Renal system

clinical introduction for Third year

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Modified by kotkot

OUTLINE:

- Give an introduction for renal system through clinically oriented cases.
- Briefly discuss urinalysis ,hematuria and proteinuria.

Every case has a different symptoms which tells you about its differential diagnosis

Case 1:

- 23 yrs old male , previously healthy, c/o Rt loin pain of 2 days duration and noticed blood in the urine.

what is your next step?

You have to make full examination

- You sent for him a urinalysis and it showed:

nill protein, nill sugar, RBCs 10-20, WBCs 4-5.

Nill Means nothing

what is next ?

(?case of kidney stones)

Case 2:

- 66 yrs. old male ,previously healthy, c/o Rt loin pain of 2 days duration and noticed blood in the urine.

what is your next step?

You sent for him a urinalysis and it showed:
Nil protein ,nil sugar,10-20 RBCS,WBCs 4-5
What's your next step

In this age you need to rule out Renal cell carcinoma

Case 3:

- 30 yrs old male previously healthy, he noticed blood in the urine.

your next step was to send a urinalysis for him.

⬆️protein -Suspect Glomerulonephritis

- Urinalysis showed:

  +2 protein , nil sugar , 10-20 RBCs, 4-5 WBCs.

  now what is next?

(?case of Glomerulonephritis)

Case 4:

- 30 yrs old male previously healthy, c/o sudden sever Lt loin pain ,then noticed blood in the urine.

Urinalysis:+3 protein , nil sugar , 10-20 RBCs, 4-5 WBCs)

What is next?(?Lt renal vein thrombosis)

Heavy ⬆️proteinuria —sudden sever loin pain -Suspect Left renal thrombosis

Case 5:

- 30 yrs. old male ,previously healthy , had diarrhea and treated with metronidazole noticed blood in the urine.

urinalysis showed : protein nil, sugar nil , RBCs 1-2 , WBCs 1-2 .

What is next?(Drug related red urine)

It's a **Red urine** and not true hematuria
-Suspect Drug related red urine

Case 6

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

his urinalysis showed no sugar ,+1 protein, 10-15 RBCs, and 20-25 WBCs.

(? UTI)

Typical UTI Symptoms

Case 7 :

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

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

(?transitional cell carcinoma of bladder)

A lot of RBCs + numerous transitions cells -think about TRANSITIONAL CELL CARCINOMA

Case 8:

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

His urinalysis showed numerous RBCs, 8-10 WBCs.

you noticed that his body was covered with some dark red-black areas that he can't remember any trauma at these sites.

(?low platelets, meds like warfarin)

Rule out presence of abnormal platelets wither it's about its number or its function
-It could be from drugs

Case 9 :

- 13 yrs old female came to the clinic with back pain which radiates to the groin and attacks of hematuria.

her urinalysis showed only 8-10 RBCs.

(?menses related)

Very young female ,back pain,only RBCs —her first menses

Case 10 :

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

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

her urinalysis showed nil sugar, +3 protein and 10-15 RBCs with casts.

(?SLE and lupus nephritis)

(Pain,arthralgia ,rash) —rule out GN due to presence of SLE

Case 11 :

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

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

her urinalysis showed nil sugar, +1 protein and 10-15 RBCs with casts.

(?vasculitis)

Elderly ,need to rule out vasculitis
(Suspected from the (RBCs ,+1 protein)

Case 12 :

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

She noticed bloody urine sometimes and new onset ankle swelling.

her urinalysis showed +3 sugar, +2 protein and 5-8 RBCs with no casts.

(?Diabetic nephropathy)

Polyuria ,numbness—Rule out diabetic nephropathy

Normal Urine

Dipstick:(visual or automated)

- Blood negative
- Ketones negative
- Glucose negative
- Protein negative or trace
- pH 5.0 to 8.0

Normally it should be negative for everything

Microscopy

High power field

- Cells: Rare red cells (<< 1/hpf); squamous cells
- CastsHyaline
- Crystals Calcium oxalate

