Clinical Case Discussion

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Based on Patient Presentation from Megan Krowicki, CUSOM Class of 2018 Wake Med Cary Hospital Internal Medicine Clerkship . . .

61-year-old woman presented as transfer from Harnett Health.

10-day history of E Coli UTI treated incompletely with 3 days of Macrobid and then 3 days of Bactrim. Both D/C due to nausea, vomiting, and dizziness.

On presentation, patient is dizzy, has vomited once, and has overt hematuria.

She has not been seen by a physician in >10 years.

Special thanks to Megan Krowicki, CUSOM Class of 2018

On exam:
General: elderly woman complaining of nausea
bp 140/100 p 78 RR 28 temp 98.2F O2 sat 94% on RA

HEENT: anicteric sclerae; PERRL
OP: moist mucous membranes; dentition good

Neck: Full ROM; supple; no lymphadenopathy; trachea midline; no thyromegaly; JVP 8 cm at 30 degrees

Car: r/r/r without murmur.
PMI normal

Lungs: few bibasilar rales. No egophony or dullness to percussion

Abdomen: nondistended; active bowel sounds; soft, nontender, no guarding or rebound; liver and spleen not palpable.

Neuro: Alert; oriented to person, place and time

CNs: II through XII intact

Motor:

Bulk: normal all 4 extr

Tone: normal in all 4 extr

Strength: 5/5 wrist ext B/L
5/5 hip flex B/L; 5/5 1st toe dorsiflexion B/L

Sensory: Grossly intact to light touch in all 4 extr

Cerebellar: finger to nose testing without dysmetria B/L

Reflexes: 1+ biceps, triceps, patellar, ankle

Gait: not tested

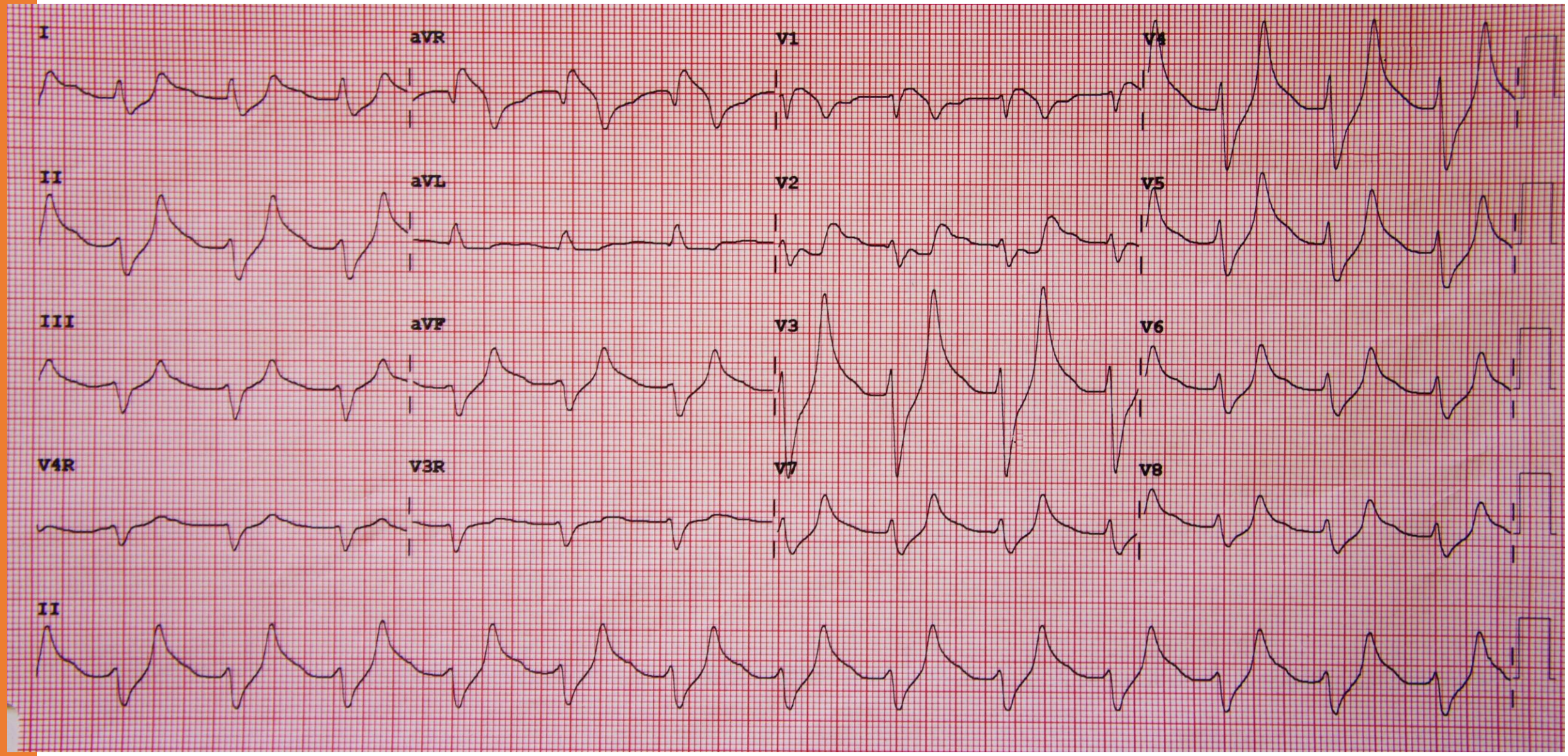
Na	141
K	6.9
CL	110
CO2	16
BUN	78
Cr	6.38
Glc	90

