

# Approach to the Patient with Low Urine Output

**Raimund Pichler M.D.**

**Division of Nephrology**

**Department of Medicine**

**University of Washington, Seattle**



# Clinical Case

- It is 3:15 AM. You have just fallen asleep 2 minutes ago. Page from an RN in the ICU regarding patient X.



- “Urine output has dropped to 5 ccs/hr”
- What is your response?

# Clinical Case: What to do?

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- A) Let me sleep and call me later.
- B) Good for you, less emptying of the Foley bag!
- C) Give the patient 200mg Lasix IV.
- D) Give the patient a 2 Liter Fluid Bolus.
- E) Call Renal.

I WANT TO SEE SOME URINE!



# Oliguria

- Urine output  $< 500\text{ccs/day}$  (about  $20\text{ccs/h}$ )
- Average person excretes  $600\text{mOsm}$  of solute per day.
- Maximal urinary concentration ability is  $1200\text{ mOsm/L}$   $\rightarrow$  Hence at least  $0.5$  Liters of urine needed.

# Oliguria-some numbers

- Urine output  $< 0.3\text{ml/kg/h}$  for 24 hours.

50 kg person:  $15\text{ml/h} = 360\text{ mls/24hrs}$

70 kg person:  $21\text{ml/h} = 504\text{ mls/24hrs}$

100 kg person:  $30\text{ml/h} = 720\text{ mls/24hrs}$

# Oliguria: Incidence

- 18% of patients in the medical-surgical ICU who have intact renal function.
- 69% of patients in the ICU who develop Acute Kidney Injury (Acute Renal Failure)

# Oliguria: Pathophysiology

- Urine output is a function of glomerular filtration, tubular secretion and reabsorption.
- Glomerular filtration is directly depending on renal perfusion.
- Oliguria indicates a reduction in GFR or a mechanical obstruction to urine flow.



# Differential Diagnosis of Oliguria

Pre-renal

Not enough juice going to the kidneys.

Renal

Kidneys not Filtering Properly.

Post-renal

Urine can't get out.

# Oliguria Checklist: Postrenal

- ✓ Is the Foley Catheter working and in the right place?



# Oliguria Checklist: Postrenal

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- ✓ Is the Foley Catheter working and in the right place?
- ✓ Is there any other Obstruction present?  
Ureters, renal Pelvis, Bladder emptying etc.
- ✓ Consider getting a renal ultrasound.

# Clinical Case

- Called to see a 50 year old woman POD#3 following Gastric Bypass surgery for decreased urine output (20 ccs/hour).
- The surgeons tell you that they have given her 7 Liters of Fluid POD#1 and 6 Liters of Fluid POD#2 and that she remains oliguric despite this. She is a total of 18 Liters fluid up.
- Her creatinine has increased from a baseline of 0.6 mg/dl to now 1.3 mg/dl.

# Clinical Case

Primary team is very worried about the absence of urine in the bag!

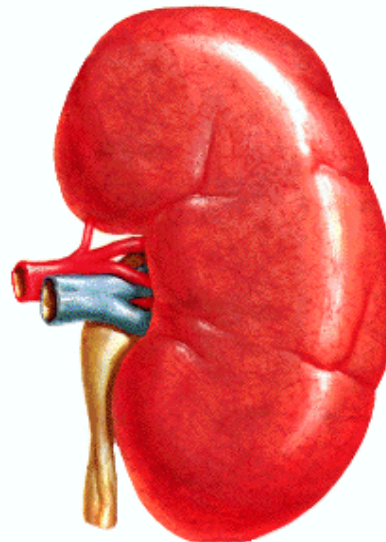


# Differential Diagnosis of Oliguria

Pre-renal

Renal

Post-renal



# Oliguria Checklist



- ✓ Foley OK? Obstruction?
- ✓ Enough juice going to the kidneys?

# Is this Patient Prerenal?

## Are the kidneys getting enough juice?

- ✓ Blood Pressure, Heart Rate, Orthostatics

BP 140/70, HR 84, unable to sit up or stand

- ✓ Filling Pressures, Neck Veins

No central line, unable to see neck veins

- ✓ Evidence for CHF?

TTE done but unable to get good images given body habitus in this 500 lbs woman.



