

● SHEET NO. 1

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Urinalysis

What is urinalysis?

A Test of 2 parts: Dipstick part (when urine reacts with certain factors) and Microscopy part.

➔ Let's take a look into the normal and abnormal urinalysis:

Dipstick test (visual or automated)

	Normal	Abnormal
Blood	Negative	Trace to large
Ketones	Negative	Any ketones
Glucose	Negative	Any glucose
Protein	Negative or trace	0.3 g/L to 20 g/L
pH	5-8	less than 5 or higher than 8

Microscopy test

	Normal	Abnormal
Cells	Rare red cells (1-3), ONLY RBCs is allowed to be seen	More RBCs, WBCs, yeas... etc
Casts	Hyaline	Granular, RBC, WBC, hemogranular and lipid
Crystals	Calcium oxalate	Urate, cysteine, triple phosphate, drugs

✎ Also, abnormally you might see oval fat bodies, lipid droplets and debris (ATN) in the microscopy test.

Now, we will take a look at some examples (cells, casts crystals and others) of what you might see while you are doing the microscopy test:

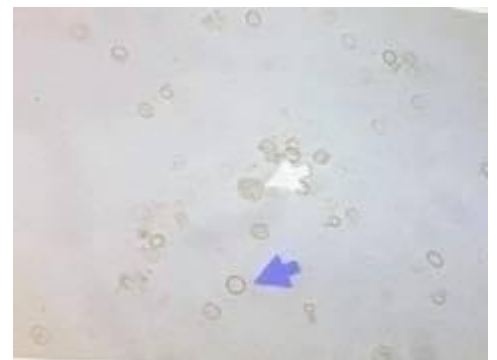
1) Cells:

A) RBCs

Blue arrow: circular, no nucleus and biconcave which means this is normal RBC.

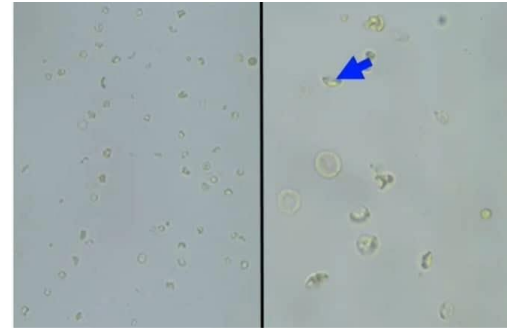


Please don't be confused, the RBC itself is normal BUT its existence in the urine is abnormal (its due to kidney stones for example).



B) Dysmorphic RBCs

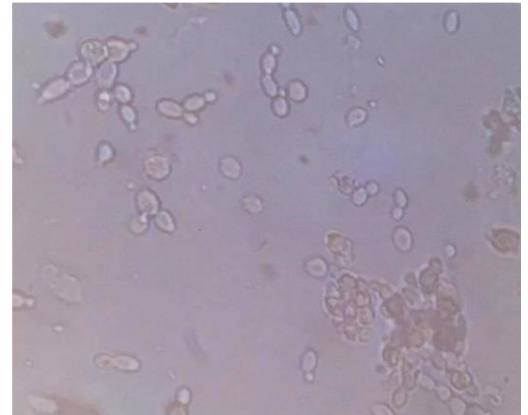
Typical of glomerular disease



C) Yeasts

This microorganism can cause serious UTI in immunosuppressed patients, so if you see it under the microscope, you should make sure that your patient is immunocompetent.

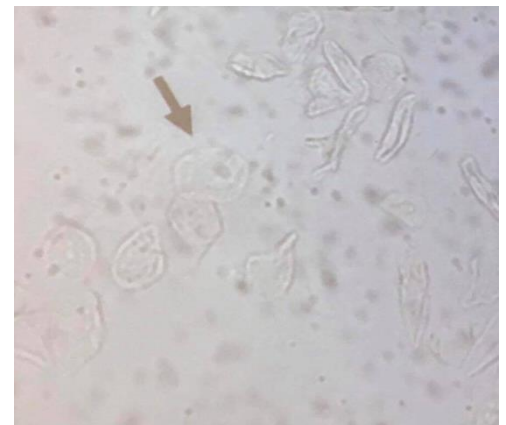
We can see some normal RBCs here too



D) Squamous cells

Large cells (due to large cytoplasm) and very distinct nucleus which is the shape of a squamous cell.

