Urinalysis Interpretation

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Background Readings


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, rhabdomyolysis, 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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color, Urine</td>
<td>Yellow</td>
</tr>
<tr>
<td>Clarity, Urine</td>
<td>Hazy</td>
</tr>
<tr>
<td>Specific Gravity, ...</td>
<td>1.008</td>
</tr>
<tr>
<td>PH, Urine</td>
<td>7.0</td>
</tr>
<tr>
<td>Leuko Esterase, Urine</td>
<td>Moderate</td>
</tr>
<tr>
<td>Nitrites, Urine</td>
<td>Negative</td>
</tr>
<tr>
<td>Protein, Urine</td>
<td>3+</td>
</tr>
<tr>
<td>Glucose, Urine</td>
<td>1+</td>
</tr>
<tr>
<td>Ketones, Urine</td>
<td>Negative</td>
</tr>
<tr>
<td>Urobilinogen, Urine</td>
<td>0.2</td>
</tr>
<tr>
<td>Bilirubin, Urine</td>
<td>Negative</td>
</tr>
<tr>
<td>Hemoglobin, Urine</td>
<td>Trace</td>
</tr>
<tr>
<td>WBC, Urine</td>
<td>21-50</td>
</tr>
<tr>
<td>WBC Clumps, Urine</td>
<td></td>
</tr>
<tr>
<td>RBC, Urine</td>
<td>2-5</td>
</tr>
<tr>
<td>Bacteria, Urine</td>
<td>Present</td>
</tr>
<tr>
<td>Squam Epi Cells, Urine</td>
<td>1</td>
</tr>
<tr>
<td>Renal Epi Cells, Urine</td>
<td>Not Seen</td>
</tr>
</tbody>
</table>
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!