

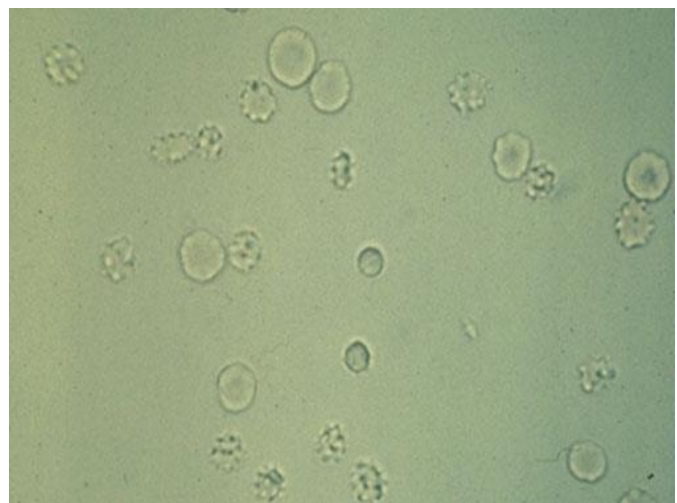
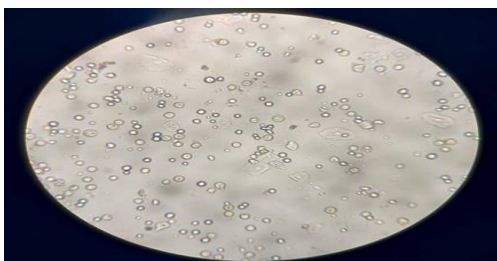
**Microscopic Examination of Urine**

- A sample of well-mixed urine (usually 10-15 ml) is centrifuged in a test tube at relatively low speed (**about 2-3,000 rpm**) for **5-10 minutes**, the supernatant is decanted and a volume of 0.2 to 0.5 ml is left inside the tube. The sediment is re-suspended in the remaining supernatant by flicking the bottom of the tube several times. A drop of suspended sediment is poured onto a glass slide and cover slipped

The sediment is first examined under **low power** to identify most crystals, casts, squamous cells, and other large objects. The various types of cells are usually described as the number of each type found per average high-power field (HPF). Example: 1-5 WBC/HPF. Count in at least 10 high power fields for cells and express the average as the number of cells per high power field.

**1- Red Blood Cells**

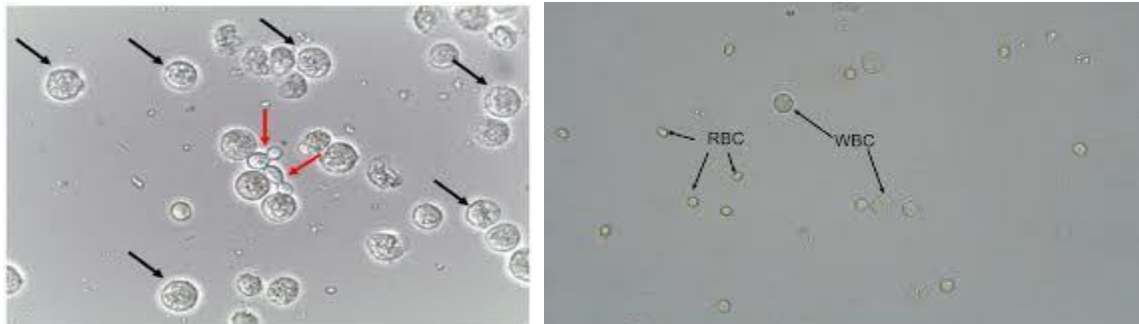
Under high power they appear as **pale discs**. If the specimen is stale, because of dissolution of haemoglobin, these cells will appear as ghost cells. These red cells may show crenated margins. Hematuria is the presence of abnormal numbers of red cells in urine due to: glomerular damage, kidney trauma, urinary tract stones, upper and lower urinary tract infections, nephrotoxins. RBCs may be confused with oil droplets or yeast cells. Oil droplets are variable in size and are refractile.