We might allow 1 or 2 squamous cells, but in the picture the urine is full of them which leads us to think of squamous cell carcinoma in the urethra for example.



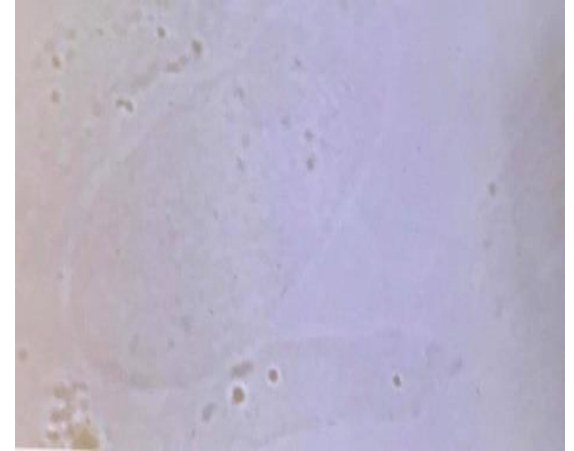
2) Casts:

A) Hyaline cast (acellular cast)

Note: Cast: قالب

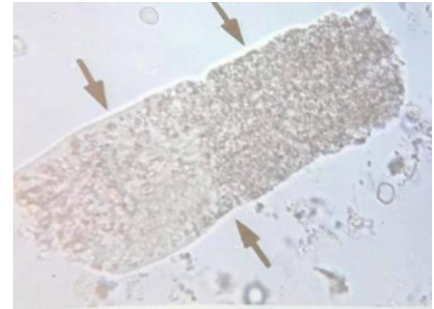
The name of this قالب depends on what is inside it.

- It is called Hyaline cast because it has hyaline inside (**Tamm-Horsfall protein**).
- **Q: How is it formed and seen in the urine?**
- A: Normally, this hyaline material is flushed out with urine BUT in certain conditions (dehydration for example).. there is less excretion of urine which will cause hyaline to aggregate forming a hyaline cast which we can see in urinalysis.
- Can be normal in certain conditions, so it is not really pathological (Ex. Fever, dehydration or pregnant).



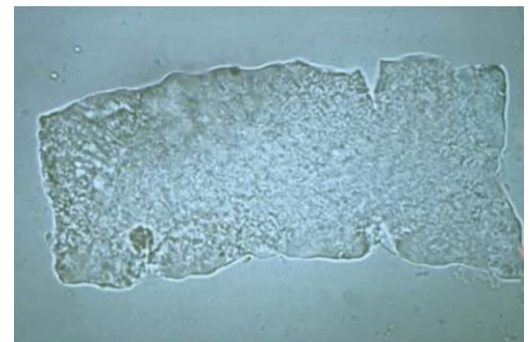
B) Granular cast (acellular cast)

- We have granules instead of cells.
- ALWAYS abnormal.
- Totally non-specific (so you know this patient has some sort of abnormality, but you will need more tests to specify it).
- You might see RBCs or WBCs around the granular cast.



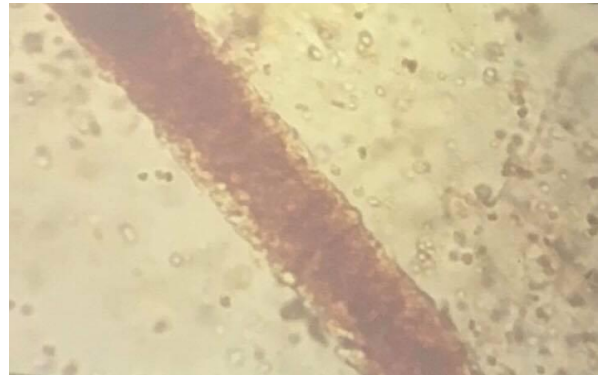
C) Waxy (acellular cast)

- It is originally a hyaline cast, but when you have prolonged decrease in the GFR or urine output.. the material becomes hard like a wax.
- Can be seen in patients with advanced kidney disease



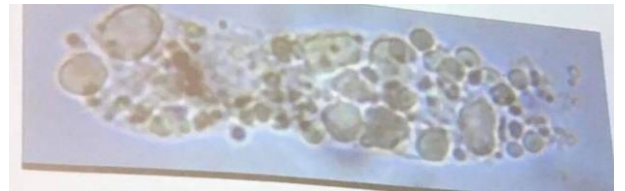
D) Heme Granular Cast (acellular cast)

- We will see it in most of our patients inshAllah.
- Very common to be seen in patients having:
 1. ATN (most common)
 2. Proliferative or necrotizing GN
- Always indicates we are having some sort of tubular injury.
- This brownish color is due to massive number of broken RBCs (the hemosiderin accumulated in the cast giving it this color).
- This background is called "Dirty background" because we are having a lot of debris, RBCs and other cells secondary to acute kidney injury.



