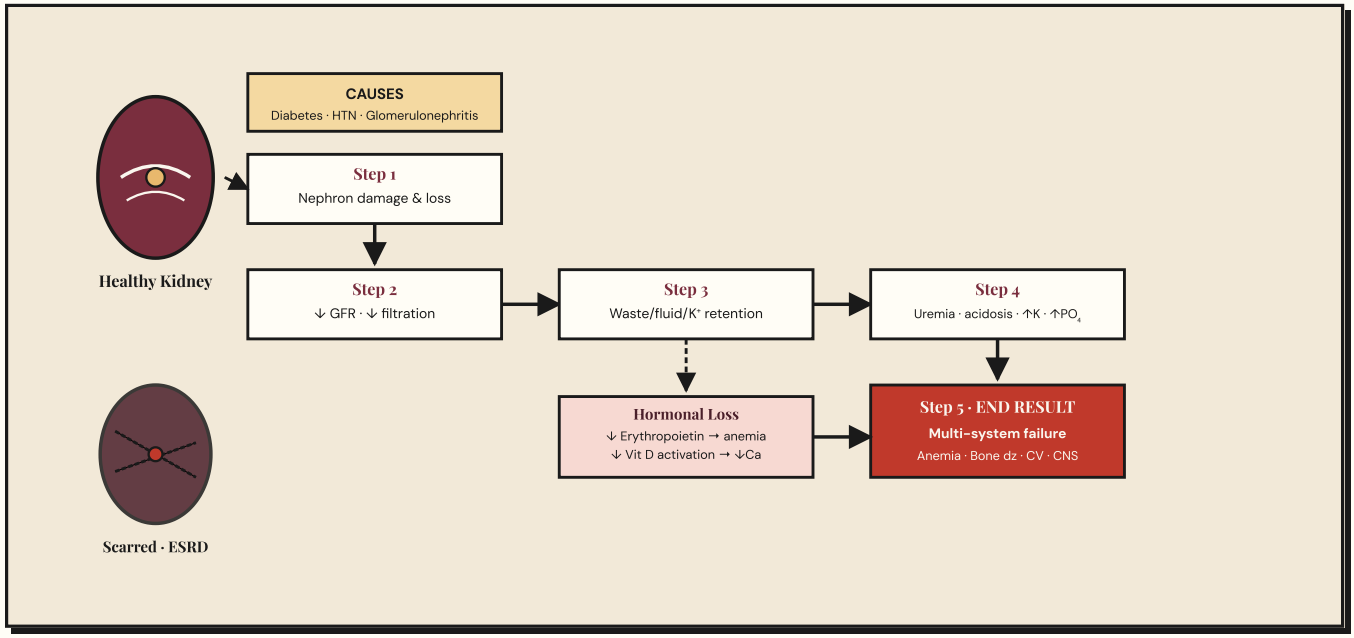
Kidneys fail to excrete waste, regulate fluid/electrolytes, activate vitamin D, produce erythropoietin, or maintain acid-base balance. End-stage = **dialysis or transplant** for survival. **Hyperkalemia** is the leading cause of cardiac arrest in CKD.

CKD Stages by GFR (mL/min/1.73m²)

G1	G2	G3	G4	G5
≥90	60-89	30-59	15-29	<15
Damage, normal GFR	*Mild ↓*	*Moderate ↓*	*Severe ↓*	*ESRD · Dialysis*

2 Pathophysiology

Nephron loss to multi-system failure — step by step



Core mechanism: Healthy nephrons hypertrophy to compensate → eventually overwhelmed → glomerular sclerosis → permanent fibrosis. Process is **irreversible**; goal is to slow progression and manage complications.

