

# FIRST EVALUATION OF THE PATIENT WITH ABNORMAL RENAL FUNCTION

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Utility of the Urinalysis

# The Urinalysis

- Specific Gravity
- pH
- Protein
  - Dipstick
  - Quantification
- Blood
- Nitrite
- Leukocyte esterase
- Bacteria

# Specific Gravity

- A stand-in for osmolality, rarely useful in isolation
- Range: 1.001-1.035
- Dipstick measurement not affected by contrast excretion or glycosuria
- Hydrometer measurement is increased by contrast excretion, glucose, heavy proteinuria, without increasing osmolality
- If there are questions, order urine osmolality

# pH

- Normal 4.5-8; but rarely  $<5$  or  $>7$
- pH  $>8$  suggests
  - UTI with urea-splitting organisms
  - exogenous bicarbonate ingestion
  - recent vomiting
  - Contamination with quarternary ammonium skin cleanser
- Dipstick pH not sufficiently accurate for evaluation of various renal tubular acidoses

# Protein (dipstick)

- pH dependent: alkaline urine or skin cleansers may → false positive
- Sensitive to albumin, less so to globulins or heme proteins
- Sensitivity for albuminuria <300mg/day uncertain
- Significance:
  - Orthostatic or exercise-associated: not significant
  - Isolated (<2gm/d, normal GFR, no urine RBC, no positive serologies or systemic illness): observe with close f/u, transient in 5-10%, but if associated with RBC or low GFR, biopsy
  - 4+ proteinuria always implies glomerular disease

# Protein 2

- Diabetes with proteinuria does not require biopsy routinely
- Biopsy IF
  - Sudden increase in amount of protein
  - Abnormal serology
  - Absence of other end-organ damage
- Biopsy in these circumstances will show NON-diabetic renal disease in 30-40%

# Protein 3

- Quantification
  - Protein:creatinine ratio x creatinine excretion/day = 24 hr protein excretion
  - (estimated creatinine excretion is 15-20mg/kg/day for women and 20-25mg/kg/day for men)

# Blood (dipstick)

- Heme peroxidase catalyzes an organic peroxide → oxidation of an indicator dye
- False + in presence of povidone-iodine, semen, high pH
- False – with ascorbate
- Detects hemoglobin, RBC, and myoglobin
- Heme + dipstick **REQUIRES** microscopic exam



# Blood 2

- >3 RBC/hpf is abnormal
- RBC without proteinuria almost always urological
  - Exceptions: thin basement membrane disease, IgA nephropathy, cystic disease, Hgb S
  - RBC without proteinuria >35yo: w/u for malignancy, preferably with ultrasound and cysto, though yield is low; anticoagulant use does NOT obviate need for this evaluation
- Heme + without RBC on micro
  - Myoglobinuria, intravascular hemolysis, possible lysis of RBC, especially with dilute urine
- Dysmorphic RBC
  - 85% sensitive for glomerular source but may be confused with crenated RBC related to high urine osmolality

# Nitrite

- Many GNB convert nitrate to nitrite, which activates a chromogen
- Some GNB and most GPC do not → positive nitrite
- The reaction is slow and urine has to have been in the bladder about 4 hours to → nitrite

# Leukocyte esterase

- Cleaves pyrrole amino acid esters, producing free pyrroles that react with a chromogen
- Threshold is 5-15 WBC/hpf
- False NEG: glycosuria, high SG, tetracycline or cephalexin, high oxalate excretion
- Vaginal discharge contamination may → positive dipstick in absence of UTI

# Bacteriuria (on micro exam)

- Bacteriuria with negative culture:
  - Unclear what to do
  - Treat if pyuria and symptoms
- Be very hesitant to attribute an abnormal urinalysis to UTI in the absence of symptoms!

# Casts

- RBC casts: represent glomerular bleeding
- WBC casts: pyelonephritis, occasionally acute interstitial nephritis
- Muddy brown casts: ATN
- Granular casts: chronic renal disease
- Hyaline casts: meaningless

# Urine microscopy

- Leave the microscopic exam to the technicians!

# Abnormal Renal Function: First Evaluation

- Acute renal injury?
- Acutely discovered chronic renal disease?
- Both?

# History

Has there been an illness that seems capable of causing acute renal injury?

Vomiting, diarrhea, bleeding, fever, meds

Are there voiding symptoms?

What is the time frame?

Creatinine rises about 1mg%/day in fairly severe acute renal failure



# Volume Assessment 1

- Elevated BUN and creatinine are not prima facie evidence of volume depletion
- Evidence of volume depletion:
  - History: vomiting, diarrhea, diuresis, bleeding
    - poor intake alone is not a likely cause
  - Physical Exam: neck veins, IVC diameter by US, orthostasis, periorbital fullness, skin turgor, mucous membranes (dryness is not reliable but wetness is)

# Volume Assessment 2

- Lab Data:
  - BUN:creat ratio elevated in volume depletion IF the patient is eating protein AND can concentrate the urine. High urea production will produce the same picture
  - Suspiciously normal albumin or Hgb
  - Low FeNa – “low” depends on baseline GFR
    - May not be low despite volume depletion if there is CKD or ongoing diuresis
  - Abnormal urinalysis: heavy proteinuria usually chronic disease
  - Renal insufficiency with normal U/A: pre-renal, obstruction, vascular disease

# Imaging

- Small echogenic kidneys prove chronicity
- BUT
- Diabetes, amyloidosis, membranous GN may have chronic disease with normal or large kidneys, though still with echogenic parenchyma
- ALWAYS get renal ultrasound!

# Assessment: Acute

May resolve with rapid resolution of underlying cause

- Stop bleeding

- Restore to normal volume

- Treat sepsis

- Treat cardiogenic shock

- Relieve urinary obstruction

- Resolve arrhythmia

- Find and fix that dissecting aneurysm

- Talk your friendly surgeon into replacing the valve  
with the fungal vegetations

- And so on....

# Assessment: Chronic

- Place in rough categories
  - Albuminuria  $>3\text{gm/day}$  always implies glomerular disease. Lesser proteinuria can be pretty much anything
  - If there is microscopic hematuria as well as heavy proteinuria, the GN is likely proliferative
  - Renal insufficiency with normal urinalysis suggests obstruction or vascular disease