# Is this Patient Prerenal?



- ✓ Blood Pressure, Heart Rate, Orthostatics
- ✓ Filling Pressures, Neck Veins
- ✓ Evidence for CHF?

ASK THE KIDNEY?

# Investigations

140	109	15
3.8	26	1.3

$U_{Na}$  10 mEq/L

$U_K$  71

$U_{Cl}$  12

$U_{creat}$  506 mg/dl

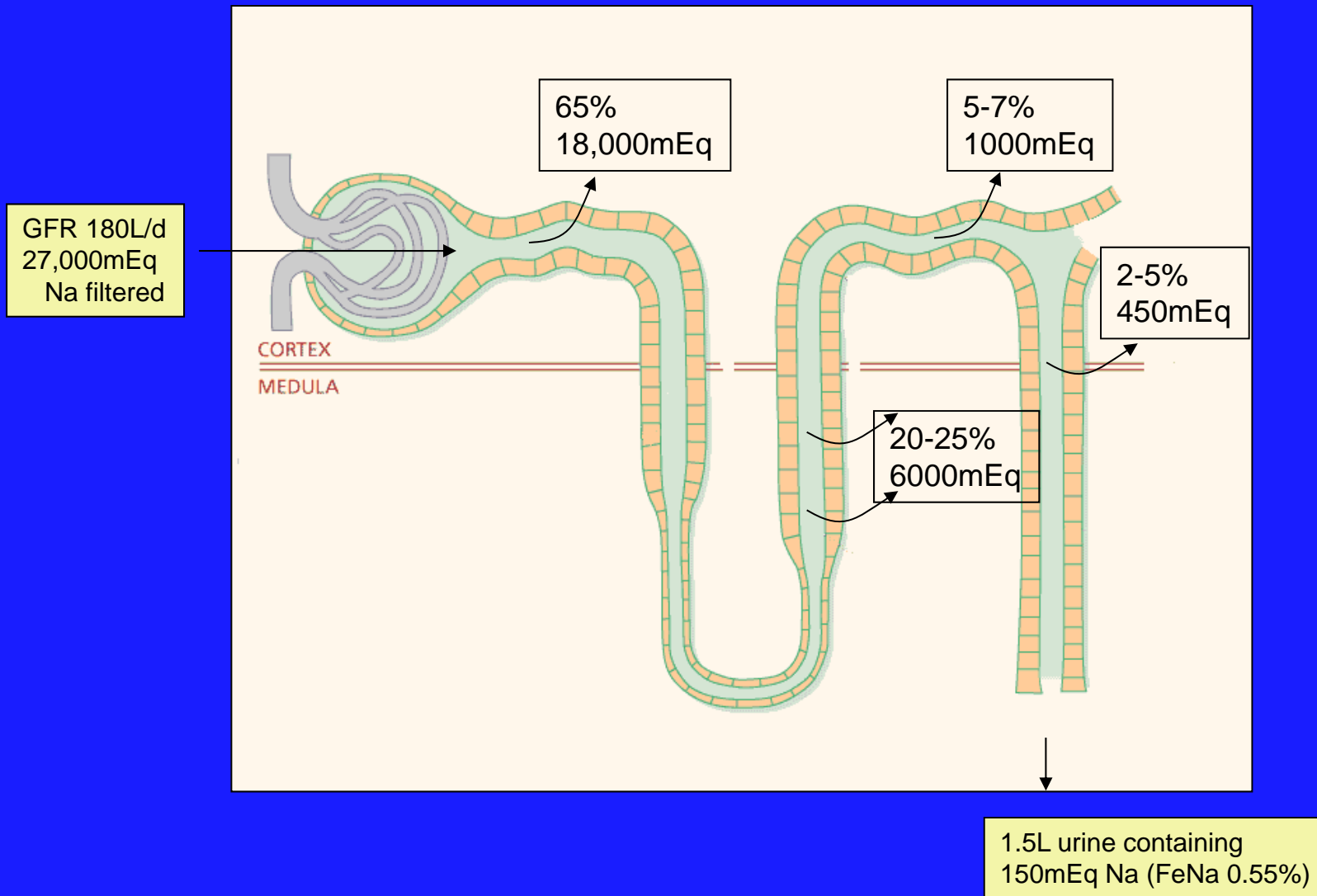