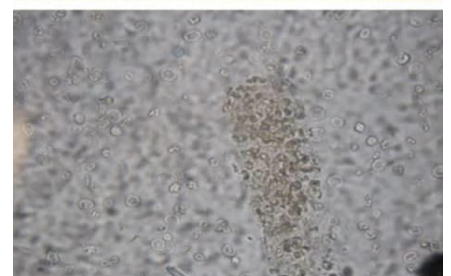
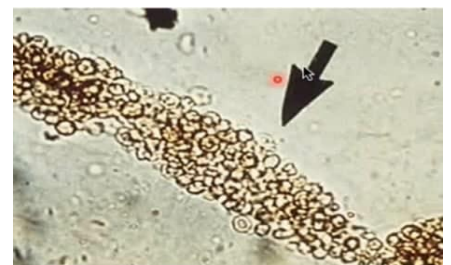
E) Lipid cast (acellular cast)

- Its content isn't cells (why? the sizes of each is different from the other + no nucleus)
- Under the microscope, it will be shining (light reflecting)
- **Q: How is it formed?**
- A: In nephrotic syndrome, there is heavy proteinuria. As a result, the liver will start synthesizing more proteins (and more lipids ☺).
- ➔ This will cause more releasing of lipids into our system which will cause some sort of dyslipidemia, so more lipids will be filtered and released in urine in the form of lipid casts.



F) RBC (cellular cast)

- Aggregation of RBCs (so it is cellular cast)
- **Mostly seen in aggressive proliferative or necrotizing GN, PSGN, proliferative lupus, IgAn, ANCA and vasculitis**

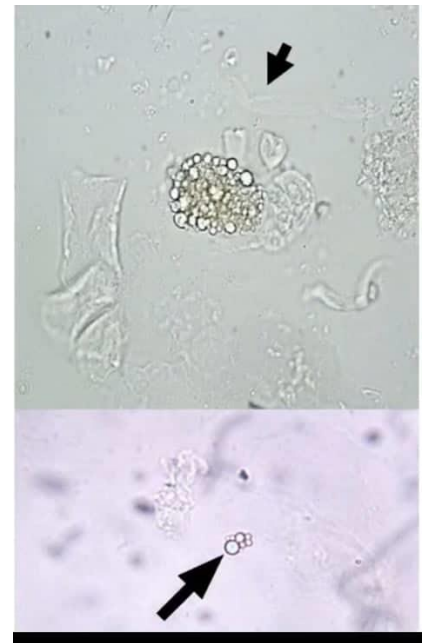


"تارة تشرق شمس أوصافه على ليل وجودك، وتارة يقبض ذلك عنك فيردك إلى حدودك، فالنهار ليس منك إليه، ولكنه وارد عليك"

3) Others:

A) Oval Fat Body, Lipid droplets

- If the lipids droplets formed a sphere it is called oval fat body (If it formed a cast, it's a lipid cast)
- Small droplets of oil
- Shining under the microscope
- The patient is having heavy proteinuria (most probably nephrotic syndrome)



B) Bacteria

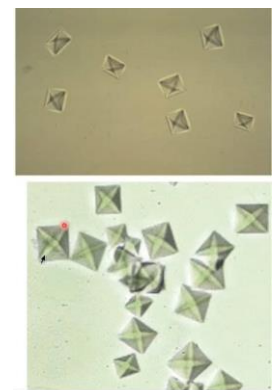
- If the sample is not centrifuged and full of bacteria, it is ALWAYS abnormal.
- In the adjacent picture, we have bacillus (most commonly UTI).
- Next step is to think which bacilli might infect your patient depending on his age group, risk factors.. etc.
- You start antibiotics probably before the culture results comes out



4) Crystals:

A) Calcium oxalate

- Seen in normal urine BUT if it was numerous, you should suspect metabolic disorder or ethylene glycol poisoning (used as anti-freeze in cars).