3 Signs & Symptoms

Early (often silent) vs. Late (uremic) presentations

🌱 EARLY (Stages 1–3)

- Often **asymptomatic** — silent disease
- Slight ↑ BUN & creatinine
- Mild hypertension
- **Nocturia** (early concentrating defect)
- Polyuria with dilute urine
- Mild proteinuria / albuminuria
- Fatigue with exertion

🔥 LATE (Stages 4–5 / Uremia)

- ▲ **Uremic frost** (urea crystals on skin)
- ▲ Anemia · pallor · fatigue
- ▲ Bone pain · pathologic fractures
- ▲ Kussmaul respirations (metabolic acidosis)
- ▲ Fluid overload · edema · JVD · crackles
- ▲ Pruritus · yellow-gray skin tone
- ▲ Pericarditis (Stage 5)
- ▲ Asterixis · encephalopathy · seizures
- ▲ N/V · anorexia · metallic taste · uremic breath
- ▲ Oliguria → anuria (late ESRD)

🚨 RED FLAG FINDINGS — Call HCP / Act NOW

- **HYPERKALEMIA** (K^+ >5.5): peaked T waves, wide QRS, weakness — lethal dysrhythmia risk
- **Pulmonary edema**: dyspnea, crackles, frothy sputum, SpO_2 <92%
- **Pericardial friction rub**: pericarditis → tamponade risk
- **Seizures / altered LOC**: severe uremia, hyponatremia, or hypertensive emergency
- **Weight gain >2 lb in 24 hr** or **>5 lb in 1 week** = fluid overload
- **Loss of thrill/bruit** in AV fistula = clotted access

🧪 Expected Lab Findings

Lab	Direction	Why
BUN / Creatinine	↑↑	Impaired waste excretion
GFR	↓ <60	Diagnostic threshold for CKD
Potassium (K^+)	↑ >5.0	Kidneys can't excrete K — LIFE-THREATENING
Phosphate (PO_4)	↑	Kidneys can't excrete PO_4
Calcium (Ca)	↓	↓ Vit D activation + binds with high PO_4

Lab	Direction	Why
Hemoglobin / Hct	↓	↓ Erythropoietin production
pH / Bicarbonate	↓ / ↓	Metabolic acidosis
Sodium (Na)	↓ (dilutional)	Fluid retention dilutes serum Na
Urine protein / albumin	↑	Glomerular damage marker

4 Priority Nursing Interventions

ABCs · Safety · NCLEX prioritization

PRIORITY #1 → Cardiac (Hyperkalemia). Always assess for peaked T waves & arrhythmias FIRST. K^+ >6.0 = emergency. **Airway** is compromised in fluid overload — always check lung sounds & SpO_2 before other tasks.

1 Monitor cardiac rhythm
Continuous telemetry if K^+ >5.5; report peaked T waves, wide QRS, dysrhythmias immediately.

2 Strict I&O · Daily weight
Same scale, same time, same clothing. 1 kg gain = 1 L retained fluid.

3 Enforce fluid restriction
Typically 1000–1500 mL/day. Include ice, soup, gelatin.

4 Assess lungs & edema
Crackles, dyspnea, JVD, dependent edema each shift.

5 Administer phosphate binders WITH meals
Calcium acetate, sevelamer — must be in stomach with food to bind dietary PO_4.

6 Give erythropoietin & iron
Treats anemia. Monitor Hgb (target 10–11), BP (HTN risk).

7 Renal diet teaching
Low protein (pre-dialysis), low Na, low K, low PO_4. *High protein only AFTER starting dialysis.*

8 Skin care for pruritus
Tepid baths, cool compresses, no harsh soaps, keep nails trimmed.

9 Protect AV fistula/graft
NO BP, IV, blood draws, or constrictive items on that arm. Palpate thrill, auscultate bruit each shift.