$U_{osm}$  560 mOsm/kg

FENa=0.02%

# Interpretation of Urine Electrolytes

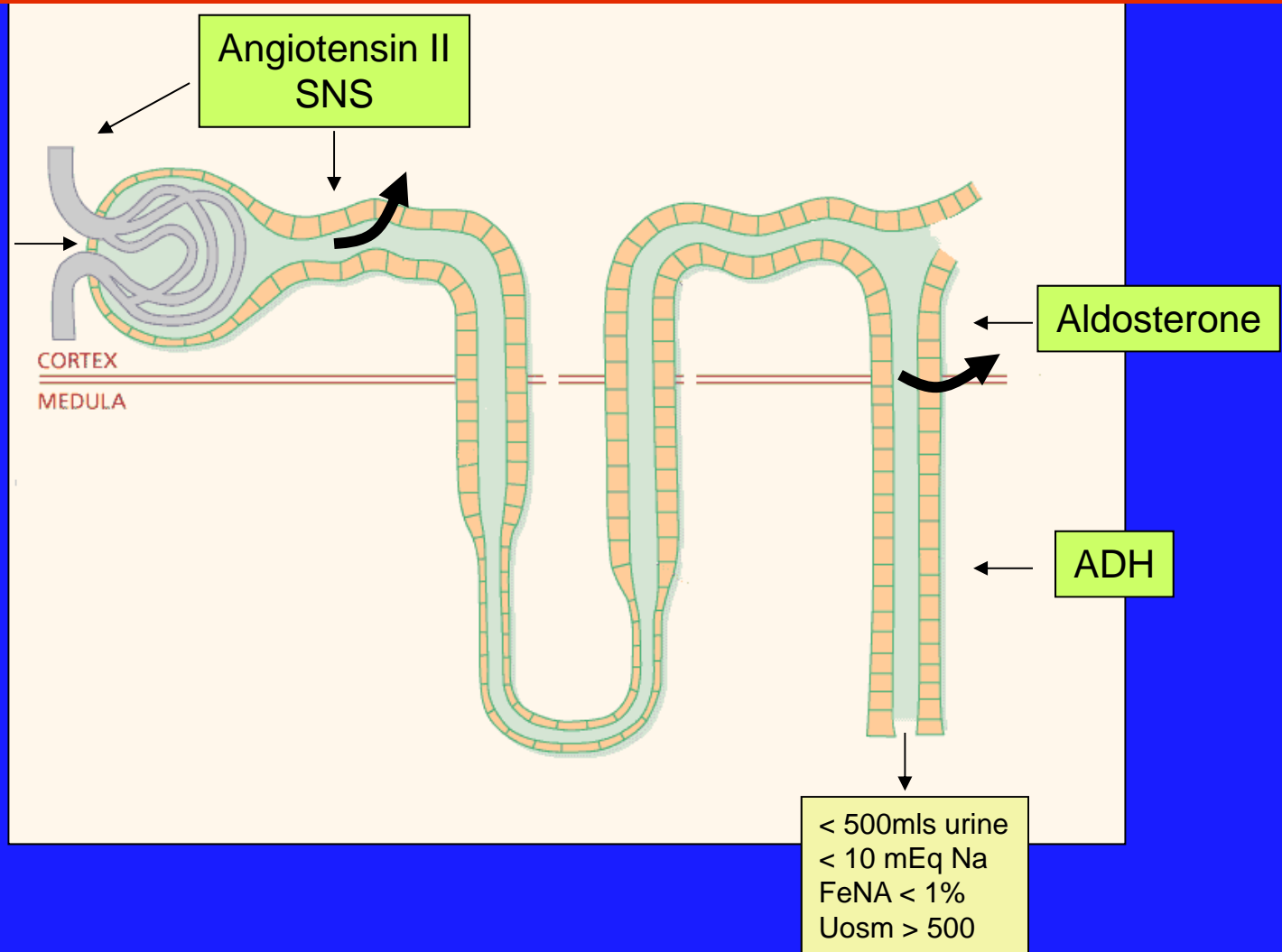
	<b>Pre-Renal Uremia</b>	<b>Acute Tubular Necrosis</b>
Urine Sodium (mEq/L) (Urine Chloride)	<10 (<15)	>20 (>20)
Fractional Excretion Sodium (FeNa)	<1%	>2%
Urine Osmolality	>500mOsm/kg	~300mOsm/kg

