

### General Urine Examination (GUE)

#### Type of urine sample

- Random urine specimen
- First morning urine specimen
- 24-hour urine specimen



Urinalysis consists of the following measurements:

#### ➤ Macroscopic or physical examination

- Volume
- Color
- Odour

-The first part of a urinalysis is direct visual observation.

-Normal, fresh urine is pale to dark yellow or amber in color and clear.

-Normal urine volume is 750 to 2000 ml/24hr.

-Turbidity or cloudiness may be caused by excessive cellular material or protein in the urine.

-A red or red-brown (abnormal) color could be from a food dye, a drug, or the presence of hemoglobin.

-If the sample contained many red blood cells, it would be cloudy as well as red.

<u>Physical Examination</u>	
Collection	Random
Volume	Sample
Colour	Yellow
Odour	Aromatic
Aspect	Clear
Deposit	Nil

➤ Chemical examination

**Chemical Examination**

Reaction	Acidic
Sp .Gravity	1020
Proteins ( Albumin )	Nil
Glucose	Nil
Ketone Bodies	Nil
Urobilinogen	Trace
Bilirubin	Nil
Nitrite	Negative



**1 -pH :** Urinary pH may range from as low as 4.5 to as high as 8.0.

**2 - Specific gravity :** between 1.002 and 1.035 on a random sample should be considered normal if kidney function is normal.

- Any measurement below this range indicates hydration and any measurement above it indicates relative dehydration

**3 -Protein** : Dipstick screening for protein is done on whole urine. A small amount of filtered plasma proteins and protein secreted by the nephron (mucoprotein) (Tamm-Horsfall protein) can be found in normal urine.

**4 -Glucose** : Nearly all glucose filtered by the glomeruli is reabsorbed in the proximal tubules and only undetectable amounts appear in urine in healthy patients.

Above renal threshold (10 mmol/L) glucose will appear in urine. Glycosuria (excess sugar in urine) generally means diabetes mellitus (DM).

**5 -Ketones** : Ketones (acetone, acetoacetic acid, beta-hydroxybutyric acid) resulting from either diabetic ketoacidosis or some other form of caloric deprivation (starvation), are easily detected using either dipsticks or test tablets containing sodium nitroprusside.

**6 -Nitrite** : This test relies on the breakdown of urinary nitrates to nitrites, which are not found in normal urine. Many Gram-negative and some Gram-positive bacteria are capable of producing this reaction and a positive test suggests their presence in significant numbers (ie more than 10,000 per ml). A negative result does not rule out a UTI.

➤ **Microscopic examination of the sediment**

<b>Microscopic Examination</b>	
Epithelial Cells	Nil
Red Blood Cells	2-3 /HPF
Pus Cells	3-4 /HPF
Crystals	*A.Urate+1*
Ova & Parasites	Nil
Casts	Nil
Bacteruria	Nil

## **Microscopic Urinalysis**

### **Methodology**

- 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 until a moderately cohesive button is produced at the bottom of the tube.
- 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 resuspended sediment is poured onto a glass slide and cover slipped

### **Examination**

The sediment is first examined under low power to identify most crystals, casts, squamous cells, and other large objects. The numbers of casts seen are usually reported as number of each type found per low power field (LPF). Example: 5-10 hyaline casts/LPF.

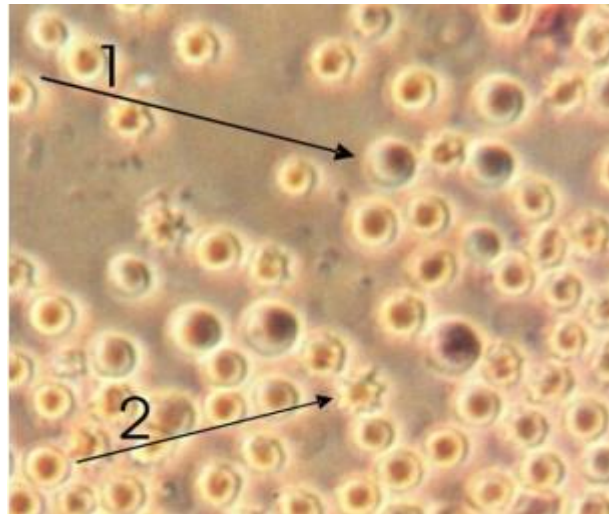
Next, examination is carried out at high power to identify crystals, cells, and bacteria. The various types of cells are usually described as the number of each type found per average high power field (HPF). Example: 1-5 WBC/HPF .

