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Urinalysis as part of minimum database (including hematology and clinical chemistry) for wellness screenings, acute or chronic care

Education of clients through variety of marketing materials about need for screening and value of urinalysis

Receptionist reminder call/postcard/email to pet owner detailing need for urine sample

Pet owner and patient arrive for appointment

Did pet owner bring in a urine sample?

Yes

Run a complete urinalysis (physical, chemical and microscopic evaluation) as part of minimum database along with chemistry and hematology

Receive urinalysis results available in ~3 minutes (IDEXX VetLab® Station, IDEXX VetLab® UA™ Analyzer, and SediVue Dx® Urine Sediment Analyzer) or send to IDEXX Reference Laboratory (following proper sample preparation and storage guidelines)

Abnormal results

Review the following interpretive guidelines

Normal results

Share results during patient visit either with IDEXX VetLab Station printed report or VetConnect® PLUS

No

Reiterate the importance of urine testing and plan to move ahead with on-site collection and testing

Collect urine from patient

Set up treatment plan and schedule recheck for follow-up urinalysis
### Urine physical parameters

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<tr>
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<th>Significance of findings and considerations</th>
<th>Possible next steps</th>
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</table>
|       | A way to describe the visual appearance of urine (pale yellow, dark yellow, brown) | • Hematuria (red or red/brown)  
• Urinary tract infection or inflammation (cystitis, pyelonephritis, nephritis, prostatitis)  
• Iatrogenic (due to traumatic cystocentesis or catheterization, or manual expression)  
• Calculi  
• Genital tract infection or inflammation (if voided sample is collected)  
• Neoplasia  
• Bilirubinuria (yellow/orange or yellow/brown)  
• Hepatic or biliary disease  
• Hemolytic disease  
• Hemoglobinuria (red or red/brown)  
• Intravascular hemolytic anemia | • Complete urinalysis |

| Clarity | A way to describe the visual appearance of the urine (clear, cloudy, turbid) | **Decreased clarity**  
• Urinary tract infection or inflammation  
• Cystitis  
• Pyelonephritis  
• Nephritis  
• Prostatitis  
• Urinary calculi  
• Genital tract infection or inflammation (if voided sample is collected)  
• Neoplasia | • Complete urinalysis |

**Note:** The following represents some of the more common causes related to urinalysis findings. For uncommon or related causes or for more detailed information, go to [vetconnectplus.com](http://vetconnectplus.com) to review the interpretive summaries.
<table>
<thead>
<tr>
<th>Urine physical parameters</th>
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</table>
| Urine specific gravity (USG) | Reflects concentration of particles in the urine. USG must be interpreted in light of the animal’s hydration status. Values ≤1.005 support the capability to dilute urine; values >1.030 (dog) or >1.035 (cat) support the capability to concentrate urine. Inappropriate USG implies kidney disease. | **Hyposthenuria (USG <1.008)**  
- Resistance to antidiuretic hormone (ADH) (nephrogenic diabetes insipidus)  
- Cushing’s disease  
- Pyometra  
- Pyelonephritis  
- Hypercalcemia  
- Increased water consumption (primary polydipsia)  
- Hyperthyroidism  
- Hypercalcemia  
- Lack of medullary concentrating ability  
- Addison’s disease  
- Medications or fluid therapy | • Blood chemistry  
• Complete urinalysis |
| Isosthenuria  
(USG 1.008–1.012) | | **Hypersthenuria**  
(USG >1.012)  
- Appropriate concentration (dog >1.030; cat >1.035)  
- Dehydration | |
**Urine chemical parameters** | **What is this?** | **Significance of findings and considerations** | **Possible next steps**
--- | --- | --- | ---
**pH** | Urine pH is a measure of acidity or alkalinity of the urine. To help maintain a normal blood pH, the kidney will vary how much acid is put into the urine. | **Decreased pH (acidic)**
- Metabolic acidosis
- Ethylene glycol intoxication
- Diabetic ketoacidosis
- Renal failure
- Lactic acidosis
- Addison’s disease
- High-protein or milk-based diet
- Paradoxical aciduria (acid urine pH with alkalosis)