# Normal Sodium Reabsorption



# Increased Na and H<sub>2</sub>O Reabsorption in Pre-Renal Azotemia

↓ GFR 14mls/min  
= 20L/d  
2800 mEq  
Na filtered



# Low Perfusion States

Low renal  
perfusion

Hypovolemia

Cardiogenic

Peripheral  
vasodilation

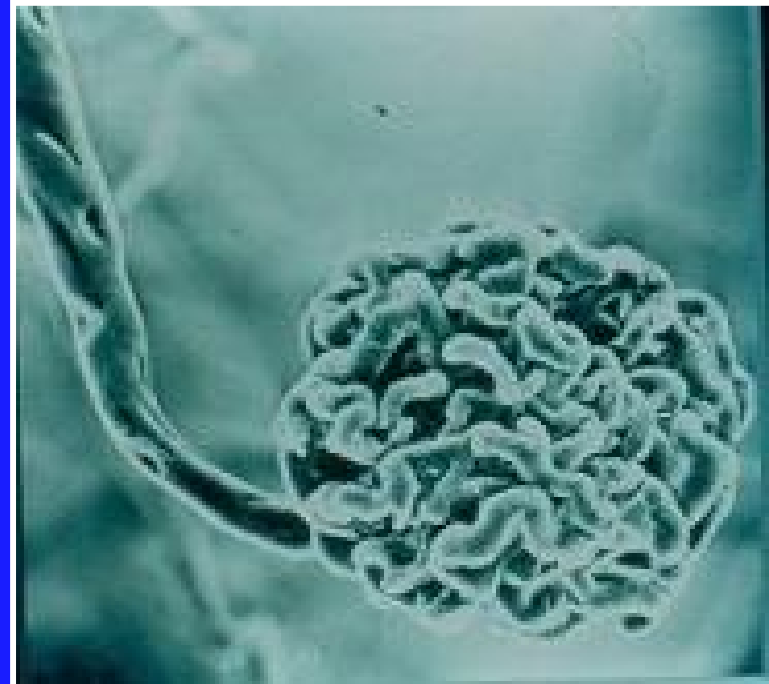
Renovascular

Myocardial dysfunction  
Valvular dysfunction  
Tamponade

Sepsis  
Cirrhosis  
Anaphylaxis

Renal vasoconstriction  
Drugs

# Cyclosporine Mediated Vasoconstriction



# DD for Low Urine Sodium in Oliguria

- Prerenal
- Hepatorenal
- CHF/Cardiorenal
- Radiocontrast
- Cyclosporine/Tacrolimus Toxicity
- Acute Glomerulonephritis



# Clinical Case

- 52 year old man with hx of ESLD from ETOH.
- POD day #3 following OTLTx.
- Difficult Transplant with 24 units of PRC, 30 units of Platelets, 28 units of FFP and 15 Liters of Crystalloid.
- Nurse is concerned because UOP has dropped to 10 ccs/hour.

# Clinical Case



- Exam:

Intubated, sedated, very edematous

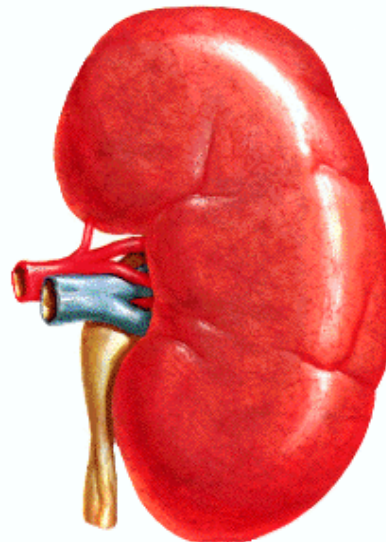
BP 115/75 HR 75

# Differential Diagnosis of Oliguria

Pre-renal

Renal

Post-renal



# Oliguria Checklist



- ✓ Foley OK? Obstruction?
- ✓ Enough juice going to the kidneys?