wbc	14.8
hgb	8.7
hct	26
platelets	320,000

AG	**15**

Is there an acute kidney injury emergency?

- Hyperkalemia
- Fluid overload
- Acidosis
- Uremia
- Pericarditis


I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
V4R
V3R
V7
V8
II

Now what???

ARF emergency: hyperkalemia

- K > 6.0
- The first symptom of hyperkalemia: death!
- EKG changes
  - Peaked t waves
  - Widened QRS complex (ie. > 120 msec)

Hyperkalemia: acute medical management

- Albuterol nebulizer:
  - Drives potassium intracellularly
  - Acts within minutes

- 1 amp calcium gluconate or calcium chloride
  - Protects myocardium from hyperkalemia
  - Acts within minutes
  - Contraindicated in patients taking digoxin (can result in digoxin toxicity)

Hyperkalemia: Acute medical management

- IV glucose (ie D50W) followed by Humulin R IV (not SQ)
  - Drives potassium intracellularly
  - Acts within minutes
  - Lasts several hours

- Sodium bicarbonate 1 amp IV x 1

Hyperkalemia: Acute medical management

- Kayexalate
  - Binds potassium in the intestinal tract
  - Actually removes potassium from the body
  - Acts within hours
  - Can give po or via enema (risk of bowel necrosis with enema)

  OR

- Lokelma
  - Increases fecal potassium excretion
  - Can give po

Three hours after treatment, follow up potassium is 5.6 and EKG changes resolve . . .

Now what???

Evaluation at the bedside . . .

Determine volume status . . .

Orthostatics:

Lying: bp 140/100 p 78

Sitting: bp 138/96 p 82

Standing: bp 142/102 p80

Not orthostatic.

Evidence of bladder outlet obstruction?

Bladder not palpable in suprapubic region

Bladder ultrasound post void < 20 ml

No evidence of bladder outlet obstruction.

Now what???

Gross Appearance	Patient Result	Normal Result
Color	dark red	Light yellow
Turbidity	turbid	Clear

Urine dipstick	Patient Result	Normal Result
Specific gravity	1.010	1.005 to 1.030
pH	6	4.5 to 8
Heme	positive	negative
Leukocyte esterase	negative	negative
Nitrite	negative	negative
Protein	3+	negative
Glucose	negative	negative

Urinalysis . . .