**Increased pH (alkaline)** —
Recent meal (postprandial alkaline tide)
- Artifact
- Delayed sample analysis (spontaneous degeneration of urea)
- Urinary tract infection (UTI) with urease-producing bacteria (*Staphylococcus* spp., *Proteus* spp.) | *Urinary sediment (bacteria)*
*Evaluation of diet*
*Blood gas analysis (VetStat® Electrolyte and Blood Gas Analyzer)*

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**Note:** The following represents some of the more common causes related to urinalysis findings. For uncommon or related causes or for more detailed information, go to [vetconnectplus.com](https://vetconnectplus.com) to review the interpretive summaries.
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</table>
| Protein                   | Proteinuria is the medical term for protein in urine. | **Negative protein**  
  • Clinically normal animal  
  • False negatives:  
    • Bence Jones protein  
    • Highly alkaline urine  
  **Increased protein**  
  • Small amounts of protein (50 mg/dL or less) can be normal in urine, especially if urine is concentrated  
  • Interpret results in conjunction with urine specific gravity  
  • Further evaluation by urine protein:creatinine ratio to determine clinical significance of observed proteinuria (Do not perform the UPC if urine sediment is active.)  
  • Prerenal proteinuria  
  • Overflow/overload preglomerular proteinuria  
  • Systemic hypertension  
  • Renal proteinuria  
  • Glomerular proteinuria  
  • Tubular proteinuria  
  • Functional—transient  
  • Postrenal Proteinuria  
  • Inflammation or infection of the upper or lower urinary tract (or reproductive tract in voided specimen)  
  • Hemorrhage into the urinary tract or reproductive tract  
  • Neoplasia of the urinary tract  
  • Cushing’s disease  
  • False positives | • Urine protein:creatinine (UPC) ratio  
• Urine sediment  
• Sulfosalicylic acid precipitation test |
| Glucose                   | Detects presence of glucose in patient’s urine | **Negative glucose**  
  • Normal  
  • False negative with dipsticks  
    • Ascorbic acid (vitamin C)  
    • Formalin  
    • Low urine temperature (refrigerated urine)  
  **Increased glucose**  
  • Diabetes mellitus  
  • Stress or excitement (cats)  
  • Pyelonephritis  
  • Leptospirosis  
  • Renal tubular dysfunction  
  • Fanconi syndrome | • Fructosamine  
• Urine sediment—glucose promotes bacterial growth |
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</table>
| Ketones                   | Detects presence of ketones in the urine, which result from burning fat for energy | **Negative ketones**  
  • Normal  
  • False negative  
  • Aged urine sample  
  • Improper storage of reagent strip (exposed to moisture, heat, or light)  
  **Elevated ketones** *  
  • Diabetic ketoacidosis  
  • Prolonged fasting or starvation  
  *For canine and feline patients, detection of 1+ (15 mg/dL / 1.5 mmol/L) in patients who are normoglycemic or have negative glucose is nonspecific and of limited clinical significance. | • Consider diabetic ketoacidosis (DKA)—life-threatening condition:  
  • Reevaluation of urine and blood glucose  
  • Blood gas analysis  
  • Fructosamine  
