Laboratory tests show increase in creatinine of 0.3 mg/dL that occurs within 48 hours, or an increase to 1.5 times the baseline, which is known or presumed to have occurred within seven days, or there is a decrease in urine volume to <3 mL/kg over six hours

Do history and physical exam suggest volume depletion?

Yes

Replete volume and repeat creatinine

Is creatinine returning to baseline?

Yes

Monitor for continued recovery. If creatinine is not back to baseline by discharge, follow up as outpatient.

No

Check urinalysis by dipstick and microscopy and urine albumin to creatinine ratio*

Is there abnormal proteinuria and/or hematuria?

Yes

Evaluate for glomerulonephritis

No

Is there sterile pyuria?

Yes

Evaluate for acute interstitial nephritis

No

Are there pigmented granular casts and/or renal tubular epithelial cells?

No

Does history/physical suggest sepsis, shock/hypotension, or nephrotoxic exposure?

No

Obtain an ultrasound to exclude obstruction

Ultrasound shows obstruction?

Yes

Address obstruction

No

Depending on clinical history, physical, and laboratory values, consider less common causes including aortic dissection, tumor lysis syndrome, acute phosphate nephropathy, malignant hypertension

If diagnosis cannot be made, further investigation depends on severity of AKI and stability of creatinine

Creatinine is only mildly elevated (ie, estimated GFR 45 to 60 mL/min/1.73 m^2)

Continue to monitor but no further investigation

Creatinine is moderately or severely elevated or continues to increase

Renal biopsy

Yes

Evaluate for ATN

CLINICAL PEARL 7-1

Diagnostic Approach in AKI

- History and physical examination.
- The first thing to do is to determine the duration of renal failure. A baseline Cr level provides this information.
- The second task is to determine whether AKI is due to prerenal, intrarenal, or postrenal causes. This is done via a combination of H&P and laboratory findings.
  - Signs of volume depletion and CHF suggest a prerenal etiology.
  - Signs of an allergic reaction (rash) suggest acute interstitial nephritis (an intrinsic renal etiology).
  - A suprapubic mass, BPH, or bladder dysfunction suggests a postrenal etiology.
- Medication review.
- Urinalysis
- Urine chemistry (FENa, osmolality, urine Na^+, urine Cr).
- Renal ultrasound (to rule out obstruction).