Urine microscopy

Red blood cell casts

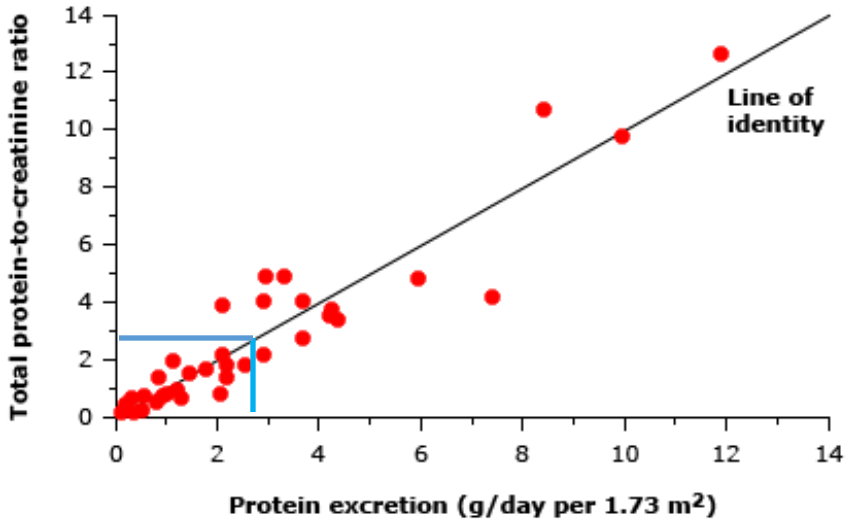
Glomerulonephritis

https://consultqd.clevelandclinic.org/in-appreciation-of-the-urinalysis/

Now what???

Lab value	Patient value	Normal value
Spot urine total protein	125	0 to 14 mg/dl in women
Spot urine creatinine	48	20-275 mg/dl in women
Spot total protein: creatinine ratio	2.6 mg/mg = 2604 mg/g, significant but non-nephrotic range	< 0.2 mg/mg Follow with 24-hour urine collection for protein, creatinine

Protein-creatinine ratio to estimate protein excretion



This graph illustrates the relation between total 24-hour urinary protein excretion and the total protein-to-creatinine ratio (mg/mg) determined on a random urine specimen. Athough there appears to be a close correlation, there can be wide variability in 24-hour protein excretion at a given total protein-to-creatinine ratio. At a ratio of 4, for example, 24-hour protein excretion varied from 2 to almost 8 g/day/1.73 m^2.

Data from: Ginsberg JM, Chang BS, Matarese RA, Garella S. N Engl J Med 1983; 309:1543.

Now what???

Renal ultrasound . . .

Normal sized kidneys, parenchymal changes consistent with medical renal disease, no masses, no hydronephrosis.

Prerenal?

Postrenal?

Intrarenal

Glomerulonephritis

Differential diagnosis

Infectious

- Hepatitis C
- Hepatitis B
- HIV
- Post-Streptococcal

Autoimmune

- Systemic lupus erythematosus
- IgA deposition disease
- Thrombotic thrombocytopenic purpura
- Granulomatosis with polyangiitis
- Anti-glomerular basement membrane disease
- ANCA-associated Rapidly Progressing Glomerulonephritis

Laboratory Evaluation for Intrarenal Acute Kidney Injury

Laboratory	**Rationale**
Hep B Surface Antigen Hep B S Antibody	Infection-associated glomerulonephritis (GN)
Hep C Antibody	Infection-associated GN
Serum protein electrophoresis (SPEP)	Multiple myeloma Amyloidosis

Laboratory Evaluation for Intrarenal Acute Kidney Injury

Laboratory	**Rationale**
Antinuclear antibody (ANA) Complement levels C3, C4 Erythrocyte sedimentation rate (ESR)	SLE Complement will be consumed Evidence of inflammation
HIV Antibody	HIV nephropathy
Anti-Streptolysin-O (ASO) Ab	Post-Streptococcal GN