  • Blood glucose curve  
  • Supportive therapy |
| Urobilinogen              | Byproduct of bilirubin breakdown in the intestines | **Negative urobilinogen**  
  • Normal  
  • Artifact  
  • Exposure to ultraviolet (UV) light or room air  
  • Delayed disease  
  • Formalin  
  **Increased urobilinogen**  
  • Red blood cell (RBC) destruction (hemolysis)  
  • Immune-mediated hemolytic anemia  
  • Zinc or onion toxicity  
  • RBC parasites | • Further patient assessment of liver (e.g., liver enzymes and bile acid profile) |
| Bilirubin                 | Hemoglobin breakdown product of senescent red blood cells that is cleared by the liver. High concentrations in the blood cause a yellowing of the skin and sclera (jaundice). | **Negative bilirubin**  
  • Normal for the cat and possible for the dog (see below)  
  • Artifact  
  • Exposure to UV light or room air  
  • Delayed analysis  
  • Ascorbic acid (vitamin C)  
  **Measureable bilirubin**  
  • Normal dogs (especially males with concentrated urine)  
  • Liver disease, bile duct obstruction  
  • RBC destruction (hemolysis)  
  • Immune-mediated hemolytic disease  
  • Zinc or onion toxicity  
  • RBC parasites | • Clinical chemistry profile including the IDEXX SDMA™ Test  
  • Complete blood count (CBC)—hematocrit, reticulocytes (HCT, retics)  
  • Diagnostic imaging (radiographs, ultrasound) |
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</table>
| Blood/hemoglobin          | Protein within the RBC that carries oxygen | **Negative blood/hemoglobin**  
  - Normal  
  - False negative  
  - Ascorbic acid, captopril, or formaldehyde in the urine  
  **Increased blood/hemoglobin**  
  - Hematuria  
  - Urinary tract infection or inflammation (cystitis, pyelonephritis, nephritis, prostatitis)  
  - Trauma  
  - Natural  
  - Iatrogenic (cystocentesis, catheterization, manual expression)  
  - Urinary calculi  
  - Genital tract infection or inflammation (if voided sample is collected)  
  - Neoplasia  
  - Cross-reaction with myoglobin | **CBC**  
  **Coagulation panel (Coag Dx™ Analyzer)**  
  **Diagnostic imaging** |
| Leukocytes                | Measure of leukocyte esterase | Feline results: not valid  
  Canine results: only valid occasionally; therefore, microscopic confirmation recommended | **Urine sediment microscopic evaluation to confirm the presence or absence of leukocytes**  
  **Not valid in felines** |
| Specific gravity (on the dipstick) | Measure of ionic strength (total solute concentration) used to estimate urine specific gravity | Urine specific gravity is an essential component of the complete urinalysis; however, the dry-reagent urine specific gravity test is unreliable in veterinary medicine. | **Not recommended for veterinary samples.**  
  **Use a calibrated and veterinary specific refractometer.** |
| Nitrite                   | • Not recommended for veterinary samples | • Not recommended for veterinary samples | • Not recommended for veterinary samples |
Note: The following represents some of the more common causes related to urinalysis findings. For uncommon or related causes or for more detailed information, go to VetConnectPlus.com to review the interpretive summaries.