## 2- White Blood Cells

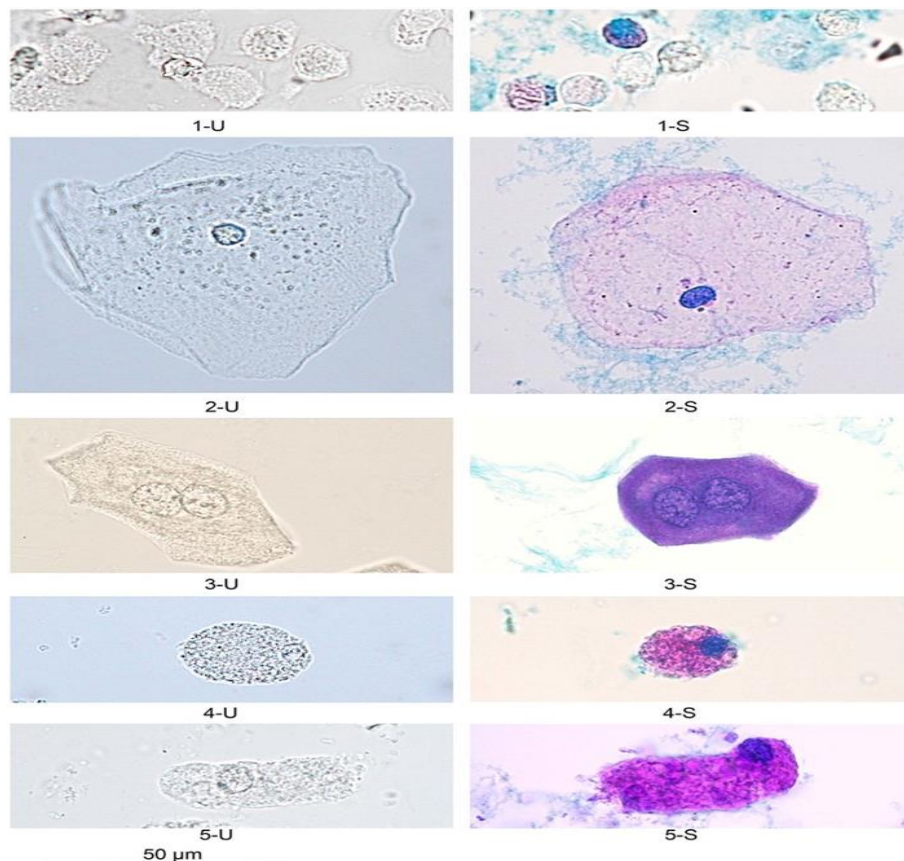
Unstained neutrophilic leucocytes appear as round granular  $12\ \mu$  spheres, larger than RBC.

Pyuria refers to the presence of abnormal numbers of leukocytes that may appear with infection in either the upper or lower urinary tract or with acute glomerulonephritis.



## 3- Epithelial Cells

Renal tubular epithelial cells, usually larger than granulocytes, contain a **large round or oval nucleus** and normally slough into the urine in small numbers.



#### 4- Casts

They are **solid and cylindrical** structures formed by precipitation of debris in the renal tubules. **Urinary casts** are formed only in the distal convoluted tubule (DCT) or the collecting duct (distal nephron).

**Hyaline casts** are composed primarily of a mucoprotein secreted by tubule cells, primarily composed of a **transparent, colorless**, homogenous protein known as **Tamm-Horsfall protein**, which is a normal constituent of urine. Hyaline casts are **cylindrical** in shape, with rounded ends, and they may appear as if they are made of a clear, glass-like material.

**Granular Casts** are a type of **cellular or proteinaceous** structure, sometimes referred to as “granular casts” or “coarse granular casts.” These casts are significant findings when analyzing urine samples, as they can provide valuable information about the underlying health of the kidneys or other parts of the urinary system

**RBCs casts** are formed when RBCs stick together and in glomerular disease.

**WBCs casts** are seen in acute pyelonephritis and glomerulonephritis.

**Granular and waxy casts** are seen in nephrotic syndrome.

**Fatty casts** also known as **lipid casts or fat casts**, characterized by the presence of **lipid or fat droplets** within them. Fatty casts are typically considered abnormal findings in urine and can be indicative of certain medical conditions.