It could be found normally

Abnormal urine

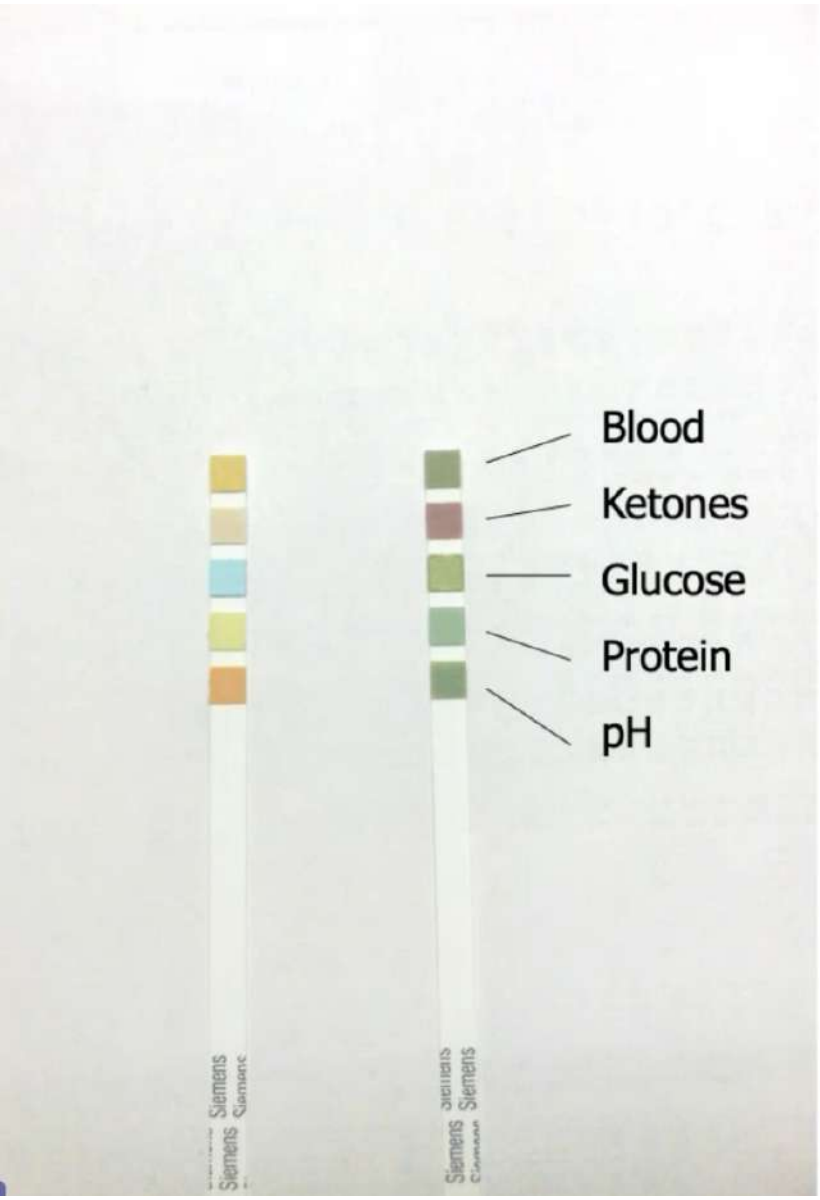
Dipstick

- Blood trace to large
- Protein 0.3 g/L to 20 g/L
- Glucose, ketones

Microscopy

- Cells: red, white, yeast
- Casts – granular, rbc, wbc, hemegranular, lipid
- Crystals: urate, cysteine, triple phosphate, drugs
- Other: oval fat bodies, lipid droplets, debris (ATN)

