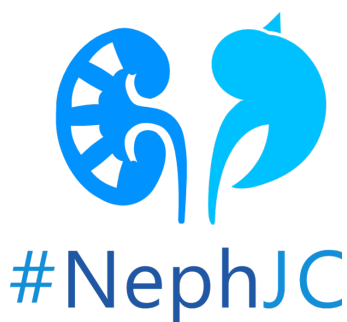




Nephrology Fellow Clinical Compendium



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Disclaimer- This guide is intended as an overview with salient details only. In order to provide high quality patient care it is important to maintain close and appropriate supervision.

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Chapter 1: Acute Kidney Injury

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- Check out the [Core Curriculum AKI](#)
- Review on [AKI evaluation](#), work-up, and staging.
- [AKI network \(AKIN\) classification](#)

Stage	Serum creatinine criteria	Urine output criteria
1	↑ to $\geq 1.5 \times$ base line or ↑ 0.3 mg/dl from base line	<0.5 ml/kg/h ≥ 6 h
2	↑ to $\geq 2 \times$ base line	<0.5 ml/kg/h ≥ 12 h
3	↑ to $\geq 3 \times$ from base line or 4mg/dl with acute ↑ ≥ 0.5 mg/dl or initiate of RRT irrespective of age at the time of initiation	<0.30 ml/kg/h ≥ 24 h anuria ≥ 12 h

Only one criterion (serum creatinine or urine output) should be fulfilled to qualify for a stage. RRT: Renal replacement therapy; ↑: Increased; X: Times

KDIGO Classification

Staging	Serum Creatinine Criteria
Stage 1	1.5 – 1.9 times reference value OR Increase ≥ 0.3 mg/dl
Stage 2	2.0 – 2.9 times reference value
Stage 3	≥ 3.0 times reference value OR Increase ≥ 4.0 mg/dl OR RRT

What to ask and consider when you get a consult?

- What is the baseline serum creatinine?
- Are they making urine? Do they need a foley catheter (i.e. if bladder outlet obstruction is in DDx)
- Triage if you have multiple calls, think who might need kidney replacement therapy sooner.
- Precipitating events: volume/BP, contrast, procedure, infection, or medication change?
- Try to go through the differential diagnosis in an order: post, pre-, intra-renal?
- When you see the patient take a urine sample if possible for microscopy *As soon as you receive the consult, ask the admitting team and/or RN to collect the urine, so it can be ready when you get to the room*
- Do they have an indication for immediate kidney replacement therapy?
- Do they have access for kidney replacement therapy?
- Is the patient in a center where kidney replacement therapy is available, do they need transfer?
- Which modality of kidney replacement therapy is preferential (HD, CRRT, PIRRT or PD)?

The Evaluation

Basics: Complete blood count (CBC), comprehensive metabolic panel (CMP), liver tests (LFTs), urinalysis (UA) with culture, if needed ABG/VBG

Spinning the Urine:

- [Renal Fellow Network Urine Sediment of the Month](#)
- [Spin Urine! - NephSIM](#)
- If needed, start a 24 hour urine collection

Urine Chemistries:

- [Review of the Clinical Use of Urine Chemistries](#)
- [Choosing Wisely in Using Urine Chemistries](#)

Imaging

- [Kidney Imaging Core Curriculum](#)
- See Kidney Biopsy Chapter 2-3

For other types of AKI, check out the following reviews:

- [RPGN](#) Rapid progressive glomerulonephritis
- [Anti-GBM](#): Anti-GBM nephritis, Goodpasture syndrome

- **Immune Complex:** Acute postinfectious GN, infectious endocarditis, IgA nephropathy, IgA vasculitis (formerly Henoch-Schonlein purpura), MPGN, lupus nephritis
- **Pauci-Immune:** renal-limited vasculitis, granulomatosis with polyangitis (formerly Wegener), microscopic polyarteritis, eosinophilic granulomatosis with polyangitis (formerly Churg-Strauss)