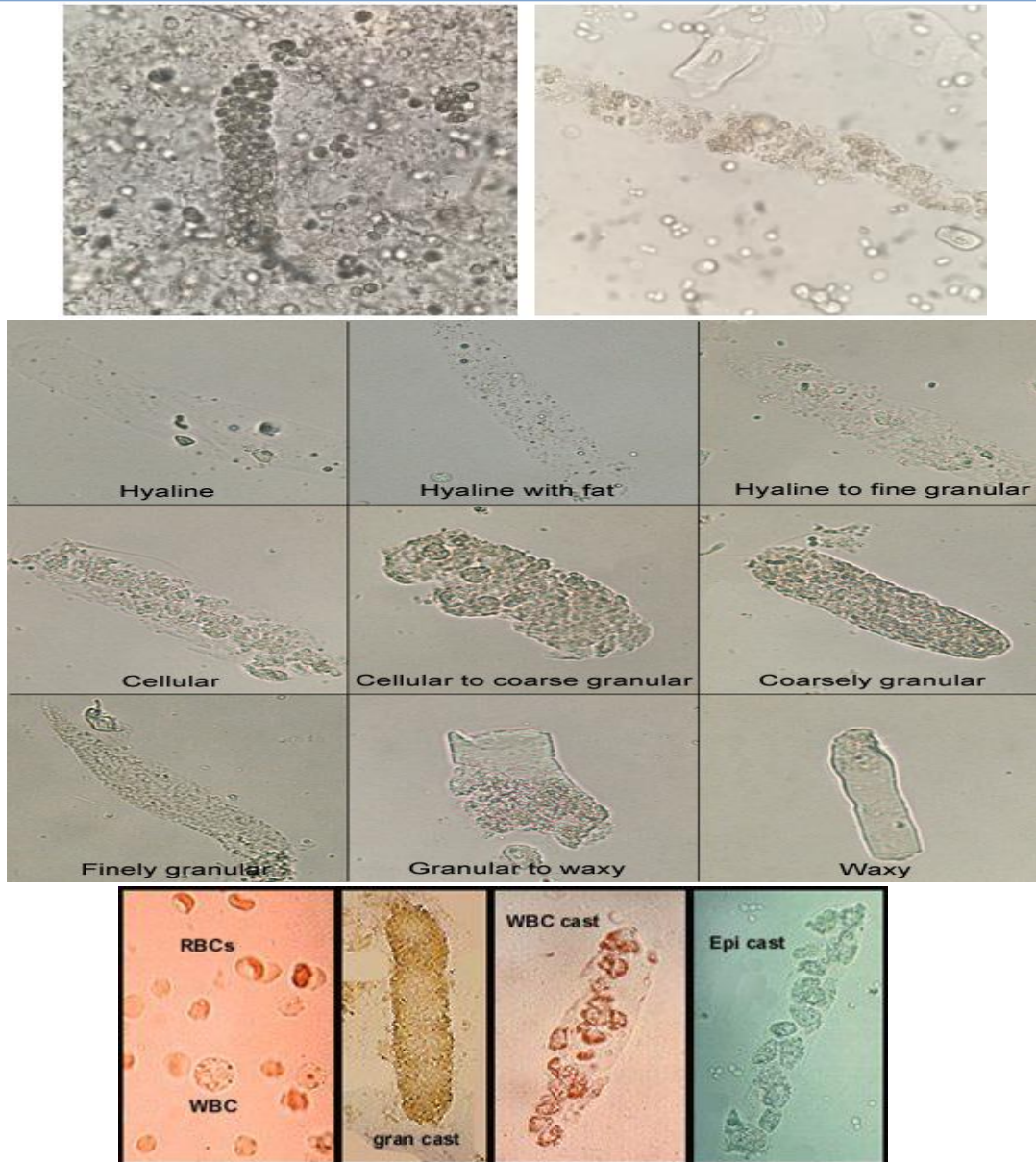


*Hyaline Cast*



*Lipid cast*

## CLINICAL ANALYSIS

**5- Bacteria**

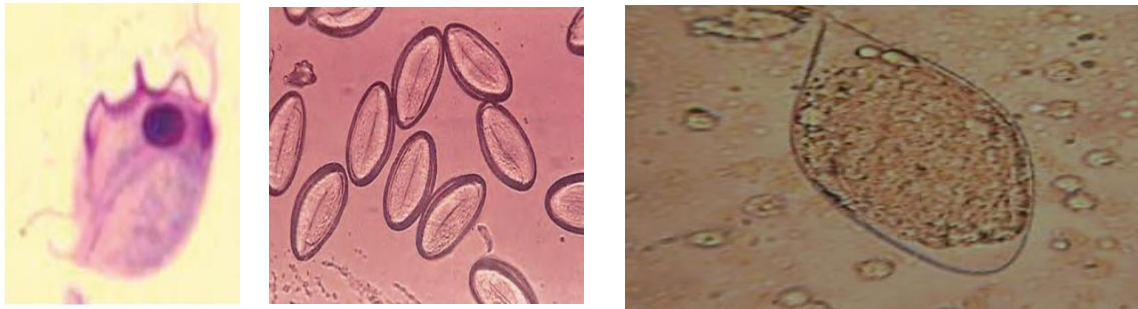
Bacteria are common in urine specimens because of the abundant normal microbial flora of the vagina or external urethral and because of their ability to rapidly multiply in urine standing at room temperature. Either cocci or bacilli.

**6- Yeast & Parasite**

Yeast cells may be contaminants or represent a true yeast infection. They are often difficult to distinguish from red cells and amorphous crystals but are distinguished by **their tendency to bud**. Parasites can be seen: e.g., *Trichomonas vaginalis* (motile, flagellated). The ova of the bladder

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parasite *Schistosoma haematobium* will appear in the urine. Fecal contamination of a urine specimen can also result in the presence of ova from intestinal parasites in the urine sediment. The most common contaminant is ova from the pinworm *Enterobius vermicularis*.



## 8- Crystals

Common crystals seen even in healthy patients include:

### a- Crystals Seen in Normal Acid Urine

- 1- **Amorphous urates**: yellow-red granules.