# Is this Patient Prerenal?

## Are the kidneys getting enough juice?

### ✓ Blood Pressure, Heart Rate, Orthostatics

BP 115/75, HR 75, unable to sit up or stand

### ✓ Filling Pressures, Neck Veins

CVP=18, PCWP= 22

### ✓ Evidence for CHF?

Swan Ganz Readings: CO 5, CI 2.5

# Is this Patient Prerenal?



- ✓ Blood Pressure, Heart Rate, Orthostatics
- ✓ Filling Pressures, Neck Veins
- ✓ Evidence for CHF?

ASK THE KIDNEY?

# Investigations

135	101	60
3.8	26	3.5

$U_{Na}$  15 mEq/L

$U_K$  35

$U_{Cl}$  13

$U_{creat}$  35 mg/dl

$U_{osm}$  510 mOsm/kg

FENa=0.4%

# Clinical Case

- Going back to the bedside.
- On exam patient has a very distended and tense abdomen.
- Could he have abdominal compartment syndrome?
- You transduce a bladder pressure which is 35 mmg Hg.



# Abdominal Compartment Syndrome

- Organ Dysfunction caused by intraabdominal hypertension
- Normal intraabdominal pressure 5-7 mm Hg.
- Intraabdominal hypertension defined as pressure  $> 12$ mm Hg
- Kidney:
  - Oliguria with IAP  $> 15$ mm HG
  - Anuria with IAP  $> 30$ mm HG

# Clinical Case

55yo male admitted following an alcoholic binge with severe abdominal and back pain. On examination, unwell with acute abdomen, P125, BP 95/42, T38.2°C, ↑RR 28/min

- Amylase x10 normal → Dx acute pancreatitis. US → no gallstones or collection.
- Initial Rx includes analgesia and IV Abx.
- Further deterioration condition D3 of admission with respiratory distress and decreased urine output (10mls/hr) and transferred to ICU.



I want some liquid gold in that bag!



# Oliguria Checklist



- ✓ Foley OK? Obstruction?
- ✓ Enough juice going to the kidneys?

# Is this Patient Prerenal?

## Are the kidneys getting enough juice?

### ✓ Blood Pressure, Heart Rate, Orthostatics

BP 100/50, HR 90, unable to sit up or stand

### ✓ Filling Pressures, Neck Veins

CVP 18 cm

### ✓ Evidence for CHF?

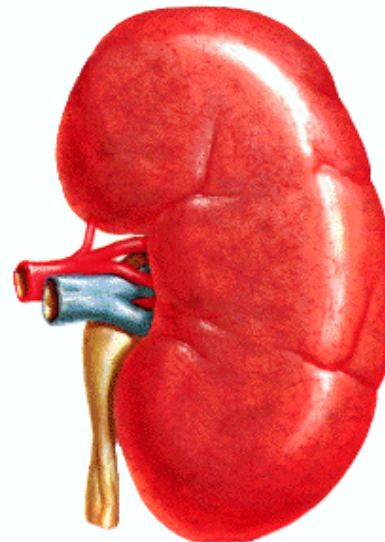
No S3 or S4 but pulmonary vascular congestion on CxRay and bilateral pleural effusions.