Compare the colour after removing the stick from the urine



Urine Dipstick

Normal and abnormal

Preparation for Microscopy

Typical: Obtain fresh urine You can't take it from **urine bag**

Spin 10-12 ml in centrifuge for 1-3 minutes

Discard supernatant

Shake residue – pour or pipette drop on slide – Always cover with coverslip

Examine on low then high power to identify cells and casts

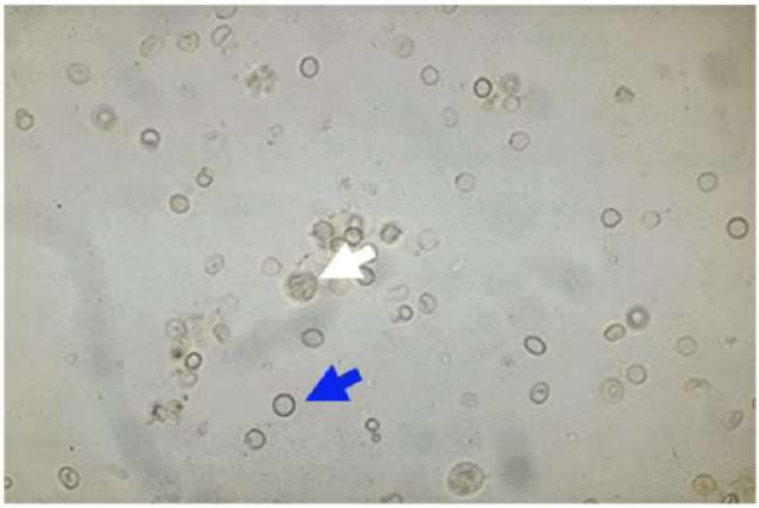
Preparation for Microscopy (2)

- If urine grossly bloody, or heavily sedimented:
- Examine Unspun and spun
- Spun sediment may be so thick that it is impossible to identify casts

Useful video:

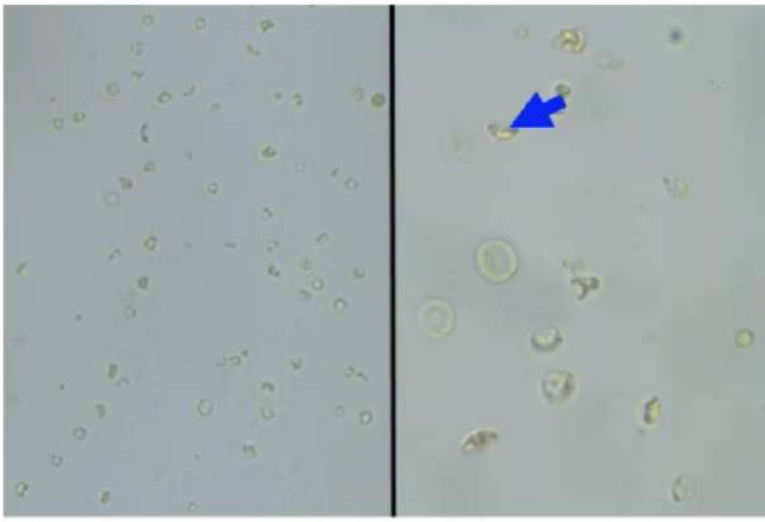
https://youtu.be/Hl4h8mvP2XI

Cells



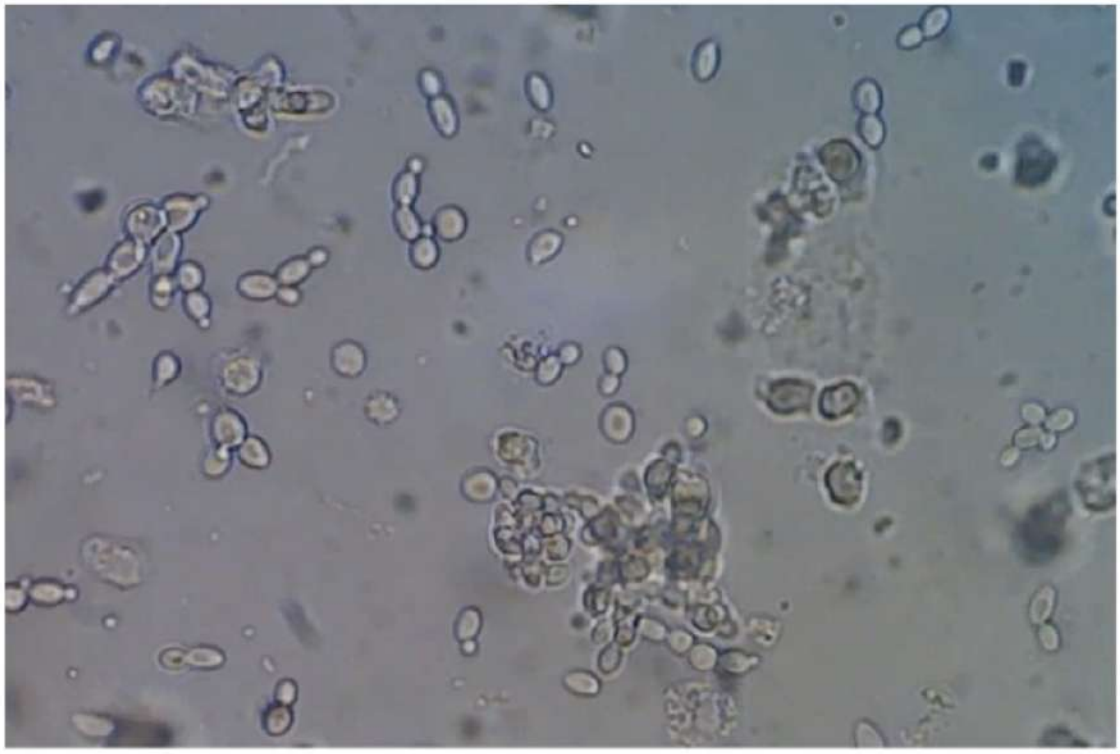
RBC – small, distinct cell membrane, clear cytoplasm