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<th>What is this?</th>
<th>Common causes</th>
<th>Possible next steps</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bacteria</strong></td>
<td></td>
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</tbody>
</table>
| Rods (bacilli)            | Rod-shaped bacteria | **Negative bacteria**<br>• The absence of bacteria is a normal finding.  
**Increased bacteria**<br>• Urogenital tract infection (cystitis, pyelonephritis, prostatitis)<br>• Urine sample contamination—particularly in catheterized or voided samples | • Collect sample via cystocentesis to localize bacteriuria to the urinary tract.  
• Prepare air-dried, stained urine sediment slide.  
• Urine culture and sensitivity. |
| Cocci                     | Round-shaped bacteria | **Negative bacteria**<br>• The absence of bacteria is a normal finding.  
**Increased bacteria**<br>• Urogenital tract infection (cystitis, pyelonephritis, prostatitis)<br>• Urine sample contamination—particularly in catheterized or voided samples | • Collect sample via cystocentesis to localize bacteriuria to the urinary tract.  
• Prepare air-dried, stained urine sediment slide.  
• Conduct urine culture and sensitivity. |
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<tr>
<td><strong>Blood cells</strong></td>
<td></td>
<td><strong>None to rare red blood cells</strong></td>
<td></td>
</tr>
</tbody>
</table>
| Red blood cells           | Red blood cells | • Normal (≤5 RBC/hpf considered clinically insignificant.  
• RBCs rapidly lyse in samples with low urine specific gravity.  
**Increased red blood cells**  
• Urinary trauma  
• Natural  
• Iatrogenic (cystocentesis, catheterization, manual expression)  
• Urinary tract infection or inflammation (cystitis, pyelonephritis, nephritis, prostatitis)  
• Urinary calculi  
• Genital tract infection or inflammation (if voided sample is collected)  
• Neoplasia | • Urine sediment  
• Hematology (CBC)  
• Diagnostic imaging  
• Pathology  
• Urine cytology  
• Biopsy histopathology |
| White blood cells         | White blood cells | **None to rare white blood cells** |       |
|                           |               | • Normal (≤5 WBC/hpf considered clinically insignificant)  
• Artifact (e.g., cell lysis)  
• Occult inflammation:  
• Low urine specific gravity  
• Diabetes mellitus  
• Cushing’s disease  
• Anti-inflammatory medications  
**Increased white blood cells**  
• Urinary tract infection or inflammation (cystitis, pyelonephritis, nephritis, prostatitis)  
• Urinary calculi  
• Genital tract infection or inflammation (if voided sample is collected)  
• Neoplasia | • Air-dried, stained urine preparation  
• Urine culture and sensitivity  
• Clinical chemistry profile including the IDEXX SDMA™ Test |
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</thead>
<tbody>
<tr>
<td>Epithelial cells</td>
<td></td>
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</tr>
</tbody>
</table>
| Squamous epithelial cells | Cells that line the surfaces of the external genitalia and lower urinary tract | None to rare squamous epithelial cells  
- Low numbers (<1/hpf) may be present in urine samples from normal dogs and cats in free-catch voided urine samples.  
Increased squamous epithelial cells  
- Possible with voided or catheterized samples from normal dogs and cats  
- Urinary tract infection or inflammation (urethritis +/- cystitis)  
- Urinary calculi  
- Genital tract infection or inflammation (if voided sample is collected)  
- Neoplasia | Collect urine by cystocentesis.  
- Prepare air-dried, stained urine sediment slide. |
| Nonsquamous epithelial cells (transitional cells and renal tubular epithelial cells) | Cells that line the urinary system (renal tubules, renal pelvis, ureters, and urinary bladder) | None to rare nonsquamous epithelial cells  
- Low numbers (<1/hpf) may be present in urine samples from normal dogs and cats.  
Increased nonsquamous epithelial cells  
- Possible with voided or catheterized samples from normal dogs and cats  
- Urinary tract infection or inflammation (cystitis, pyelonephritis, nephritis, prostatitis)  
- Urinary calculi  
- Neoplasia (especially transitional cell carcinoma) | Prepare air-dried, stained urine sediment slide.  
- Cytological evaluation by pathologist.  
- Ultrasound. |
<table>