- 2- **Uric acid**: yellow or red-brown irregular but usually whetstone crystals or rhomboids.

- 3- **Calcium oxalate**: refractile, octahedral "envelopes."

### b- Crystals Seen in Normal Alkaline Urine

- 1- **Amorphous phosphates**: fine precipitate.
- 2- **Triple phosphate**: colourless, three to six-sided prisms. Occasionally fern leaf.
- 3- **Ammonium biurate**: yellow brown spheres "thorn apple."
- 4- **Calcium phosphate**: stellate prisms.
- 5- **Calcium carbonate**: colourless spheres or dumbbells, tiny.

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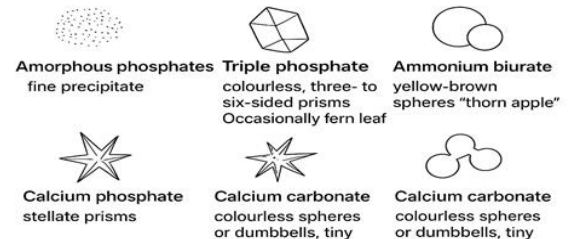
### c- Crystals seen in Abnormal Urine

- 1- **Cystine**: colourless, refractile, hexagonal plate.

#### Crystals Seen in a Healthy Patients



#### Crystals Seen in Normal Alkaline Urine



#### Crystals Seen in Abnormal Urine



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**2-Tyrosine:** fine needles arranged in sheaves or clumps, usually yellow, silky.

**3-Leucine:** yellow, oily appearing spheres with radial and concentric striations.

**4-Sulphonamide crystals** (sulphadiazine); yellow-brown asymmetrical, striated sheaves, and round forms with radial striations.

Cholesterol appears as flat notched plates in acid urine.