# Differential Diagnosis of Oliguria

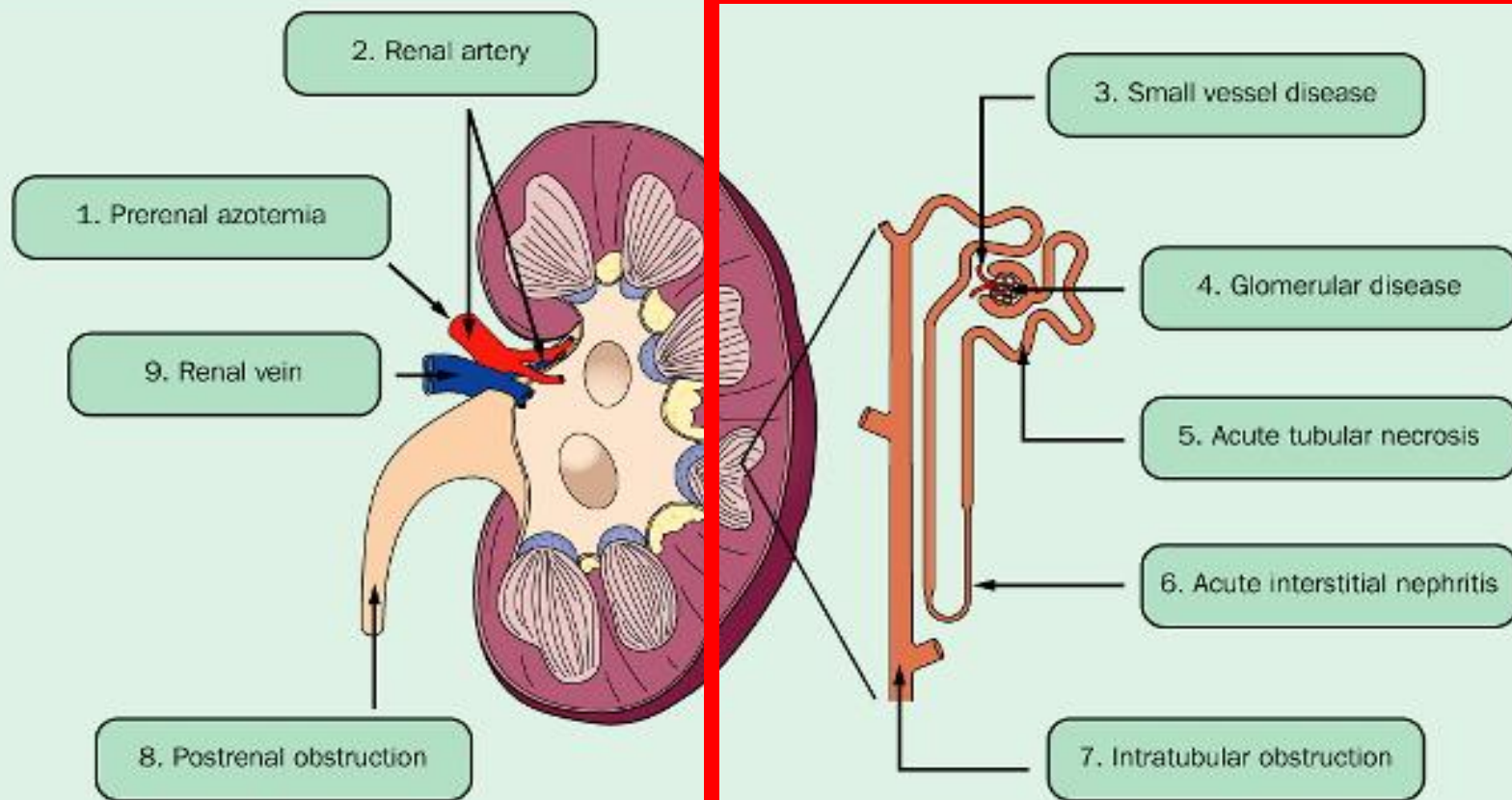
~~Pre-renal~~

Renal

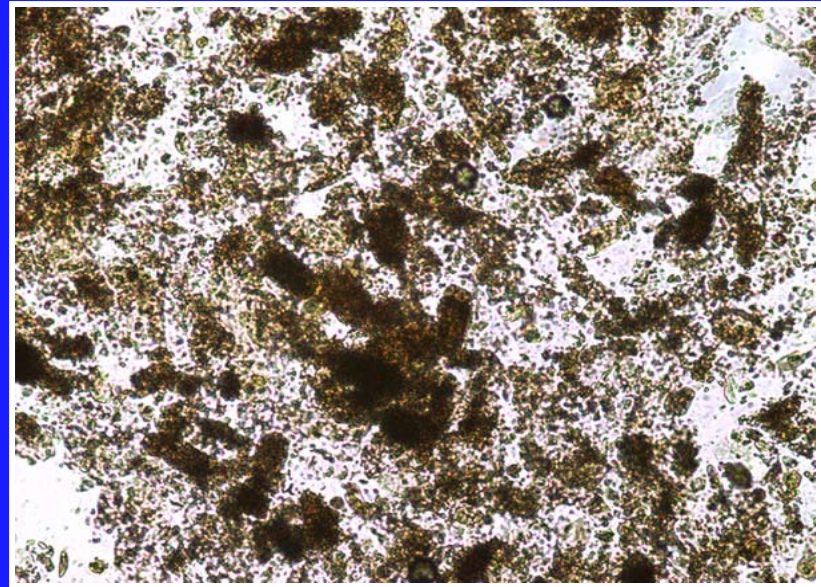
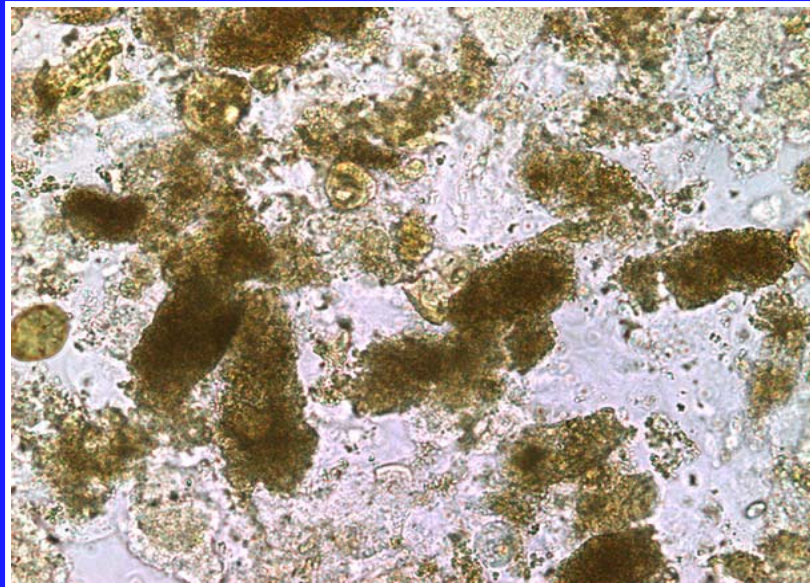
~~Post-renal~~



# Differential Diagnosis of ARF



# What is the Diagnosis? Ask the Kidney!



Repeat Creatinine went from 1 -> 2mg/dl



# What to do?

- 55 year old man with pancreatitis and oliguric AKI from ATN who is volume overloaded. You should now:
  - a) Give him more fluid.
  - b) Give him Diuretics.
  - c) Call Renal.
  - d) Turn your pager to silent and take a nap.

# Clinical Case

- 35 year old man with idiopathic dilated cardiomyopathy with EF=20% admitted with CHF exacerbation.
- Despite industrial doses of Diuretics his UOP has dropped off to 5 ccs/hour.
- The nurse wants you to restore a healthy flow of urine.

# Oliguria Checklist



- ✓ Foley OK? Obstruction?
- ✓ Enough juice going to the kidneys?

# Is this Patient Prerenal?

## Are the kidneys getting enough juice?

- ✓ Blood Pressure, Heart Rate, Orthostatics

BP 94/50, HR 70.

- ✓ Filling Pressures, Neck Veins

JVP is to the angle of his jaw.

- ✓ Evidence for CHF?