WBC – larger, less distinct cell membrane, granular cytoplasm



Dysmorphic red cells – typical of glomerular disease

Cells: yeast



Budding yeast: note they are similar in size to rbc but often in chains – dipstick blood may be negative

Seen in :Diabetic /steroids /anti suppressant
Presence is always pathological

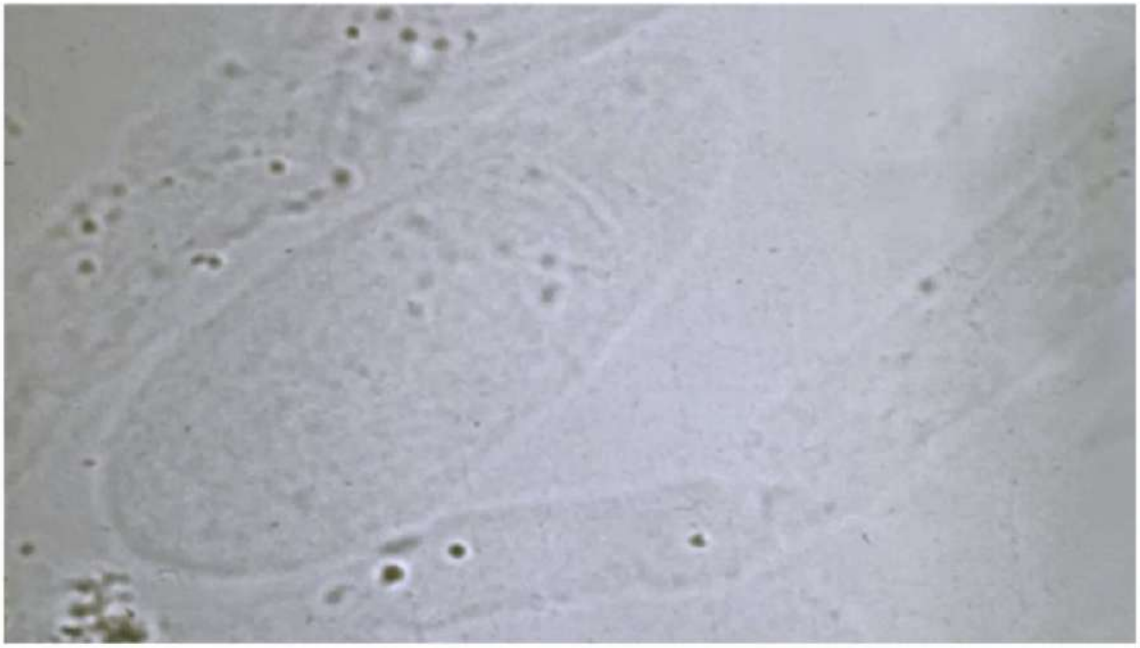
Squamous cells

Large, polygonal cells from uroepithelium

Well defined nucleus & very large
Seen in :
1-TCC(transitional cell carcinoma)
2-TUMOR AROUND MEATUS
You're expected to see a lot of them in the urine in these cases