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<tbody>
<tr>
<td><strong>Casts</strong></td>
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<tr>
<td>Hyaline casts</td>
<td>Cell-free casts (cylinders) formed from Tamm-Horsfall mucoproteins within the renal tubules</td>
<td><strong>None to rare hyaline casts</strong>&lt;br&gt;• Less than 1 hyaline cast/lpf in the urine is a normal finding.</td>
<td>• Urine protein to urine creatinine (UPC) ratio recommended to quantify the amount of proteinuria&lt;br&gt;• Clinical chemistry profile including the IDEXX SDMA™ Test&lt;br&gt;• Diagnostic imaging</td>
</tr>
<tr>
<td></td>
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<td><strong>Increased hyaline casts</strong>&lt;br&gt;• Low numbers may be normal in a highly concentrated urine&lt;br&gt;• Fever/exercise in low numbers&lt;br&gt;• Glomerular disease&lt;br&gt;• Glomerulonephritis&lt;br&gt;• Glomerular amyloidosis</td>
<td></td>
</tr>
<tr>
<td>Nonhyaline casts</td>
<td>An umbrella term coined by IDEXX that includes various types of casts (cellular, granular, waxy)</td>
<td><strong>None to rare nonhyaline casts</strong>&lt;br&gt;• Less than 1 nonhyaline cast/lpf in the urine is a normal finding.</td>
<td>• Clinical chemistry profile including the IDEXX SDMA™ Test&lt;br&gt;• Diagnostic imaging</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Increased nonhyaline casts</strong>&lt;br&gt;• Low numbers may be normal in a highly concentrated urine&lt;br&gt;• Fever/exercise: low numbers of fine granular casts&lt;br&gt;• Pyelonephritis: epithelial cells, white blood cells, and granular casts possible&lt;br&gt;• Active renal injury: epithelial cells, white blood cells, and granular casts possible&lt;br&gt;• Toxicity (NSAIDs, aminoglycosides, ethylene glycol)&lt;br&gt;• Renal ischemia/shock/hypoperfusion&lt;br&gt;• Acute renal failure&lt;br&gt;• Renal infarction</td>
<td></td>
</tr>
<tr>
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<td>Common causes</td>
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<tr>
<td>Crystals</td>
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<tr>
<td>Struvite crystals</td>
<td>Common type of crystal formation found in urinary samples (also called triple phosphate or magnesium ammonium phosphate)</td>
<td><strong>None to rare struvite crystals</strong>&lt;br&gt;- The absence of crystals in the urine is a normal finding.&lt;br&gt;<strong>Increased struvite crystals</strong>&lt;br&gt;- Normal&lt;br&gt;- May form after collection in stored, refrigerated samples&lt;br&gt;- Urinary tract infection&lt;br&gt;- Idiopathic lower urinary tract disease of cats&lt;br&gt;- Potentially associated with struvite urolithiasis</td>
<td>• Diagnostic imaging&lt;br&gt;• Dietary changes&lt;br&gt;• Surgery (to remove stones or unblock urinary system)</td>
</tr>
<tr>
<td>Calcium oxalate dihydrate crystals</td>
<td>Common finding in veterinary samples</td>
<td><strong>None to rare calcium oxalate dihydrate crystals</strong>&lt;br&gt;- The absence of crystals in the urine is a normal finding.&lt;br&gt;<strong>Increased calcium oxalate dihydrate crystals</strong>&lt;br&gt;- Normal&lt;br&gt;- May form after collection in stored, refrigerated samples&lt;br&gt;- Increased calcium excretion&lt;br&gt;- Ingestion of food rich in oxalates, calcium, or vitamin D&lt;br&gt;- Cushing’s disease (hyperadrenocorticism)&lt;br&gt;- May be seen with ethylene glycol toxicosis (monohydrate form is more common)&lt;br&gt;- Potentially associated with oxalate urolithiasis</td>
<td>• Clinical chemistry profile including the IDEXX SDMA™ Test&lt;br&gt;• Diagnostic imaging&lt;br&gt;• Surgery (bladder stones)</td>
</tr>
<tr>
<td>Calcium oxalate monohydrate crystals</td>
<td>Infrequently seen urinary crystal in the normal dog and cat</td>
<td><strong>None to rare calcium oxalate monohydrate crystals</strong>&lt;br&gt;- The absence of crystals in the urine is a normal finding.&lt;br&gt;<strong>Increased calcium oxalate crystals</strong>&lt;br&gt;- Normal&lt;br&gt;- May form after collection in stored, refrigerated samples&lt;br&gt;- Increased calcium excretion&lt;br&gt;- Ethylene glycol toxicosis&lt;br&gt;- Ingestion of food rich in oxalates, calcium, or vitamin D&lt;br&gt;- Cushing’s disease (hyperadrenocorticism)&lt;br&gt;- Potentially associated with oxalate urolithiasis</td>
