

OREGON HEALTH & SCIENCE UNIVERSITY
Hospitals and Clinics
Point of Care

Microscopic Examination of Urine

Principle

In health, the urine contains small numbers of cells and other formed elements from the whole length of the genitourinary tract; casts and epithelial cells from the nephron; epithelial cells from the pelvis, ureters, bladder and urethra; mucous threads and spermatozoa from the prostate. A few erythrocytes and leukocytes apparently reach the urine by diapedesis from any part of the urinary tract.

In renal parenchymal disease, the urine usually contains increased numbers of cells and casts discharged from an organ, which is otherwise accessible only by biopsy or an operation. The urinary sediment provides information useful both for diagnosis and prognosis.

Specimen Requirements

1. Random fresh urine sample. The first voided morning specimen is the most suitable for urinalysis because it is concentrated and is less likely to lyse or distort the formed elements.
2. Minimum volume is ½ mL.
3. Test within two (2) hours of collection.
4. If unable to test within two (2) hours, the sample is stable refrigerated at 2-4°C for twelve (12) hours. (Formed elements such as casts may be destroyed after 2-4 hours.) Return specimen to room temperature before testing.

Interferences

1. Hyaline casts and other partially transparent elements may be obscured by excessively bright light. Always use subdued light.
2. Vaginal secretions may contaminate the urine with epithelial cells, bacteria, or trichomonas.
3. Urine may be contaminated with fecal materials or *Giardia Lamblia*.
4. Starch granules, oil droplets from lubricants, fiber fragments, or bacteria and yeast from contaminated urine containers.

Reference Ranges

Casts, hyaline:	O-1/LPF (no other types of casts should be seen)
White Blood Cells:	0-5/HPF
Red Blood Cells:	0-3/HPF
Crystals:	Usually not significant unless found persistently in patients with renal calculi or if associated with certain metabolic diseases; i.e., sulfonamide, cystine, leucine and tyrosine crystals.
Amorphous:	Not significant. Present if urine is not tested immediately.
Epithelial Cells:	Few/HPF
Bacteria:	Present unless clean catch specimen or patient is catheterized for collection.
Mucus:	Not significant.

Large numbers of erythrocytes, leukocytes, and casts may appear in the urine of healthy subjects after strenuous exercise, exposure to severe cold, or trauma. Except under these conditions, certain abnormal constituents always indicate renal disease, e.g., red cell casts and white cell casts.

Procedure

1. Pour urine sample into a **labeled** disposable twelve (12) mL centrifuge tube. If <1mL urine is collected, do not centrifuge. Perform microscopic on unspun urine and note on patient chart.
2. Centrifuge tubes for five **(5)** minutes at 400g. (1500 rpm with a 15.25 cm radius head).
3. Remove the supernatant, leaving approximately 1 mL of concentrated urine sediment. Mix the sediment well to re-suspend.
4. Place a drop of the re-suspended urine sediment onto a glass slide. Place a coverslip over the urine sediment suspension.
5. Always use subdued light; adjust the microscope condenser down and close the

diaphragm so that the light is subdued.

6. Scan 10 fields using the low power objective and subdued light. Hyaline casts and other partially transparent solid elements may be obscured by excessively bright light. Count the number of casts seen per low power field and record the average number casts/LPF.
7. Count and record the average range of Red Blood Cells (RBCs) by scanning at least 10 - 15 fields using the high power objective. If more than one hundred (100) RBCs are present, record >100/HPF.
8. Observe and note RBC morphology. Normal, unstained RBCs in wet preparations appear as pale yellow-orange discs. They vary in size, but are usually about 8 μ m in diameter. With dissolution of hemoglobin in old or hypotonic urine specimens, RBCs may appear as faint, colorless circles or "ghost cells". With hypertonic urine specimens, RBCs may appear crenated with irregular edges and surfaces.
9. Count and record the average number of White Blood cells (WBCs) by scanning at least 10 - 15 fields using the high power objective. If more than one hundred (100) WBCs are present per field, record as > 100/HPF.
10. If the field is obscured by >100 WBCs/HPF, dilute the sample with saline so that other cells and elements may be counted. Add 2 drops saline to 1 drop of well-mixed urine sediment and place a drop onto the slide.
All cells and elements counted using a diluted sample must be multiplied by the dilution factor.
11. Continue scanning using high power objective for crystals, yeast, bacteria, epithelial cells, mucus, and other formed elements. Count and record the elements seen/HPF.