10 Prepare for dialysis
Indicated when GFR <15 or AEIOU criteria met. Educate on HD vs PD vs transplant.

11 Avoid nephrotoxins
Hold NSAIDs, aminoglycosides, IV contrast. Confirm safety of all new meds.

12 Monitor mental status
Uremic encephalopathy → confusion, asterixis, seizures. Implement safety precautions.

5 Pharmacology

CKD medications · mechanism · key side effects · nursing pearls

Drug / Class	Mechanism	Key Side Effects	Nursing Pearls
Phosphate Binders *Calcium acetate (PhosLo) · Sevelamer (Renagel)*	Bind dietary PO_4 in gut → excreted in stool	Constipation · hypercalcemia (Ca-based)	**GIVE WITH MEALS** — useless on empty stomach. Monitor Ca and PO_4.
Erythropoietin *Epoetin alfa (Epogen, Procrit) · Darbepoetin (Aranesp)*	Stimulates bone marrow RBC production	**HYPERTENSION** · thrombosis · seizures	Monitor BP & Hgb (target 10–11). Iron stores must be adequate. Hold if Hgb >12.
Iron Supplements *Ferrous sulfate (PO) · Iron sucrose (IV)*	Replenishes iron stores for RBC synthesis	Constipation · dark/tarry stools · GI upset	Give with Vitamin C/OJ. Anaphylaxis risk with IV iron — test dose first.
Active Vitamin D *Calcitriol (Rocaltrol)*	Replaces what kidneys can't activate → ↑Ca absorption	Hypercalcemia · hyperphosphatemia	Monitor Ca & PO_4. Hold if Ca >10.5.
Loop Diuretics *Furosemide (Lasix) · Bumetanide*	Inhibit Na/K reabsorption in loop of Henle → diuresis	**Hypokalemia** · ototoxicity · dehydration	Only effective if urine output present. Give IV slowly to prevent ototoxicity. Monitor K.
Potassium Lowering Agents *Sodium polystyrene sulfonate (Kayexalate) · Patiromer (Veltassa)*	Exchanges Na (or Ca) for K^+ in GI tract	Constipation · bowel necrosis (rare) · Na/fluid retention	Hold for absent bowel sounds. Monitor K hourly during acute treatment.
ACE Inhibitors / ARBs *Lisinopril · Losartan*	Reduce intraglomerular pressure → slow CKD progression	**Hyperkalemia** · ↑ creatinine · dry cough (ACEi) · angioedema	First-line in diabetic nephropathy. Mild ↑Cr expected. Hold for K >5.5.
Antihypertensives *Calcium channel blockers · beta blockers*	Lower BP & protect remaining nephrons	Bradycardia · hypotension · edema (CCB)	BP goal <130/80. Monitor for orthostasis.
IV Calcium Gluconate *(Acute hyperkalemia)*	Stabilizes cardiac membrane — does NOT lower K	Hypercalcemia · tissue necrosis on extravasation	First line for K >6.5 with ECG changes. Push slowly with cardiac monitor.
Insulin + D50 *(Acute hyperkalemia)*	Shifts K^+ intracellularly — temporary	Hypoglycemia (give D50 with it)	Monitor glucose Q15 min × 4. Effect lasts 2–6 hr; definitive treatment is dialysis.

NEPHROTOXIC — AVOID in CKD

- ✕ NSAIDs (ibuprofen, naproxen, ketorolac)
- ✕ IV contrast dye (gadolinium & iodinated)
- ✕ Salt substitutes (contain potassium!)
- ✕ K^+-sparing diuretics (spironolactone alone)
- ✕ Aminoglycosides (gentamicin, tobramycin)
- ✕ Magnesium-containing antacids (Maalox, MOM)
- ✕ Herbal supplements (esp. licorice, ginseng)
- ✕ Metformin if GFR <30 (lactic acidosis)

6 NCLEX Test Traps

Wrong-answer thinking vs. right-answer thinking

× TRAP	✓ CORRECT
"Give phosphate binder between meals so the patient won't forget."	Give phosphate binders **WITH meals** — they bind dietary PO_4 in the gut. Useless on empty stomach.
"Encourage a high-protein diet to prevent muscle wasting."	**Restrict protein** in pre-dialysis CKD (reduces urea load). High-protein diets only AFTER dialysis begins, because dialysis removes protein.
"Push fluids to flush out the kidneys."	**Fluid restriction** — typically 1000–1500 mL/day. Kidneys can't excrete excess; pushing fluids causes pulmonary edema.
"Address the anemia first — Hgb is 7.8."	**HYPERKALEMIA is the priority** — it can kill in minutes (lethal arrhythmia). Anemia is chronic and stable. Always treat the most life-threatening finding first.
"Take the BP in the arm with the fistula — it's closer."	**Use the opposite arm** for BP, IV, blood draws. BP cuff occludes the fistula → clotting. Post sign at bedside.
"Recommend salt substitute since the patient must avoid sodium."	**NEVER use salt substitutes** in CKD — they contain potassium chloride. Use herbs, lemon, garlic for flavor.
"Give IV calcium gluconate — that will lower the potassium."	Calcium gluconate **stabilizes the cardiac membrane** — it does NOT lower K^+. Use insulin/D50 or Kayexalate to actually lower K. Dialysis is definitive.
"Hold the ACE inhibitor — creatinine increased from 1.4 to 1.7."	A mild ↑ in creatinine (<30%) is **expected and acceptable** with ACE inhibitors — the benefit of slowing