<td>• Clinical chemistry profile including the IDEXX SDMA™ Test&lt;br&gt;• Diagnostic imaging&lt;br&gt;• Surgery (bladder stones)</td>
</tr>
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</tbody>
</table>
| Ammonium biurate          | Can be common in some predisposed breeds—otherwise a rare finding | None to rare ammonium biurate crystals  
- The absence of crystals in the urine is a normal finding.  
- Occasionally seen, in low numbers, in normal dog and cat urine.  
**Increased ammonium biurate crystals**  
- Possible urate urolithiasis  
- Portosystemic shunt  
- Liver disease/failure  
- May be seen in normal Dalmatians and English bulldogs  
- May form after collection in stored, refrigerated sample | • Clinical chemistry profile including the IDEXX SDMA™ Test  
• Bile acid profile  
• Serum ammonium test  
• Diagnostic imaging  
• Surgery (liver shunt) |
| Bilirubin                 | Crystal form of conjugated (water-soluble) bilirubin | None to rare bilirubin crystals  
- The absence of crystals in the urine is a normal finding.  
- Low numbers possible in highly concentrated dog urine.  
- Always absent in normal cat urine.  
**Increased bilirubin crystals**  
- Highly concentrated urine from normal dogs  
- Increased conjugated bilirubin in urine  
- Cholestatic liver disease  
- Potential hemolytic disease | • If stored in cold temperatures or aged sample, rerun fresh sample. |
| Uric acid crystals        | Crystal form of uric acid | None to rare uric acid crystals  
- The absence of crystals in the urine is a normal finding.  
**Increased uric acid crystals**  
- Highly concentrated urine from normal dogs  
- Possible uric acid urolithiasis | • Clinical chemistry profile including the IDEXX SDMA™ Test  
• Diagnostic imaging  
• Surgery (liver shunt) |
| Cystine crystals          | A crystal form of cystine | Absent  
- The absence of crystals in the urine is a normal finding.  
**Present**  
- Uncommon  
- Urolithiasis  
- Reported in many breeds; predisposed in Newfoundland, dachshund, mastiff, bassett hound, English bulldog | • Diagnostic imaging |
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<tr>
<td><strong>Miscellaneous</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sperm</td>
<td>Normal finding</td>
<td>Noncastrated male urine samples or following a bitch’s recent mating</td>
<td>n/a</td>
</tr>
<tr>
<td>Lipids</td>
<td>Incidental finding</td>
<td>No clinical significance especially in dogs.</td>
<td>• Addition of acetic acid to the urine sediment to lyse RBCs and help distinguish lipids</td>
</tr>
<tr>
<td>Mucus</td>
<td>Incidental finding</td>
<td>No clinical significance.</td>
<td>• Distinguish from casts.</td>
</tr>
<tr>
<td>Parasites</td>
<td>Incidental finding</td>
<td>Fecal contamination and less often parasitic infections. Potential parasites include (varies by region): • <em>Dirofilaria immitis</em> (heartworm) microfilaria • <em>Dioctophyma renale</em> (giant kidney worm of the dog) • <em>Pearsonema (Capillaria)</em> spp. (bladder worm of the dog and cat)</td>
<td>• Differentiate from plant pollen.</td>
</tr>
<tr>
<td>Amorphous crystalline material</td>
<td>Incidental finding</td>
<td>• No clinical significance • May be difficult to distinguish from cocci bacteria • May appear as cast-like structures</td>
<td>• Distinguish from casts. • Prepare air-dried, stained urine sediment slide to differentiate from bacteria.</td>
</tr>
<tr>
<td>Yeast</td>
<td>Yeast are microscopically similar to RBCs and lipids. <em>Candida</em> spp. is considered normal flora of the urogenital tract.</td>
<td>• Increased density can result from underlying disease, especially with glucosuria, or from recent antibiotic treatment. • Possible contaminant and overgrowth.</td>
<td>• Addition of acetic acid to the urine sediment to lyse RBCs and help distinguish yeast • Air-dried, stained cytological preparation for better evaluation of yeast or fungal components</td>
</tr>
<tr>
<td>Fungi</td>
<td>Systemic fungal infections may manifest in urine specimens.</td>
<td>Increased density can result from underlying disease, especially with glucosuria, or from recent antibiotic treatment.</td>
<td>• Addition of acetic acid to the urine sediment to lyse RBCs and help distinguish yeast • Air-dried, stained cytological preparation for better evaluation of yeast or fungal components</td>
</tr>
</tbody>
</table>