Serology of RPGN and other causes of AKI

Disease	Laboratory data
Lupus	ANA, Anti-dsDNA
Light Chain Disease, Myeloma	Serum free light chains, serum protein and urine immunofixation
Anti-GBM Antibodies Anti-GBM disease (Goodpasture syndrome) or Anti-GBM glomerulonephritis (Goodpasture disease) Active Granulomatosis with Polyangiitis (GPA) Active Microscopic Polyangiitis (MPA, systemic and kidney limited) Eosinophilic Granulomatosis with Polyangiitis (EGPA)	Cytoplasmic-Antinuclear Antibody (C-ANCA) Against neutrophil proteinase 3 (PR3) Perinuclear-Anti-Nuclear Antibody (P-ANCA) Against myeloperoxidase (MPO)
Cryoglobulins	Type I, II, III Cryoglobulinemia, associated with myeloma, Waldenstrom macroglobulinemia, viral infection (Hep B and Hep C), and connective tissue disease (eg. SLE, Sjogren syndrome, or rheumatoid arthritis)

Complement levels can help us to differentiate certain RPGNs

- **Mnemonic:** Low Serum Complement Levels (**CHAMPS**):
- **C**ryoglobulinemia, **C**3 glomerulopathy (usually normal C4 and low C3)
- **H**heavy chain deposition

- **Athero-embolic disease**, also cholesterol emboli
 - History of cardiac catheterization or vascular intervention
 - See eosinophilia
 - Can see low compliments
- **MPGN**
- **Post-infectious glomerulonephritis (GN)** or called PIGN, Infectious Endocarditis
- **SLE (lupus)**

Indications for *urgent* kidney replacement therapy (caveat- refractory to medical management)

- **Acidosis**- typically if severe and refractory to medical management - read [BICAR-ICU trial](#) (Lancet 2018)
- **Electrolyte imbalance**, particularly potassium - *be cautious when dialyzing someone with severe hyponatremia*
- **Ingestion of toxic compound** - *remember to check for osmolar gap*
- **Overload of fluid** - *often overlooked, keep an eye (and POCUS) out for it*
- **Uremia**
- **Friday**, think practically of the services available at nights/weekends and if access needed earlier

The Consult Note

Mention the following in your note:

- **History and Exam:**
 - Appropriate time-sensitive history, date kidney replacement initiated and when access placed
 - Blood pressure/volume: assessment via physical exam *and point of care ultrasound (POCUS)*
- **Investigations**
 - Follow up labs including kidney indices and electrolytes
 - Acid/Base: see acid/base section.
 - Urine microscopy of patients with AKI.
 - Consider kidney ultrasound to rule out obstructive nephropathy
 - *Consider loop diuretic challenge if volume overloaded*
- **Assessment:**
 - AKI: baseline serum creatinine and whether patient oliguric (<400 cc's/day) or non-oliguric
 - Most likely etiology
- **Plan:**
 - Does the patient need urgent kidney replacement therapy or not?

- Review Medications for dosing and contraindications in kidney failure: Especially antibiotics, pain medications, and muscle relaxants (baclofen)
- Medications should be dosed based on kidney function (caveat - when severe AKI ie AKIN stage 3, medications should be dosed as if patient has minimal to no kidney function (eGFR <10) regardless of serum creatinine and calculated eGFR)
- Recommendations on the cause of AKI - can we stop/reduce further kidney injury?
- Talk to the primary team, communication is key!

Special Acute kidney injury

- Review of kidney disease and pregnancy: [Core curriculum 2019](#).
- Review of Onco-nephrology including AKI:
 - Onco-Nephrology review in CJASN: [AKI in the Cancer Patient](#).
 - Onco-Nephrology: [Core Curriculum](#)
- Review of non-kidney solid organ transplant AKI:
 - [Liver and heart](#)
 - [Hematopoietic stem cell transplantation](#)