Laboratory Evaluation for Intrarenal Acute Kidney Injury

Laboratory	**Rationale**
Anti-neutrophil cytoplasmic antibodies (ANCA): inflammatory leukocytes damage vessel walls • Cytoplasmic (C)-ANCA • Perinuclear (P)-ANCA	ANCA-associated vasculitis

Merkel P UpToDate 2023

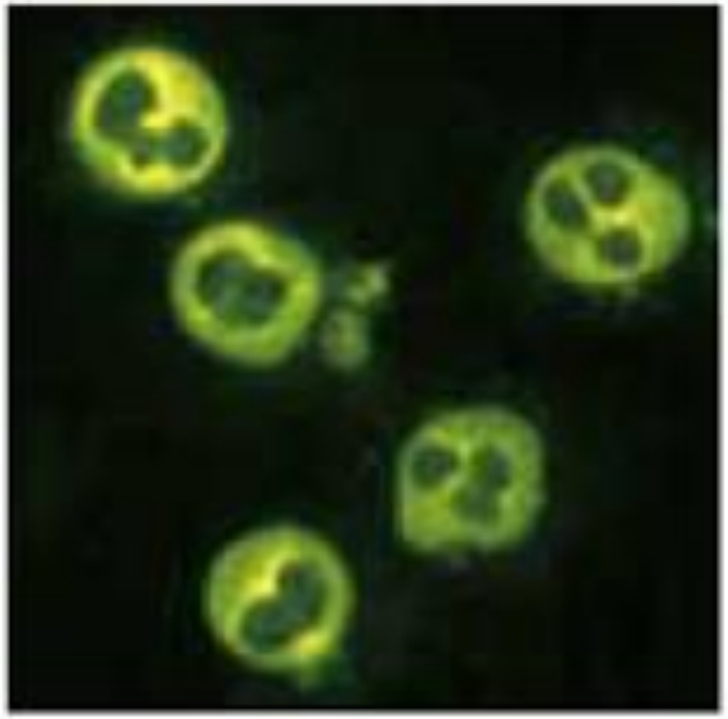
Our patient . . .

Laboratory Test	Patient Result
Hep S Ag	Negative
Hep B S Ab	Negative
Hep C Ab	Negative
HIV	Negative
SPEP	Normal

Our patient . . .

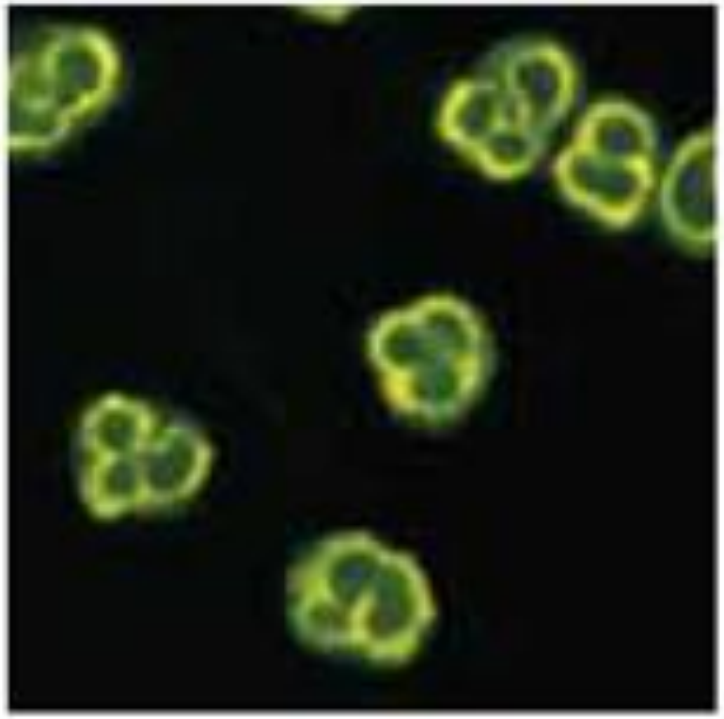
Laboratory Test	Patient Result
ANA	Negative
C3	Normal
C4	Normal
ESR	**Very elevated**
ASO-Ab	Negative
C-ANCA	**Very Elevated**
P-ANCA	**Negative**