Known CHF with EF of 20%. Pulmonary edema and peripheral edema.

# Is this Patient Prerenal?



- ✓ Blood Pressure, Heart Rate, Orthostatics
- ✓ Filling Pressures, Neck Veins
- ✓ Evidence for CHF?

ASK THE KIDNEY?

# Investigations

132	100	35
3.4	28	1.4

$U_{Na}$  10 mEq/L

$U_K$  71

$U_{Cl}$  12

$U_{creat}$  80 mg/dl

$U_{osm}$  510 mOsm/kg

# What is the Diagnosis?

A thick, horizontal red bar with a slight gradient and a shadow effect, positioned below the title.

Cardiorenal Syndrome

# What should you do now?

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- 200 mg Torsemide IV followed by 500 mg of Diuril IV.
- 500 cc fluid bolus.
- Dobutamine and Nesiritide.
- Consider Ultrafiltration.
- Call Cardiology and Renal.



# Oliguria-Summary

Pre-renal

Not enough juice going to the kidneys.

Renal

Kidneys not Filtering Properly.

Post-renal

Urine can't get out.  
Foley OK?  
Obstruction?

# Oliguria-Summary

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- Rule out an outflow problem.
- Make sure the tank is full but do not overflow the tank.
- Assess hemodynamics and ensure renal perfusion.
- Ask the kidney (urine lytes and urine sediment).