CAST:Named according to whatever there's inside
-The M/C is hylaine :it's a concentrated (Tamm) protein secreted from kidney tubular cells that will be flushed out from kidney by urine
-Normally :seen in Fever ,dehydration , fasting
-Looks translucent and pure under microscopy

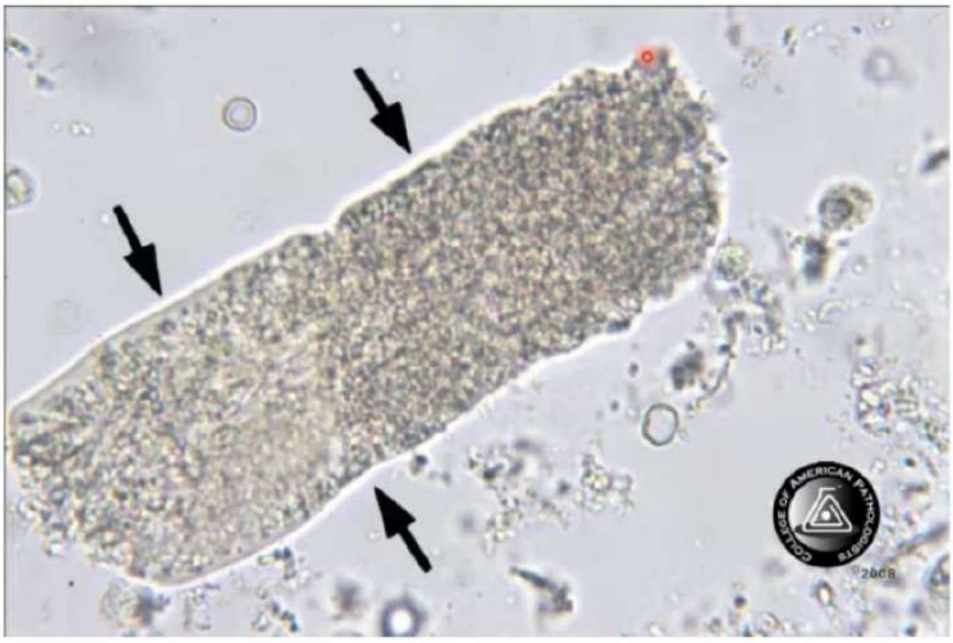
Acellular Casts: Hyaline cast



Hyaline cast: no significance; common in highly concentrated urine: probably Tamm-Horsfall protein

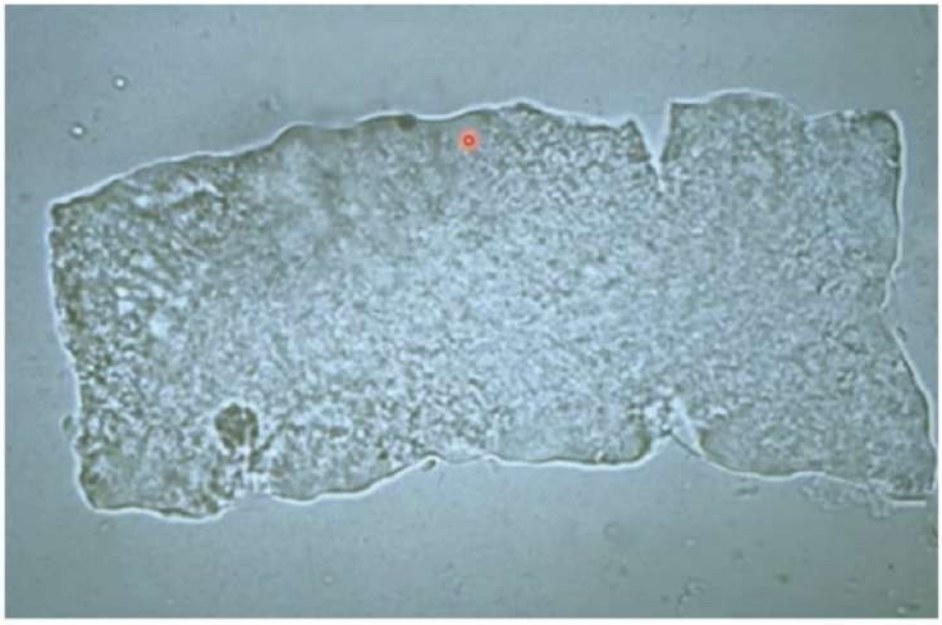
-The color is darker than hyaline,it appears Granular (contains granules) it’s always pathological
-Not specific (meaning we don’t know what we are dealing with)