Detection of ANCA by indirect immunofluorescence staining (FLUORO ANCA test)



c-ANCA

Cytoplasmic staining of granulocytes



p-ANCA

Perinuclear staining

Special thanks to Megan Krowicki, CUSOM Class of 2018

Renal Biopsy . . .

Indications for Kidney Biopsy

- Glomerular hematuria
- Severe proteinuria
- Acute or chronic kidney disease of unclear cause
- Monitoring of kidney transplant

Kidney Biopsy

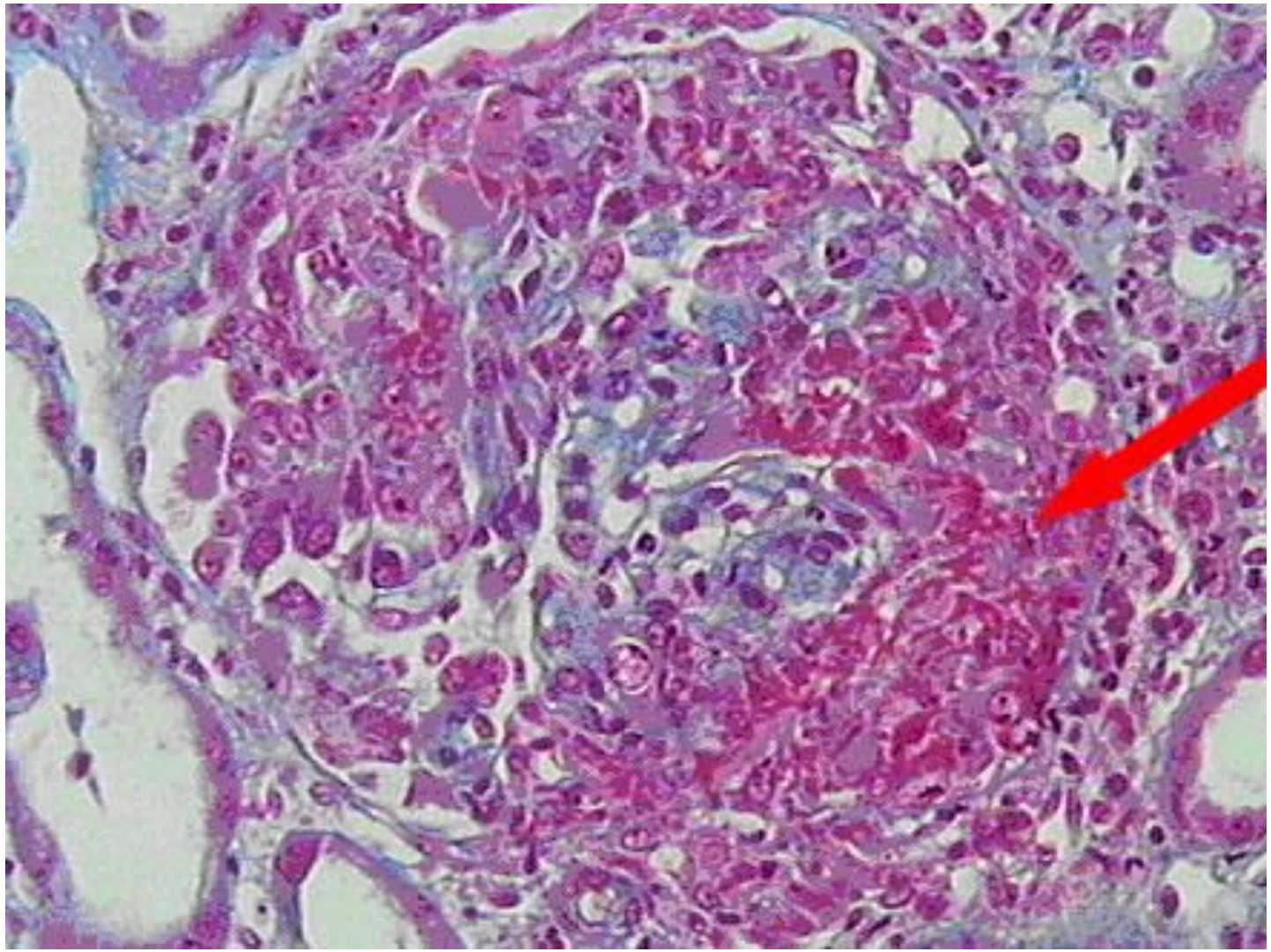
- U/S or CT-guided

- Contraindications:
  - Uncooperative patient
  - Bleeding diathesis
  - Uncontrolled HTN
  - Poor kidney visualization
  - Atrophic kidneys
  - Active UTI

Kidney Biopsy Risks

- Retroperitoneal bleeding
- Pain
- Hematuria
- More serious complications are very rare

Renal Biopsy: diffuse necrotizing extracapillary glomerulonephritis is the histological hallmark of **ANCA-associated Vasculitis**



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Final Diagnosis: C-ANCA Vasculitis

Admitted

- ARF
- Hyponatremia
- Anemia