Calculations

1. If a saline dilution is required, multiply average number of elements counted by the dilution factor.
Example: 12 yeast seen/HPF x 3 (dilution factor) = 36 yeast/HPF

Reporting Results

1. Report casts as the average number of casts seen per low power field. Differentiate and quantitate different types of casts as hyaline, cellular, fatty, or waxy.
2. Report RBCs as the average number of RBCs seen per high power field. If more than 100 RBCs/HPF are seen per field, report as >100 / HPF.

- Report WBCs as the average number of WBCs seen per high power field. If more than 100 WBCs/HPF are seen per field, report as >100 / HPF.
- Report other cellular or formed elements as few, moderate, or many using the following as a guide:

Element	Few	Moderate	Many
Crystals	0-4/ HPF	5-10/HPF	>10/ HPF
Bacteria	0-25 /HPF	25-50/HPF	>50/HPF
Yeast	0-25 /HPF	25-50/HPF	>50/HPF
Epithelial Cells	0-4 /HPF	5-10/ HPF	>10/HPF

Interpretation of Results

- The microscopic findings are compared to the dipstick biochemical results when available.
- Compare positive microscopic findings for RBCs, WBCs, Bacteria and/or Casts to the biochemical results using the following table as a guide.

Microscopic Findings	Expected Dipstick Correlation	Possible Explanations for Discrepancies
>RBC/HPF	Blood: POSITIVE	<ol style="list-style-type: none"> Decreased or false negative blood result with high S.G. urine Test is equally sensitive to myoglobin Intact RBCs may produce spots on the test pad rather than a uniform color Presence of abnormally high amounts of ascorbic acid may cause a decreased or false negative results
>15 WBC/HPF	Leukocyte Esterase: POSITIVE	<ol style="list-style-type: none"> Non-granulocytes do not contain esterase. Large numbers of non-granulocytes will give a negative dip stick result Markedly elevated glucose (>3000 mg/dL) or high specific gravity urine may cause decreased or false negative results Tetracycline, Oxalic acid, Cephalexin, Cephalothin may cause decreased or false negative results
Moderate-Many Bacteria	Nitrite: POSITIVE	<ol style="list-style-type: none"> High specific gravity can give false negative nitrite results Presence of bacteria that do not reduce nitrate to nitrite. Inadequate bladder incubation time (.4 hrs) for reduction of nitrate to nitrite Absence of dietary nitrate Low levels of nitrite may be masked by ascorbic acid >25mg/dL

> 5 Hyaline Casts/LPF	Protein: POSITIVE	<ol style="list-style-type: none"> 1. Reagent strip is more sensitive to albumin than to globulins, hemoglobin, Bence-Jones protein, and mucoprotein. A negative result does not rule out the presence of these proteins. 2. False positive results from highly buffered or alkaline urines 3. False positive results from contamination by quaternary ammonium compounds (e.g. some antiseptics and detergents) or with skin cleansers containing chlorhexidine.
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Test Accuracy and Reliability Verification

1. All faculty providers performing urine microscopic examinations must be enrolled in the annual on-line competency program. Contact Point of Care at 4-6035 to enroll.

References

1. Schumann, G. Berry, Urine Sediment Examination, 1980.
2. College of American Pathologists, Surveys, Hematology Glossary, 2000.
3. Holen, Meryl H., MD, A Primer of Microscopic Urinalysis, ICL Scientific, pp. 15-17.

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