Acellular Cast: Granular



Granular cast: abnormal but non-specific

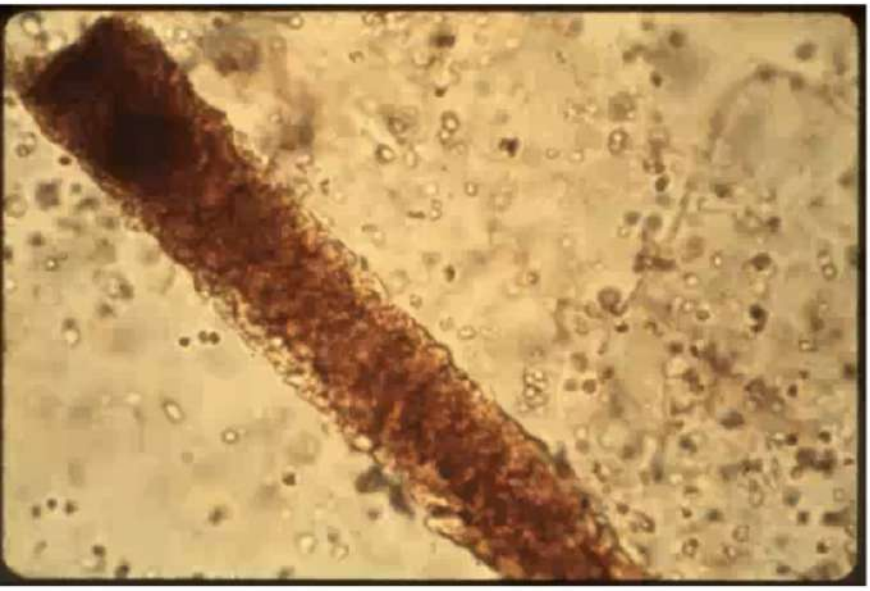
Acellular Cast: waxy



Broad "waxy" cast – said to be typical of advanced CKD

Seen in Advanced **CKD** due to **PROLONGED stagnation** caused by lower GFR and lower urine output resulting in accumulation of material making this cast

Acellular Cast: Heme Granular Cast



Heme-pigmented granular cast.

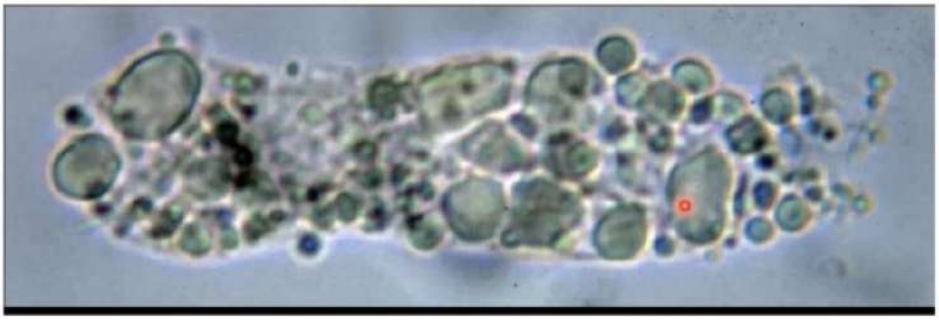
1. ATN (most common)

2. Proliferative or necrotizing GN (same significance as RBC cast in this setting)

With ATN look for tubular cells and debris

-Pigmented (muddy brown)
Typical in ATN(mostly)/PNGN
Dirty field/a lot of debris —necrosis In the tubules