- Hematuria
- D5W + 3 amp NaHCO3 at 125 ml/hr

U/S Guided renal parenchyma biopsy

Dx C-ANCA Vascultis

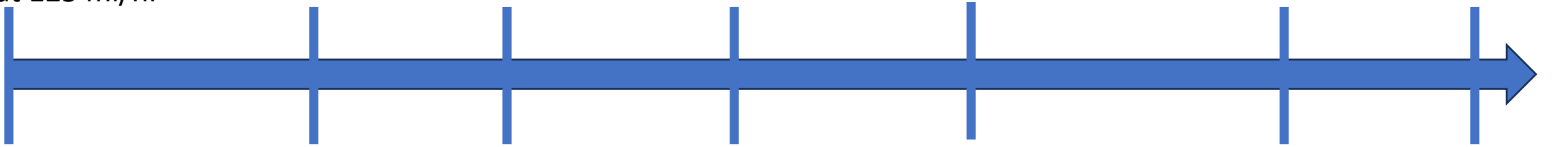
- IV Cytoxan with pulsed IV Solumedrol

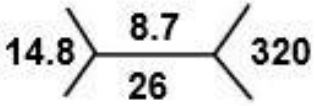
Heme- Onc consult for worsening anemia

Improving Renal function

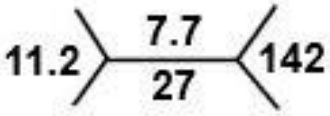
PRBC Transfusion

Discharged home

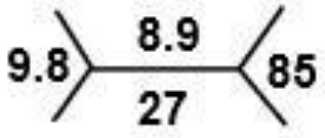




BUN: 78
Cr: 6.38



BUN: 111
Cr: 4.52



BUN: 87
Cr: 2.91

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Osteopathic Considerations in Acute Kidney Injury

OMT Technique	Treatment Goals
Rib Raising T10 to L2	Increase blood flow to the kidneys; optimize diuresis

OMT Technique	Treatment Goals
Thoracic inlet myofascial release	• Improve lymphatic drainage
Pedal Pump	• Optimize lymphatic drainage from the whole body

Patient follow up:

- Patient’s symptoms of nausea improved.

- She was discharged to continue cyclophosphamide infusions as an outpatient

Questions?

Thank you!