### 9- Spermatozoa

Spermatozoa are easily identified in the urine sediment by their **oval, slightly tapered heads and long, flagella-like tails.**

Urine is toxic to spermatozoa; therefore, they rarely exhibit the motility observed when examining a semen specimen.



Spermatozoa are occasionally found in the urine of both men and women following sexual intercourse.

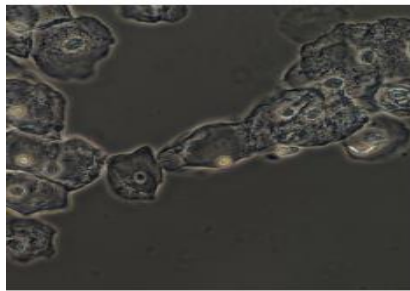
### Urine storage

-The urine sample must be collected in a clean, dry container and should be examined when freshly voided or within (1 hour), if cannot be examined through this time the sample must be refrigerated. If the sample is delayed to examined:

- 1) Red cells, leukocytes and casts decompose with time.
- 2) Bilirubin and urobilinogen will decrease especially with exposure to light.
- 3) The normal urine becomes alkaline on standing because of the conversion of urea to ammonia by bacterial action.
- 4) Changes in color caused by oxidation or reduction of metabolites

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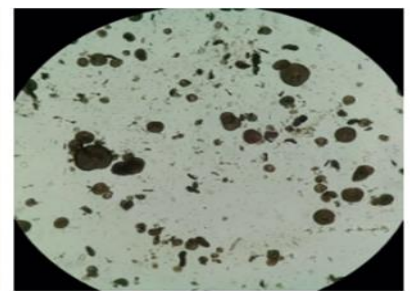
5) Increased turbidity caused by bacterial growth and precipitation of amorphous material.



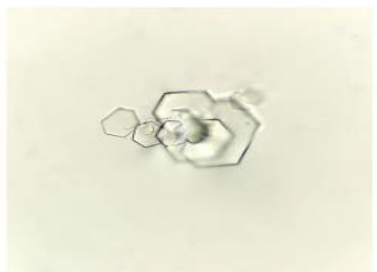
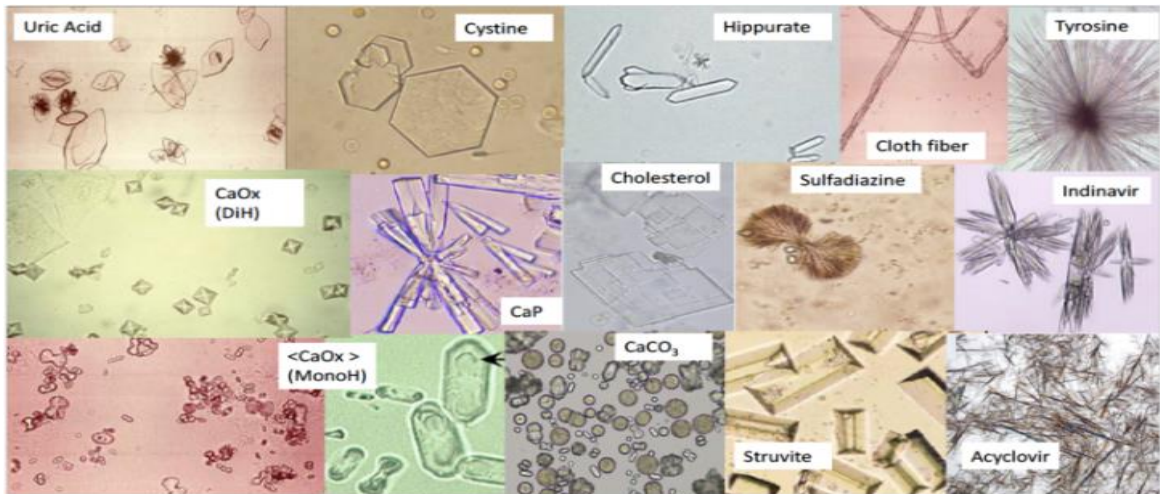
Squamous Epi Cells