### **1 -Red Blood Cells**

Hematuria is the presence of abnormal numbers of red cells in urine due to:

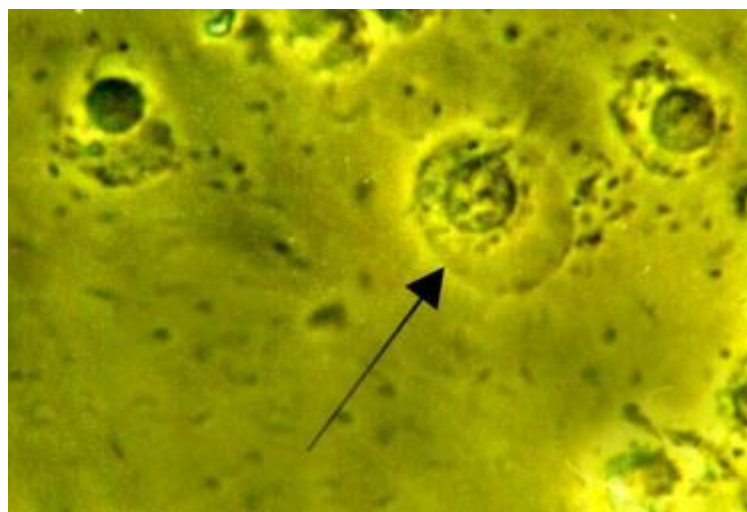
- glomerular damage.
- kidney trauma.
- urinary tract stones.
- upper and lower urinary tract infections.
- nephrotoxins.
- physical stress.

- Red cells may also contaminate the urine from the vagina in menstruating women.



## 2 -White Blood Cells

- 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.
- Usually, the WBC's are granulocytes. White cells from the vagina, especially in the presence of vaginal and cervical infections.
- If two or more leukocytes per each high power field appear in non-contaminated urine, the specimen is probably abnormal.
- Leukocytes have lobed nuclei and granular cytoplasm.

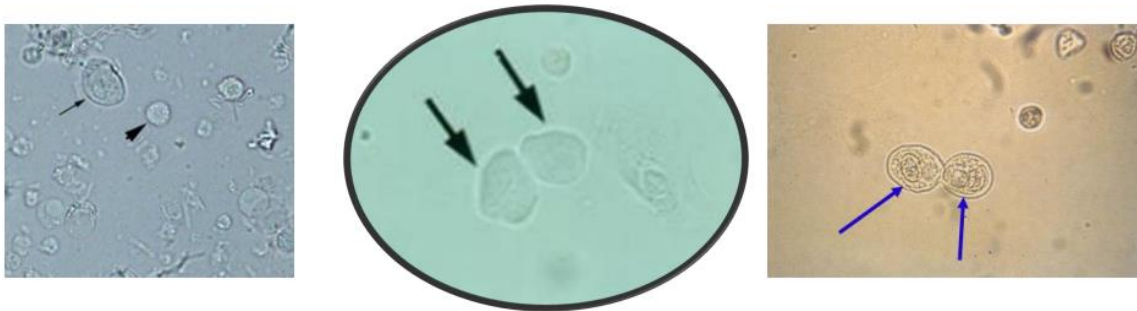




### 3 -Epithelial Cells

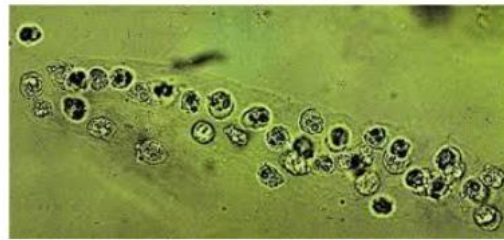
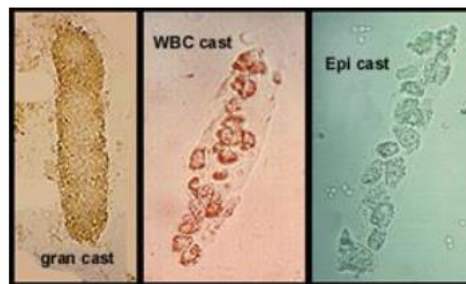
Renal tubular epithelial cells, usually larger than granulocytes, contain a large round or oval nucleus and normally slough into the urine in small numbers.

However, with nephrotic syndrome and in conditions leading to tubular degeneration, the number sloughed is increased.



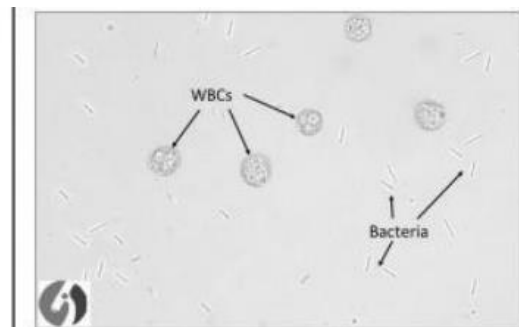
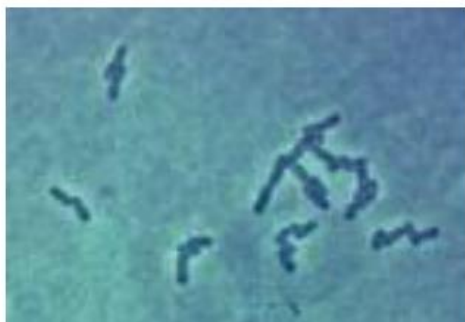
### 4 -Casts

- 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). The proximal convoluted tubule (PCT) and loop of Henle are not locations for cast formation.
- Hyaline casts are composed primarily of a mucoprotein secreted by tubule cells, hyalin cast are seen in healthy individuals.
- 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.