Acellular Casts: Lipid Cast

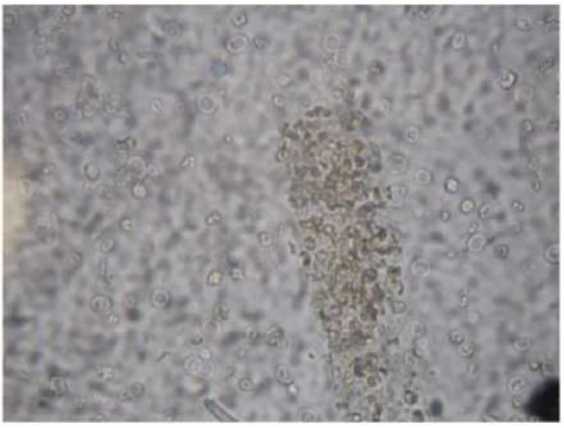


Lipid cast: seen in nephrotic syndrome;
dipstick protein ≥ 3 g/L

Note variable size of droplets of lipid

-Appearance of droplets of oils,typically in nephrotic(heavy proteinuria) —in addition to loosing proteins you are loosing lipid with it
-Circular/Spherical shape :it’s called oval fat body

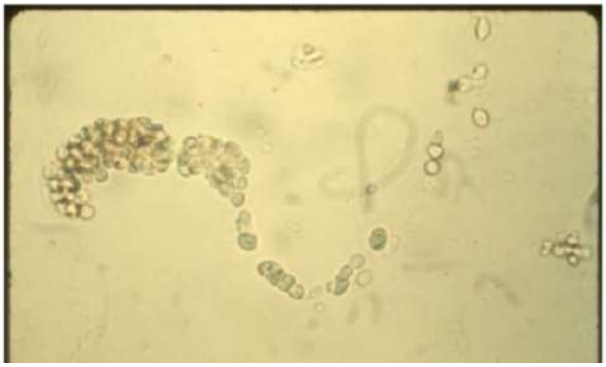
Cellular Cast: RBC



Distinct red cells seen within cast. Dip must be positive for blood.

Not numerous.

Seen in proliferative or necrotizing GN: PSGN, proliferative lupus, IgAN, ANCA vasculitis etc.



RBC casts —typical Glomerulonephritis ,so you should look for the underlying cause

Cellular Cast: WBC casts

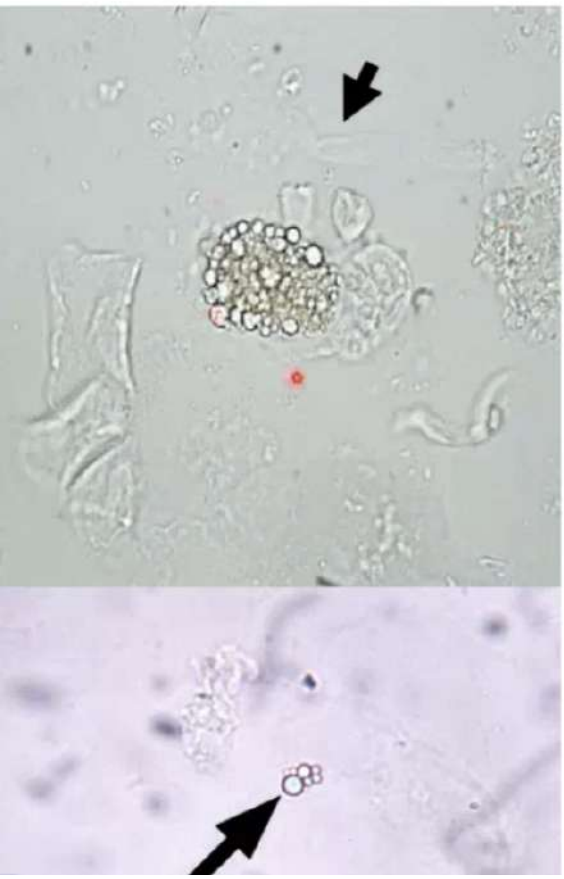
Seen in:

- Pyelonephritis
- Allergic intestitial nephritis
- Granulomatous interstitial nephritis
- Rarely proliferative GN

Shelleh

GIN(like in the case of **sarcoidosis** or **Tb** affecting the kidney)