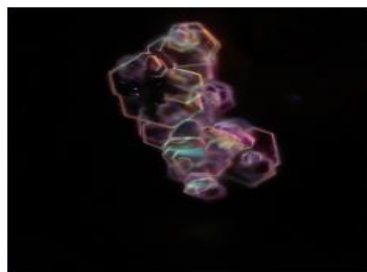
Leucine Crystal



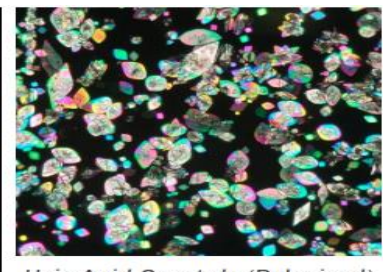
Sulfadiazine Crystals



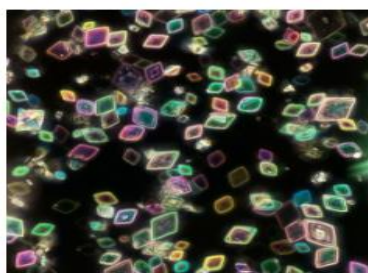
Cystine crystals (Brightfield)



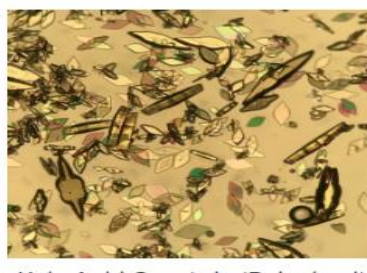
Cystine crystals (Darkfield)



Uric Acid Crystals (Polarized)



Uric Acid Crystals (Polarized)

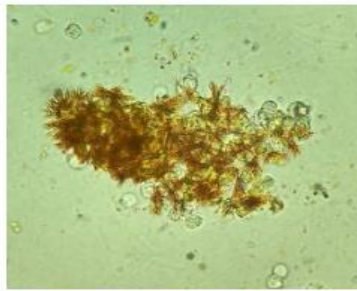


Uric Acid Crystals (Polarized)



Cholesterol Crystals

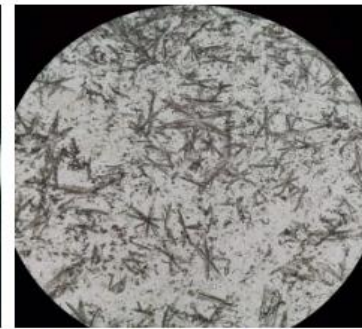
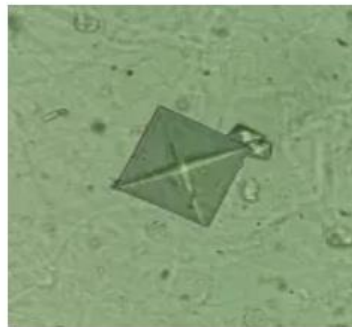
## CLINICAL ANALYSIS



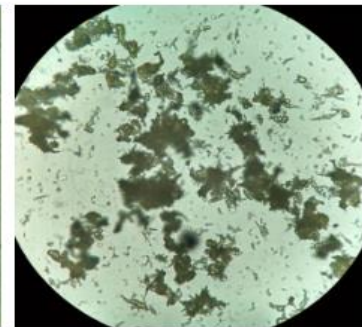
Bilirubin Crystals



Triple Phosphate Crystals

Triple Phosphate Crystals  
(Less Common)Calcium Oxalate  
(Monohydrate)

Calcium Oxalate (Dihydrate)



Ammonium Urate Crystals

**Urine Culture**

The urine culture is used, along with results from a urinalysis, to diagnose a **UTI and identify the bacteria or yeasts causing the infection**. If a urine culture is positive, susceptibility testing may be done to determine which antibiotics will inhibit the growth of the microbe causing the infection.

Primary Media for culture urine sample is **Blood agar** (for both Gram positive and Gram- negative bacteria in addition to Candida sp.) and **MacConkey agar** (Selective for Gram-negative bacteria). Depending to WHO the methods of streaking urine sample called **Cross- Streaking Method**. Touch the loop initially in the center of the plate, and then spread the inoculum in a line across the diameter of the plate

