Acute Kidney Injury

KDIGO staging, causes, urine studies, nephrotoxins, prevention, dialysis timing and nursing care for critical care exams

KDIGO DEFINITION AND STAGES

AKI (KDIGO 2012): creatinine up ≥0.3 mg/dL within 48 h, or ≥1.5 × baseline within 7 days, or urine <0.5 mL/kg/h for 6 h.

Stage by the worse criterion. The KDIGO 2026 draft (not final) adds cystatin C, injury biomarkers and urine output by ideal body weight.

STAGE	CREATININE	URINE OUTPUT
1	1.5–1.9 × baseline, or up ≥0.3 mg/dL	<0.5 mL/kg/h for 6–12 h
2	2.0–2.9 × baseline	<0.5 mL/kg/h for ≥12 h
3	≥3 × baseline, ≥4.0 mg/dL, or RRT started	<0.3 mL/kg/h for ≥24 h, or anuria ≥12 h

Creatinine rises 24–48 h after injury, once about half of function is lost; fluid and low muscle mass mask it. Urine output often falls first.

PRERENAL, INTRINSIC, POSTRENAL

TYPE	COMMON ICU CAUSES	CLUES
Prerenal	Hypovolemia, low output, vasodilation; NSAIDs, ACEi, ARBs	Concentrated urine, bland sediment; reverses with perfusion
Intrinsic	ATN (sepsis, ischemia, toxins); AIN (beta-lactams, PPIs); GN	Granular casts (ATN), WBC casts (AIN), RBC casts (GN)
Postrenal	Retention, blocked Foley, prostate, clots, stones, tumor	Full bladder on scan; hydronephrosis on ultrasound

URINE STUDIES AND BIOMARKERS

Classic cutoffs (Miller 1978; FEUrea, Carvounis 2002), most reliable in oliguria without diuretics or CKD. FENa = (urine Na × plasma Cr) ÷ (plasma Na × urine Cr) × 100.

TEST	PRERENAL	ATN
FENa	<1%	>2%
FEUrea (on diuretics)	<35%	>50%
Urine Na (mEq/L)	<20	>40
Urine osmolality (mOsm/kg)	>500	<350
Specific gravity	>1.020	Fixed near 1.010
BUN:creatinine	>20:1	10–15:1
Sediment	Bland, hyaline casts	Muddy brown casts, tubular cells

- FENa <1% also occurs in ATN from contrast, pigment or early sepsis, and in GN or obstruction
- Heme-positive dipstick with few RBCs: myoglobin or hemoglobin
- TIMP-2·IGFBP7 >0.3 flags stage 2–3 risk within 12 h; cystatin C ignores muscle mass

NEPHROTOXINS AND ICU CAUSES

- Vancomycin: AUC-guided dosing (400–600 mg·h/L) causes less AKI than trough dosing (IDSA 2020)
- Adding piperacillin-tazobactam raises creatinine, partly pseudo-AKI; ACORN 2023 found no AKI difference vs cefepime
- Aminoglycosides: once daily with levels; AKI in 5–25% of courses, classically nonoliguric after 5–7 days
- IV contrast: risk overstated; IV saline for AKI or eGFR <30 (ACR–NKF 2020); NAC and bicarbonate add nothing (PRESERVE)
- Rhabdomyolysis: CK >5,000 U/L raises risk; early isotonic fluid to urine 200–300 mL/h (trauma); watch for overload if oliguric
- Abdominal compartment: bladder pressure >20 mm Hg with new organ dysfunction (WSACS 2013)

PROTECT THE KIDNEY, PREDICT PROGRESSION

- MAP ≥65 mm Hg, consider higher in chronic hypertension (SEPSISPAM); SSC 2026 allows 60–65 at age ≥65
- Balanced crystalloid over saline; no starches; avoid overload (>10% weight gain linked to death)
- Stop NSAIDs and nephrotoxins; hold ACE inhibitors, ARBs, diuretics and metformin in shock or volume loss
- No low-dose dopamine (KDIGO 1A); diuretics for overload only, not to prevent or treat AKI
- Furosemide stress test: 1 mg/kg IV (1.5 if recent loop use) in euvolemic stage 1–2 AKI, urine replaced mL for mL; <200 mL in 2 h predicts stage 3

DIALYSIS: AEIOU AND TIMING

Numbers from the AKIKI and STARRT-AKI trials.

INDICATION	TRIGGER DESPITE MEDICAL THERAPY
A: acidosis	pH <7.15–7.20
E: electrolytes	K >6 mEq/L or ECG changes
I: intoxication	Methanol, ethylene glycol, lithium, salicylate
O: overload	Pulmonary edema with hypoxemia despite diuretics
U: uremia	Pericarditis, encephalopathy, bleeding; BUN >112 mg/dL

Starting on a stage alone saved no lives (AKIKI, IDEAL-ICU, STARRT-AKI); 38–49% of wait groups never needed RRT, and early starts raised dialysis dependence (STARRT-AKI 10.4% vs 6.0%). Waiting beyond 72 h of oliguria or BUN 112 may raise deaths (AKIKI 2).

EXAM TIP Exams: AEIOU, not a creatinine value, triggers dialysis; a uremic pericardial rub is emergent.

NURSING ACTIONS

- Strict intake and output; hourly urine output in mL/kg/h
- Daily weight, same scale and time (1 kg ≈ 1 L)
- Sudden anuria: check the Foley for kinks or clots, flush per protocol, bladder scan
- K, Mg, phosphate, bicarbonate, creatinine at least daily; more often if K rises
- Watch for overload (crackles, rising O_2 need) and uremia (confusion, asterixis, pericardial rub, bleeding)
- Pharmacist review: full loading doses, adjusted maintenance, drug levels; avoid morphine and NSAIDs
- Post-obstructive diuresis (>200 mL/h for 2 h): replace fluid and electrolytes as ordered

SAFETY Potassium kills first: peaked T waves or a wide QRS need IV calcium and insulin with dextrose now, then removal (Electrolytes page).

Sources (25) are listed with links at icubasics.com/sheets/aki.html. For education and exam preparation only. Not medical advice; follow current guidelines and your institution's protocols. ICU Basics is an independent study aid not affiliated with any certifying body.