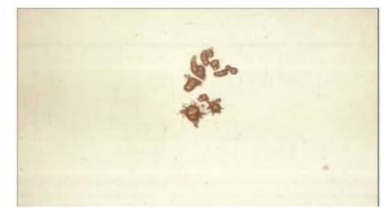
B) Uric acid crystals



Sodium urate



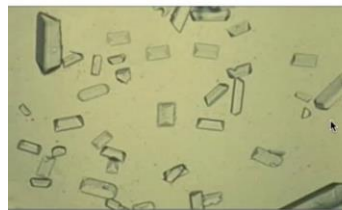
Uric acid



Ammonium biurate

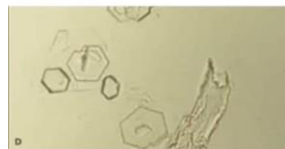
C) Other abnormal crystals

-Triple phosphate crystals are usually seen in chronic UTI infection with a urea splitting bacteria (Proteus or Klebsiella).

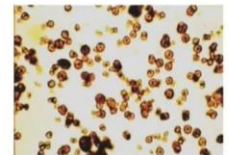


Triple phosphate: seen with chronic UTI (coffin lid)

-The mode of inheritance of the genetic disorder causing cysteine crystals is autosomal recessive (AR)



Cysteine: rare – AR genetic disorder of children, teens; cause of stones



2,8-dihydroxyadenine (DHAP): extremely rare

5) Others like mucous or sperms in males

- Although urinalysis is a simple test, it's very important in decision making about the diagnosis
- RBC casts lead us toward GN.
- WBC casts lead us toward pyelonephritis or glomerulitis disease in general.
- Lipid casts lead us toward nephrotic syndrome
- In general, urinalysis is really useful in cases of hematuria and acute kidney injury





❖ Case 1:

A **23 years** old male, previously healthy, complaining of right loin pain of 2 days duration and noticed blood in the urine. What is your next step?

Answer: We will do 3 steps:

- 1) Very detailed history
- 2) Physical examination
- 3) Investigation (the best investigation in this case is doing urinalysis)

You did a urinalysis and the results came out as the following:

- 1) Nil protein (no protein)
- 2) Nil sugar (no sugar)
- 3) 10-20 RBCs
- 4) WBCs 4-5.

Ok, we saw the urinalysis results. What's next ?

Answer: This will depend on the clinical presentation, most likely the diagnosis of a patient of this age group is kidney stones (we can confirm this diagnosis by imaging).

Our conclusion:

The most common cause of hematuria in this age group is kidney stones.

❖ Case 2:

A **66 years** old male, previously healthy, complaining of right loin pain of 2 days duration and noticed blood in the urine. What is your next step?

Answer: We will do 3 steps:

- 1) Very detailed history
- 2) Physical examination
- 3) Investigation (the best investigation in this case is doing urinalysis)

You did a urinalysis and the results came out as the following:

- 1) Nil protein (no protein)

2) Nil sugar (no sugar)

3) 10-20 RBCs

4) WBCs 4-5.

Diagnosis: based on his age group, we might think of renal cell carcinoma.

Our conclusion:

The most common cause of hematuria in this age group is renal cell carcinoma.

❖ Case 3:

A 30 years old male, previously healthy, has noticed blood in the urine. What is your next step?

Answer: You did a urinalysis and the results came out as the following:

1) +2 protein (this means significant amount of protein in the urine)

2) Nil sugar (no sugar)

3) 10-20 RBCs

4) 4-5 WBCs.

Diagnosis: based on his age group, we might think of glomerulonephritis.

Why glomerulonephritis ?

Answer: The key is proteinuria. Proteinuria only happens when there is a defect in the filtration barrier.

Our conclusion:

The most common cause of proteinuria in this age group is glomerulonephritis.

❖ Case 4:

A 30 years old male, previously healthy, complains of sudden severe left loin pain, then after that he noticed blood in the urine.

You did a urinalysis and the results came out as the following:

1) +3 protein (heavy proteinuria)

- 2) Nil sugar (no sugar)
- 3) 10-20 RBCs
- 4) 4-5 WBCs.

What is the first idea that should come to your mind in this scenario ?

Answer: Renal infarction or renal vein thrombosis usually after heavy nephrotic syndrome.

Our conclusion:

When the patient complains of sudden severe pain, we should think of thrombosis.

