General urine examination (Urinalysis)

Urinalysis is a diagnostic physical, chemical, and microscopic examination of a urine sample (specimen). It is used to detect [urinary tract infections (UTIs)](http://labtestsonline.org/understanding/conditions/uti) and other disorders of the urinary tract.

Types of Urinalysis

1- Macroscopic examination (physical examination)

2- Chemical examination

3- Microscopic examination

4- Culture

5- Cytological examination

Macroscopic examination (physical examination)

1- Volume:  
Normally 1.5 - 2 liter/day.  
If more than 2 liters/day named as polyuria (in diabetes or in chronic renal diseases)  
If less than 1 liter/day named as oligouria (in case of excessive sweating , vomiting and diarrhea).

2- Color:  
Normal color: is yellow or pale yellow.  
  
Abnormal colors:  
1.Colorless (polyuria).  
2. Orange (due to antibiotic intake or eating certain foods).  
3. Brownish or greenish (Bilirubin >2mg/dl in blood).  
4. Reddish (RBC’s due to stone).  
5. Milky (usually in male due to sperms in urine).  
6. Cloudy with offensive odor (due to pus, crystals or epithelial cells).

3- Appearance

Normal urine is usually clear. Urine may appear cloudy or turbid from the presence of leukocytes and epithelial cells, bacteria can also cause cloudiness to urine.

4- Odor:  
Normally with aromatic odor.  
Abnormally:  
Offensive odor due to pus increase.  
Acetone odor due to ketones increases (ketonuria).

5- Specific gravity:  
Normally : 1003 – 1025

Chemical examination

[pH](http://labtestsonline.org/understanding/analytes/urinalysis/ui-exams/start/1#ph)1-

Usually, the pH of urine is between 4.5 and 8.0. The kidneys regulate this acid-base chemistry by reabsorbing sodium and secreting hydrogen and ammonium ions. Highly acidic urine can occur with uncontrolled diabetes, diarrhea, dehydration, and certain respiratory diseases while High alkaline urine can occur with urinary tract infections and certain kidney and lung conditions.

2- [Protein](http://labtestsonline.org/understanding/analytes/urinalysis/ui-exams/start/1#protein)

Excessive protein in the urine called proteinuria is a sign of kidney disorders.

Conditions that can produce proteinuria include:

* Disorders that produce high amounts of proteins in the blood, such as [multiple myeloma](http://labtestsonline.org/understanding/conditions/mult-myeloma)
* Conditions that destroy red blood cells
* [Inflammation](http://labtestsonline.org/glossary/inflammation), malignancies (cancer), or injury of the urinary tract - for example, the bladder, prostate, or [urethra](http://labtestsonline.org/glossary/urethra)
* Vaginal secretions that get into urine

3- [Glucose](http://labtestsonline.org/understanding/analytes/urinalysis/ui-exams/start/1#glucose)

Glucose is normally not present in urine. When glucose is present, the condition is called **glucosuria**. It results from either:

1. An excessively high glucose concentration in the blood, such as [diabetes mellitus](http://labtestsonline.org/understanding/conditions/diabetes)
2. A reduction in the "renal threshold.

4- [Ketones](http://labtestsonline.org/understanding/analytes/urinalysis/ui-exams/start/1#ketones)

Ketones are not normally found in the urine. They are intermediate products of fat metabolism. They can form when carbohydrates are not available or when a person's body cannot use carbohydrates properly. The body metabolizes fat instead to get the energy it needs to keep functioning.

Ketones in urine can give an early indication of insufficient insulin in a person who has diabetes. Severe exercise, exposure to cold, and loss of carbohydrates, such as with frequent vomiting, can also increase fat metabolism, resulting in ketonuria.

5- [Bilirubin](http://labtestsonline.org/understanding/analytes/urinalysis/ui-exams/start/1#bili)

Normally Bilirubin is not present in the urine. Bilirubin is a waste product that is produced by the liver from the hemoglobin of destroyed RBCs.

The presence of bilirubin in urine is an early indicator of liver diseases such as [jaundice](http://labtestsonline.org/understanding/conditions/jaundice) .

6- [Urobilinogen](http://labtestsonline.org/understanding/analytes/urinalysis/ui-exams/start/1#uro)

Normally Urobilinogen is present in urine in low concentrations.

It is formed in the intestine from bilirubin, and a portion of it is absorbed back into the bloodstream. Positive test results help detect liver diseases such as hepatitis and [cirrhosis](http://labtestsonline.org/understanding/conditions/cirrhosis/) and conditions of increased RBC destruction ([hemolytic anemia](http://labtestsonline.org/understanding/conditions/anemia?start=4)).

7- Bile pigments

Normally absent. Present in liver disorders.

8- Bile salts

Normally absent. Present in liver disorders.

Microscopic examination

1- [RBCs](http://labtestsonline.org/understanding/analytes/urinalysis/ui-exams/start/1#blood)

Normally small number of RBCs present in urine, the presence of RBCs in the urine known as **hematuria**, and indicate a problem, such as a disease of the kidney or urinary tract, trauma, medications, smoking, or intense exercise (e.g., running a marathon).

**2- WBCs**

A high number of white blood cells in the urine indicate inflammation of the kidneys or urinary tract.

**3- Epithelial Cells**

In healthy individuals, epithelial cells are normally present in the urine in small amounts.  However, the amount of epithelial cells in the urine increases when someone has a urinary tract infection.

**The presence of squamous epithelial cells may indicate contamination of the urine specimen.**

**4- Casts**

|  |  |
| --- | --- |
| Common clinical situations | Type of cast |
| Normal health, fever, exercise renal disease | Hyaline |
| Glomerular disease, tubular disease, pyelonephritis, viral infections | Granular |
| Advanced renal failure | Waxy |
| Nephrotic syndrome | Fatty |
| Glomerulonephritis, tubulointerstitial | Red blood cell |
| Pyelonephritis, glomerulonephritis | White blood cell |
| Acute tubular injury/necrosis, glomerulonephritis | Epithelial cell |

**5- Crystals**

Crystals typically found in acidic urine are:

1. Calcium oxalate
2. uric acid
3. Amorphous urate.

Crystals typically found in alkaline urine are:

1- Calcium phosphate

2- Amorphous phosphate

3- Ammonium magnesium phosphate (struvite)

Microorganism

1- Bacteria

2- Parasites

3- Fungi