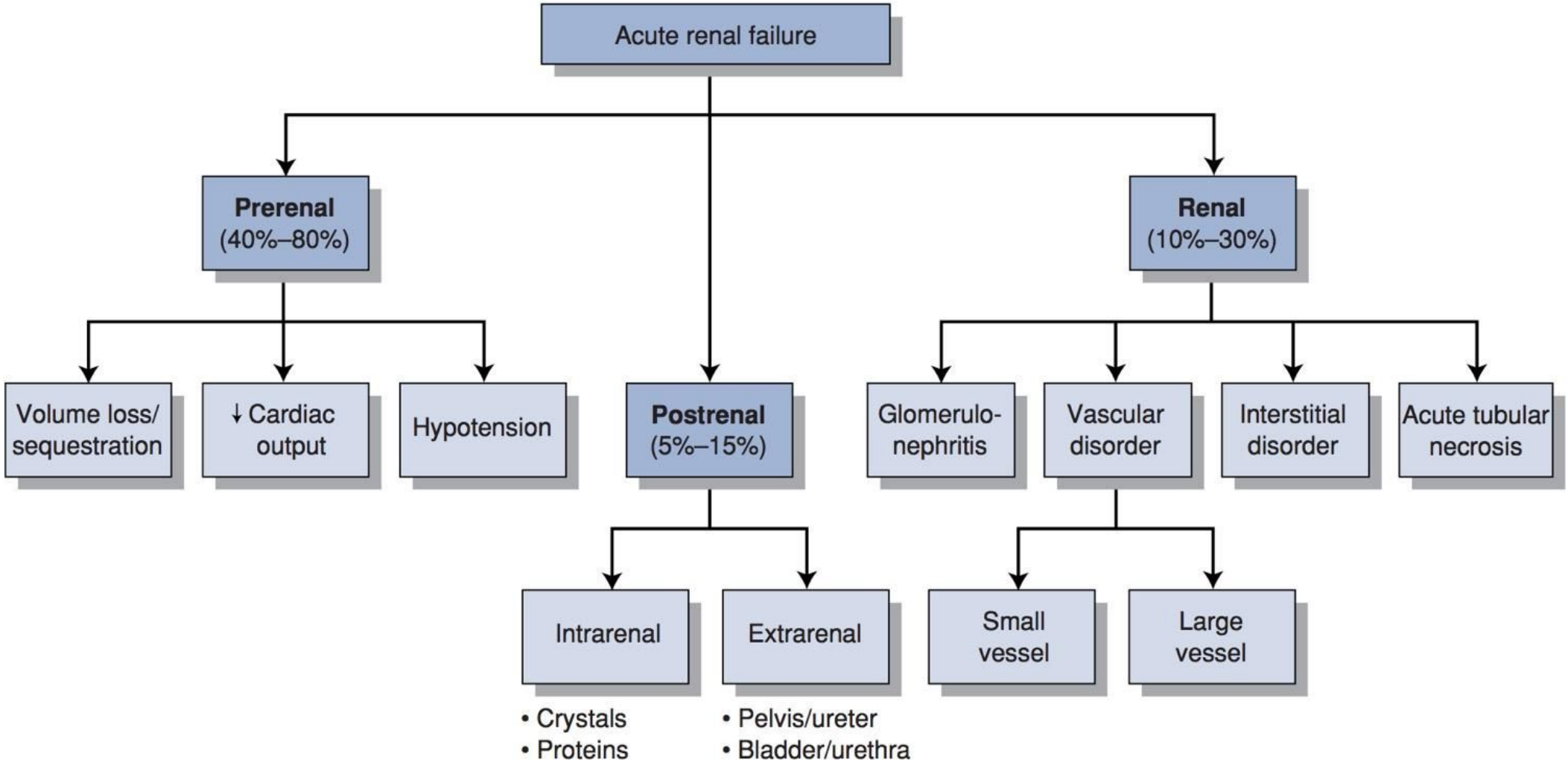

FIGURE 7-1 **Causes of AKI.**

Criteria for acute kidney injury

	RIFLE[1]	AKIN[2]	KDIGO[3]
Diagnostic criteria*			
		Increase in serum creatinine of ≥0.3 mg/dL or ≥50% within 48 hours OR Urine output of <0.5 mL/kg/hour for >6 hours	Increase in serum creatinine of ≥0.3 mg/dL within 48 hours or ≥50% within 7 days OR Urine output of <0.5 mL/kg/hour for >6 hours
Staging criteria			
Risk (RIFLE) or stage 1 (AKIN/KDIGO)	Increase in serum creatinine to 1.5 times baseline OR Urine output of <0.5 mL/kg/hour for 6 to 12 hours	Increase in serum creatinine of ≥0.3 mg/dL or to 150 to 200% baseline OR Urine output of <0.5 mL/kg/hour for 6 to 12 hours	Increase in serum creatinine of ≥0.3 mg/dL or 1.5 to 1.9 times baseline OR Urine output of <0.5 mL/kg/hour for 6 to 12 hours
Injury (RIFLE) or stage 2 (AKIN/KDIGO)	Increase in serum creatinine of to 2 times baseline OR Urine output of <0.5 mL/kg/hour for 12 to 24 hours	Increase in serum creatinine to 200 to 300% baseline OR Urine output of <0.5 mL/kg/hour for 12 to 24 hours	Increase in serum creatinine to 2.0 to 2.9 times baseline OR Urine output of <0.5 mL/kg/hour for 12 to 24 hours
Failure (RIFLE) or stage 3 (AKIN/KDIGO)	Increase in serum creatinine to 3 times baseline OR Increase in serum creatinine by >0.5 mg/dL to >4.0 mg/dL OR Urine output of <0.3 mL/kg/hour for >24 hours or anuria for >12 hours OR Initiation of renal replacement therapy	Increase in serum creatinine to >300% baseline OR Increase in serum creatinine by >0.5 mg/dL to ≥4.0 mg/dL OR Urine output of <0.3 mL/kg/hour for >24 hours or anuria for >12 hours OR Initiation of renal replacement therapy	Increase in serum creatinine to ≥3.0 times baseline OR Increase in serum creatinine of ≥0.3 mg/dL to ≥4.0 mg/dL¶ OR Urine output of <0.3 mL/kg/hour for ≥24 hours or anuria for ≥12 hours OR Initiation of renal replacement therapy
Loss (RIFLE)	Need for renal replacement therapy for >4 weeks		
End stage (RIFLE)	Need for renal replacement therapy for >3 months		

RIFLE: risk, injury, failure, loss, ESRD; AKIN: Acute Kidney Injury Network; KDIGO: Kidney Disease: Improving Global Outcomes; ESRD: end-stage renal disease.
* AKIN and KDIGO provided both diagnostic and staging criteria. RIFLE provided a graded definition of AKI that is implicit in the staging criteria.
¶ In patients <18 years, stage 3 AKI is also defined by KDIGO as a decrease in estimated glomerular filtration rate (eGFR) to <35 mL/min/1.73 m^2.

References:

1. *Bellomo R, Ronco C, Kellum JA, et al. Acute renal failure-definition, outcome measures, animal models, fluid therapy and information technology needs: the Second International Consensus Conference of the Acute Dialysis Quality Initiative (ADQI) Group. Crit Care 2004; 8:B204. Copyright © 2004 BioMed Central Ltd.*
2. *Mehta RL, Kellum JA, Shah SV, et al. Acute Kidney Injury Network: report of an initiative to improve outcomes in acute kidney injury. Crit Care 2007; 11:R31. Copyright © 2007 BioMed Central Ltd.*
3. *Kidney Disease: Improving Global Outcomes (KDIGO). Acute Kidney Injury Work Group. KDIGO clinical practice guidelines for acute kidney injury. Kidney Int Suppl 2012; 2:1.*

The CKD-EPI equation i.e., $eGFR = 141 \times \min(Scr \times 0.0113/k, 1)^{\alpha} \times \max(Scr \times 0.0113/k, 1)^{-1.209} \times 0.993^{Age} \times 1.018$ [if female] × 1.159 [if black], where Scr is serum creatinine, k is 0.7 for females and 0.9 for males, $^{\alpha}$ is -0.329 for females and -0.411 for males, min indicates the minimum of Scr/k or 1, and max indicates the maximum of Scr/k or 1.