### 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.
- Therefore, microbial organisms found in all but the most carefully collected urines should be interpreted in view of clinical symptoms.



### 6 -Yeast

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. Most often they are Candida, which may colonize bladder, urethra, or vagina .

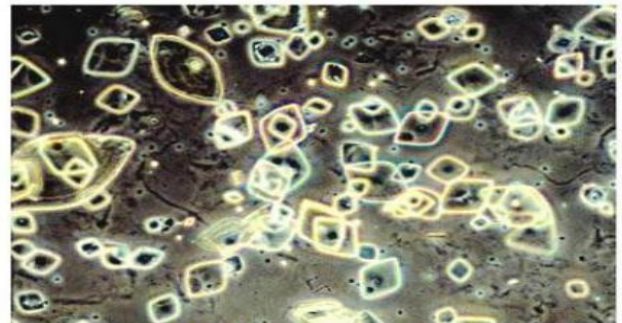


### 7 - Crystals

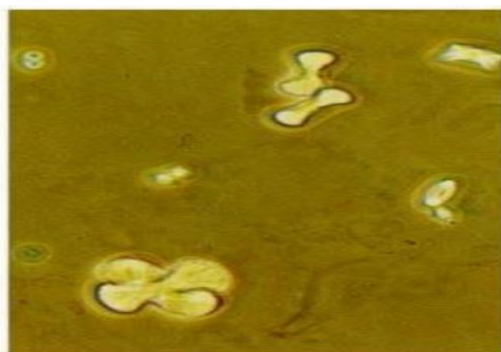
Common crystals seen even in healthy patients include calcium oxalate, triple phosphate crystals and amorphous phosphates.



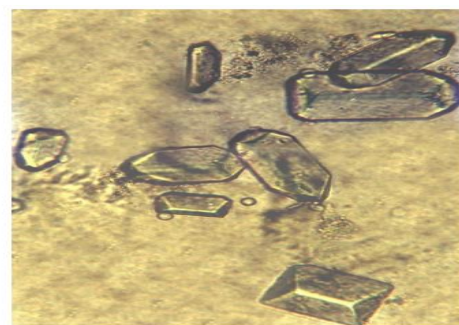
Calcium oxalate



Uric Acid



Calcium oxalate (monohydrate)



Amonium megnesium (triple phosphate)



Urin C/S



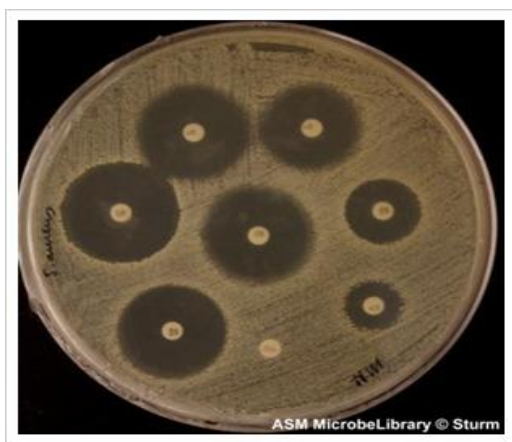
Blood Agar

Macconkey Agar





Mueller Agar



<i>Antibiotic</i>	short	Result	
Streptomycin	S	S	+++
Ciprofloxacin	CIP	S	++
Amikacin	AK	S	++
Vancomycin	VA	S	++
Gentamicin	CN	S	++
Meropenem	MEM	S	++
Colistin	CT	S	++
Amoxiclin	AML	R	
Tobranycin	TOB	R	
Ticarcillin	TIC	R	
Piperacillin / Tazobactam	TPZ	R	

Information		Status: Final	Analysis Time: 14.03 hours			
Antimicrobial	MIC	Interpretation	Antimicrobial	MIC	Interpretation	
Cefoxitin Screen	POS	+	Teicoplanin	4	S	
Benzylpenicillin	$\geq 0.5$	R	Vancomycin	2	S	
Oxacillin	$\geq 4$	R	Tetracycline	2	*R	
Gentamicin	$\leq 0.5$	S	Tigecycline	$\leq 0.12$	S	
Tobramycin	$\leq 1$	S	Fosfomicin			
Levofloxacin	$\leq 0.12$	S	Nitrofurantoin	$\leq 16$	S	
Moxifloxacin	$\leq 0.25$	S	Fusidic Acid	$\geq 32$	R	
Inducible Clindamycin Resistance	NEG	-	Mupirocin			
Erythromycin	$\geq 8$	R	Rifampicin	$\leq 0.5$	S	
Clindamycin	$\leq 0.25$	S	Trimethoprim/ Sulfamethoxazole	$\leq 10$	S	
Linezolid	1	S				