	CKD progression outweighs the risk. Only hold for K >5.5 or Cr ↑ >30%.
× TRAP "Give ibuprofen for the patient's headache."	✓ CORRECT **NSAIDs are nephrotoxic** — they cause vasoconstriction of afferent arterioles, worsening GFR. Use acetaminophen instead (renal-safe at appropriate doses).

7 Patient & Family Education

What to teach before discharge

1. **Fluid restriction:** Track all intake including ice, popsicles, soup. Suck on hard candy for thirst.
2. **Avoid salt substitutes** — they contain potassium and can be fatal.
3. **Renal diet:** Low Na · Low K · Low PO_4 · Low protein (pre-dialysis). Avoid bananas, oranges, potatoes, tomatoes, dairy, processed foods.
4. **Take phosphate binders WITH meals** — set medication next to plate as a reminder.
5. **Daily weight:** Same scale, time, and clothing. Report >2 lb gain in 24 hr or >5 lb in a week.
6. **Check BP at home daily.** Goal <130/80. Bring log to every appointment.
7. **Protect the AV fistula arm:** No BP, IV, blood draws, watches, or tight sleeves. Feel for thrill & listen for bruit daily.
8. **Avoid NSAIDs, herbal supplements, IV contrast.** Show all providers an updated med list.
9. **Strict diabetes & HTN control** = #1 way to slow progression. Take meds as prescribed.
10. **Recognize hyperkalemia signs:** Muscle weakness, tingling, palpitations — go to ER immediately.
11. **Skin care for pruritus:** Tepid water, mild soaps, moisturize, trim nails to prevent scratching infections.
12. **Smoking cessation & alcohol moderation** — both accelerate kidney decline.
13. **Vaccinations:** Annual flu, pneumococcal, hepatitis B series (especially before dialysis).
14. **Mental health support** — depression is common. Encourage support groups (NKF, AAKP).

8 Memory Boosters & Mnemonics

High-yield retrieval cues

AEIOU

Indications for emergent dialysis

- **A**cidosis (metabolic, severe)
- **E**lectrolytes (refractory hyperkalemia)
- **I**ntoxication (dialyzable drugs/toxins)
- **O**verload (fluid, pulmonary edema)
- **U**remia (pericarditis, encephalopathy)

STOP

Slow CKD progression

- **S**top NSAIDs & nephrotoxins
- **T**reat HTN and diabetes aggressively
- **O**ptimize fluid & electrolyte balance
- **P**rotect the AV access

"Bind During Dining"

Phosphate binder timing

- PhosLo, Renagel, Tums = **WITH meals**
- Must be in stomach with food to bind dietary phosphate
- Snack? Take a binder. No food = no binder needed

"BOPTASD"

High-K foods to AVOID

- **B**ananas · **O**ranges · **P**otatoes
- **T**omatoes · **A**vocado · **S**pinach · **D**ried fruit
- Also: salt substitutes, melons, beans, dairy

"Tall T's Tell Trouble"

Hyperkalemia ECG signature

- **Peaked T waves** → first ECG change in hyperkalemia
- Then wide QRS, prolonged PR
- Then sine wave → V-fib → arrest

"Feel the Thrill, Hear the Bruit"

AV fistula patency check

- **Palpate** for thrill (buzzing vibration)
- **Auscultate** for bruit (whooshing sound)
- Absence = clotted fistula → notify HCP STAT

"5 P's of Uremia"

Late-stage CKD findings

- **P**ruritus · **P**ericarditis
- **P**allor (anemia) · **P**ulmonary edema
- **P**aresthesia (neuropathy)

"Ca & PO_4 Seesaw"

Mineral imbalance

- PO_4 goes **UP** ↑ → Ca goes **DOWN** ↓
- Inverse relationship in CKD
- Result: renal osteodystrophy & bone pain

