Urinalysis Interpretation

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Background Readings

1. Coyle EA and Prince RA. Urinary tract infections and prostatitis. In: DiPiro JT, Talbert RL, Yee GC, et al. *Pharmacotherapy: A Pathophysiologic Approach*. McGraw-Hill; 2011:1995-2010.

2. Gerber GS and Brendler CB. Evaluation of the Urologic Patient: History, Physical Examination, and Urinalysis. In: Wein AJ, Kavoussi LR, Novick AC, et al. *Campbell-Walsh Urology*. Philadelphia, PA: Elsevier Saunders; 2011:84-97.

3. Meyrier A. Urine sampling and culture in the diagnosis of urinary tract infection in adults. *Up To Date*. Updated April 22, 2011.

Objectives

- Describe which patients may benefit from a urinalysis
- Define the components of a macroscopic, dipstick, and microscopic urinalysis
- Interpret the results of a macroscopic, dipstick, and microscopic urinalysis
- Identify the limitations of a urinalysis

Definition

- Urinalysis
  - Physical, chemical, and microscopic examination of urine
  - Involves many tests to detect and measure various compounds that pass through the urine
  - Also used to detect the presence of an infection in the urinary tract

Why perform a urinalysis?

- Symptoms of a urinary tract infection
  - Painful urination
  - Frequency
  - Urgency
  - Lower abdominal pain
  - Flank pain
- Diagnosis of urologic conditions
- Elderly patients with unexplained delirium
- Unexplained fever

Methods of sampling urine

- Clean-catch specimen
  - Preferably first morning void, although this is usually not possible
  - Patient should waste first 5 mL, then catch 5 – 10 mL mid-stream
  - Antibacterial wipes
    - Studies have not demonstrated consistent clinical benefit
- Catheter specimen

Methods of Urinalysis

1. Macroscopic
2. Dipstick chemical analysis
3. Microscopic
4. Urine culture
   - Identify specific organism causing infection (if any)
   - Typically takes 1-3 days to result

Macroscopic Urinalysis

- Direct visual observation of urine
  - Color
    - Dark – dehydration, rhabdomyolisis, liver disease
    - Red tinge – blood in the urine
    - Other colors – medications (e.g. rifampin – red/orange)
  - Clarity
    - Hazy or cloudy – infection

Dipstick Introduction

- Plastic strip dipped in urine sample
  - Test for various chemical components of urine
  - Results in seconds to minutes
- Often performed in emergency departments or ambulatory clinics that do not have a micro lab available
- Associated with false negatives
  - Use caution if a negative dipstick test results in a patient with symptoms of a UTI
  - Dipstick is specific, but not very sensitive
    - Sensitivity related to bacterial load
  - Perform a urine culture
- Tests
  - Specific gravity, pH, leukocyte esterase, nitrites, hemoglobin, protein, glucose, ketones, urobilinogen, bilirubin

Dipstick Example

Dipstick Indicators of Infection

- pH
  - Normal: 4.5 – 8
  - Alkaline urine in a patient with UTI suggests the presence of a urea-splitting organism (ex. *Proteus*)
    - Some exceptions exist, such as *Staphylococcus, Enterococcus*, and *Pseudomonas*

- Leukocyte esterase
  - Normal: negative
  - Esterase released by White Blood Cells (WBCs)

- Nitrite
  - Normal: negative
  - Bacteria reduce dietary nitrates to nitrites

- Hemoglobin
  - Normal: negative
  - RBCs can enter urinary tract due to disease or trauma

Non-infectious Dipstick Tests

- **Specific gravity**
  - Normal: 1.003 – 1.030
  - Indication of hydration status
- **Protein**
  - Normal: negative
  - Positive result could indicate infection, diabetes, trauma
- **Glucose**
  - Normal: negative
  - Most glucose filtered by kidneys is reabsorbed
  - Glucose may spill into urine if amount of glucose present exceeds kidney's capacity to reabsorb (uncontrolled diabetes)

Non-infectious Dipstick Tests (cont.)

- ## Ketones
  - Normal: negative
  - Product of body fat metabolism commonly associated with uncontrolled diabetes

- ## Urobilinogen
  - Normal: 0.1 – 1.0 mg/dL
  - Excess concentrations can indicate liver damage (e.g hepatitis, cirrhosis) or hemolytic anemia

- ## Bilirubin
  - Normal: negative
  - Can indicate liver disease or biliary obstruction

Microscopic Urinalysis

- Used to confirm and further define a positive dipstick urinalysis
- Will provide quantity of bacteria
- Allows for eventual speciation and sensitivity testing to be completed, in order to guide therapy
- Often used in patients with:
  - Recurrent infection
  - Prior infection unresolved with antibiotics
  - Signs/symptoms of an upper urinary tract infection
  - Complicated UTIs

Microscopic Urinalysis (cont.)

- WBC
  - Normal: 0 – 5 per hpf
    - Men usually have < 2/hpf; women usually have < 5/hpf
  - Presence of elevated WBCs indicates the body may be fighting infection in the urinary tract
- RBC
  - Normal: 0 – 1 per hpf
  - Presence indicates damage to urinary tract (e.g., infection, physical trauma, etc.)
- Bacteria
  - Normal: negative
  - Presence of bacteria is not always predictive of a UTI (ex. asymptomatic bacteriuria, catheter colonization)
  - Must use in conjunction with other factors

Microscopic Urinalysis (cont.)

- Epithelial cells
  - Squamous epithelial cells
    - Normal: 0 – 2 per hpf
    - Large numbers may indicate a poor sample (contamination)
  - Renal epithelial cells
    - Normal: 0 – 1 per hpf
    - Large numbers may indicate renal tubular injury
- Crystals and casts
  - Typically indicative of inflammation, infection, or injury in the urinary tract

Urinalysis Example

URINALYSIS		
COLOR, URINE	YELLOW	
CLARITY, URINE	HAZY	
SPECIFIC GRAVITY, ...	1.008	
PH, URINE	7.0	
LEUKO ESTERASE, URINE	MODERATE	▮
NITRITES, URINE	NEGATIVE	
PROTEIN, URINE	3+ *	▮
GLUCOSE, URINE	1+	▮
KETONES, URINE	NEGATIVE	
UROBILINOGEN, URINE	0.2	
BILIRUBIN, URINE	NEGATIVE	
HEMOGLOBIN, URINE	TRACE	▮
WBC, URINE	21-50 *	▮
WBC CLUMPS, URINE		
RBC, URINE	2-5	▮
BACTERIA, URINE	PRESENT *	▮
SQUAM EPI CELLS, U...	1	
RENAL EPI CELLS, U...	NOT SEEN	

Misleading Aspects

- Squamous epithelial cells present
  - May not be a clean-catch sample
- Elderly patients
  - May have bacteria in urine without having an active infection
- Presence of urinary catheter
  - Catheter may be colonized with bacteria (not a true infection)
- No single lab test result is sufficient to definitively indicate infection by itself
  - Must interpret lab tests along with clinical picture

Thank you!