❖ Case 5:

A 30 years old male, previously healthy, had history of diarrhea and was treated with metronidazole, then after that he noticed blood in the urine.

You did a urinalysis and the results came out as the following:

- 1) Nil protein (no protein)
- 2) Nil sugar (no sugar)
- 3) 1-2 RBCs
- 4) 1-2 WBCs.

Diagnosis: Most likely related to metronidazole intake (We didn't think of infectious cause since RBCs and WBCs numbers are TOTALLY normal).

Our conclusion: Metronidazole changes the color of body secretions into red or orange (urine, saliva and tears.. etc).

❖ Case 6:

A 70 years old male presented to the clinic with painless attacks of bloody urine and urgency with feeling of hotness.

His urinalysis showed:

- 1) Nil sugar
- 2) +1 protein (we might find it in normal or abnormal cases so this result gives us nothing toward the diagnosis)
- 3) 10-15 RBCs
- 4) 20-25 WBCs (this is significant)

Diagnosis: Most likely UTI by looking at his age, hotness and urgency.

Our conclusion: Hotness, urgency and high WBCs leads us to think about UTI like cystitis.

❖ Case 7:

A 70 years old male presented to the clinic with painless attacks of bloody urine, and history of passing clots (passing clots means he is having heavy hematuria).

His urinalysis showed numerous RBCs, 8-10 WBCs, and numerous epithelial and transitional cells.

Diagnosis: We should think of (Transitional Cell Carcinoma) based on his age and the existence of epithelial and transitional cells in urine.

Our conclusion: Having epithelial and transitional cells in urine with heavy hematuria in an elder patient leads us toward Transitional Cell Carcinoma.

❖ Case 8:

A 70 years old male presented to the clinic with painless attacks of bloody urine, and history of passing clots.

You have noticed while doing physical examination that his body was covered with dark red-black areas although he didn't mention having any trauma.

Diagnosis: He might be having a hematological disorder mainly with low platelets OR he uses a drug like warfarin.

❖ Case 9:

A 13 years old female came to the clinic with back pain which radiates to the groin and she mentioned having attacks of hematuria.

Her urinalysis showed only 8-10 RBCs.

She is a healthy young lady and doesn't take any drugs probably.

Diagnosis: This hematuria might be related to her menses, maybe this is her first presentation of menarche.

Our conclusion: Hematuria isn't always pathological, it might be related to normal conditions.

❖ Case 10:

A 30 years old lady came to the clinic with history of generalized pain, arthralgia and skin rash.

She noticed also bloody urine sometimes and new onset of swelling in the ankles.

Her urinalysis showed:

1) Nil sugar

2) +3 protein (massive amount)

3) 10-15 RBCs with casts

Diagnosis: (SLE) with lupus nephritis.

Our conclusion: when a young lady is coming to you with proteinuria and hematuria you should think of some sort of autoimmune diseases with arthralgia and rashes such as systemic lupus erythematosus (SLE) with lupus nephritis.

❖ Case 11:

A 70 years old lady came to the clinic with history of generalized pain, arthralgia and skin rash.

She noticed bloody urine sometimes and new onset of bloody cough.

Her urinalysis showed:

1) Nil sugar

2) +1 protein

3) 10-15 RBCs with casts

-In this age group you don't think of autoimmune diseases like SLE (SLE affects patients in their 30s and 40s).

Diagnosis: This lady probably have what we call Pulmonary Renal Syndrome (she is coughing blood + hematuria), BUT you will need to rule out the possibility of vasculitis.

Our conclusion:

When you have an old lady having bloody cough + hematuria, think of PRS or vasculitis.

❖ Case 12:

A 70 years old lady came to the clinic with history of generalized fatigue, polyuria and numbness in the tips of her fingers.

She noticed sometimes bloody urine and new onset of ankle swelling.

Her urinalysis showed:

1) +3 sugar (massive amount)

2) +2 protein (moderate or high)

3) 5-8 RBCs with no casts

Diagnosis: Diabetic nephropathy or uncontrolled diabetes.

Our conclusion: having sugar in the urine + proteinuria + generalized fatigue + polyuria will lead us toward something related to diabetes.

This sheet is over, ACTUALLY BASIC SHEETS ARE OVER (for systems at least 😊)

Our upcoming days will be much better inshAllah, wish you all the best 🤞)