9 NCJMM Clinical Judgment Scenario

Six-step Next Generation Clinical Judgment Measurement Model

Client Scenario

A **68-year-old client** with a history of type 2 diabetes (×20 yrs) and hypertension presents to the ED with worsening fatigue, bilateral leg swelling, and shortness of breath that started 3 days ago. The client reports skipping last week's nephrology appointment and "ran out" of his ACE inhibitor 2 weeks ago.

```
VS: BP 178/96 · HR 102 · RR 26 · SpO₂ 91% RA · Temp 98.4°F
Labs: BUN 78 · Creatinine 5.2 · K⁺ 6.4 · Hgb 8.1 · GFR 18 · pH 7.28 · HCO₃ 16
ECG: Sinus tachycardia with peaked T waves in leads V2-V5
```

1 Recognize Cues

- **Abnormal VS:** HTN (178/96), tachycardia, tachypnea, hypoxia (SpO_2 91%)
- **Abnormal labs:** Severely ↑ BUN/Cr, K^+ 6.4 (critical), Hgb 8.1, GFR 18 = Stage 4–5
- **ECG:** Peaked T waves = hyperkalemia signature
- **S/Sx:** Edema, dyspnea = fluid overload
- **History:** DM + HTN + missed nephrology + medication non-adherence

2 Analyze Cues

- **Hyperkalemia:** Failed K^+ excretion + ACE-inhibitor withdrawal worsening BP → cardiac membrane instability
- **Fluid overload:** Failed Na/H_2O excretion → pulmonary congestion → hypoxia
- **Anemia:** ↓ erythropoietin → tissue hypoxia, worsening dyspnea
- **Metabolic acidosis:** pH 7.28, HCO_3 16 → compensatory tachypnea (Kussmaul-like)
- **Progression to ESRD:** GFR 18 = Stage 4 imminent dialysis

3 Prioritize Hypotheses

- **#1 (highest):** Hyperkalemia → lethal cardiac dysrhythmia (V-fib/arrest)
- **#2:** Acute pulmonary edema → respiratory failure
- **#3:** Metabolic acidosis → worsens K^+ shift extracellularly
- **#4:** Severe anemia → tissue hypoxia
- **#5:** Hypertensive urgency → end-organ damage

4 Generate Solutions

- Continuous cardiac monitoring + 12-lead ECG
- Establish two large-bore IV accesses; prep for emergent dialysis
- IV **calcium gluconate** to stabilize cardiac membrane
- IV **regular insulin + D50** to shift K^+ intracellularly

- **Kayexalate** or Patiromer to remove K^+ via GI
- O_2 via NC 2–4 L to maintain SpO_2 >94%
- IV loop diuretic (furosemide) for fluid overload if any urine output
- Strict I&O · daily weight · fluid restriction
- Hold all K-containing fluids/foods; hold ACE-i acutely (resume after K corrected)
- Nephrology & vascular access consults; prep for HD via temporary catheter

5 Take Action

- Place client on cardiac monitor → confirm peaked T waves resolving
- Administer **calcium gluconate 1 g IV** over 2–5 min with cardiac monitoring
- Administer **regular insulin 10 units IV + D50 50 mL IV** per protocol
- Initiate **O_2 2 L NC**; titrate to SpO_2 >94%
- Insert temporary dialysis catheter (subclavian or internal jugular); initiate HD
- Administer **furosemide 80 mg IV** if urine output present
- Educate client on dialysis access, fluid restriction, K-restricted diet, medication adherence
- Notify nephrology & document all interventions and responses

6 Evaluate Outcomes

- **Expected:** K^+ ↓ to <5.0 within 1–2 hr; T waves normalize on ECG
- **Expected:** SpO_2 >94%, RR 16–20, breath sounds clear post-diuresis/HD
- **Expected:** BP gradually lowering to <160/90 (avoid rapid drop)
- **Expected:** No new dysrhythmias on continuous telemetry
- **Expected:** Client verbalizes understanding of CKD, dialysis plan, & medication regimen
- **Reassess:** Glucose Q15 min × 1 hr (insulin given) → goal 80–180 mg/dL
- **Re-prioritize** if K^+ rebounds, oxygenation worsens, or arrhythmia develops