Other: Oval Fat Body, Lipid droplets



Oval, round or cast-shaped dark object with small "bubbles" within

Likely droplets of lipoprotein

Typical of nephrotic range proteinuria

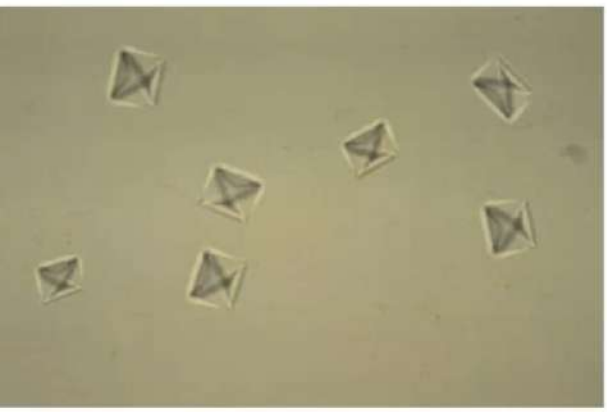
Oval fat/like lipid casts but in the form of oval or spherical shape
-heavy proteinuria with comes out with lipid droplets that will be accumulated either in the form of (casts or fat body)

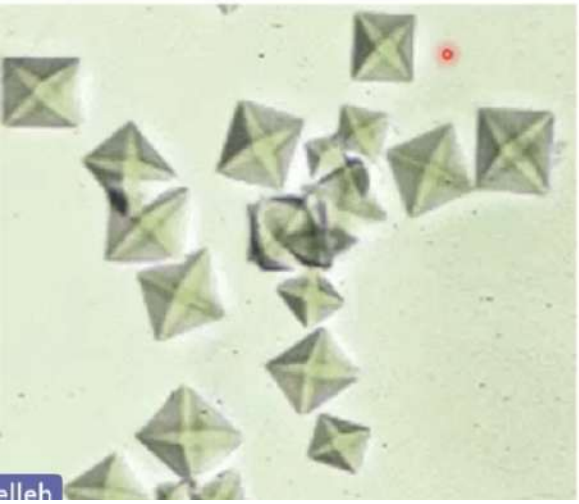
Other: bacteria

Always abnormal. If associated with white cells, suggests UTI. Look for movement of bacteria!

Bacteriuria :always abnormal /UTI
-can’t be diagnosed only from urine microscopy indeed culturing is required for diagnosis

Crystals: Calcium oxalate





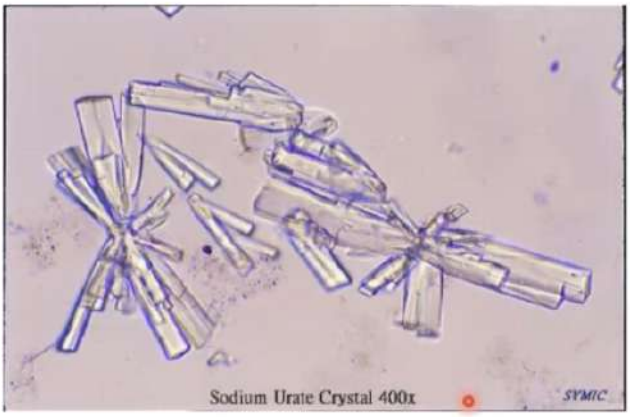
Seen in normal urine, rarely pathological

Look for them in susupected ethylene glycol poisoning.

Always pathological
-when the field is full for sure it's pathological
-not too much(1-3)can be found in normal ppl because it's found in some kind of chocolate and Nuts
-Ethylene Glycol is found in Anti freeze compounds

The doctor mentioned a case of (drunk patient presented to the ER & you can't guess what he drank ,just do a urine microscopy),it could be due to ethylene glycol poisoning &you'll find this type of crystals

Crystals: uric acid



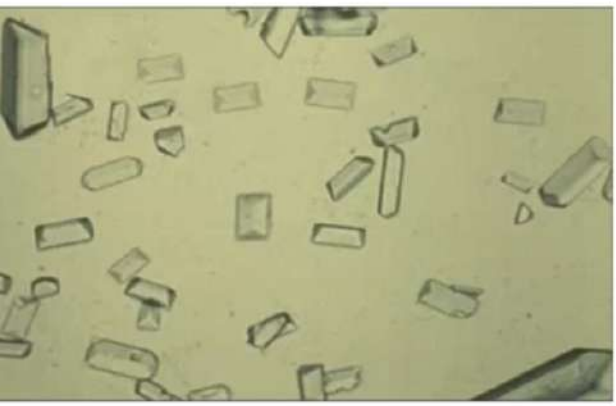
Sodium urate

Uric acid

Ammonium biurate

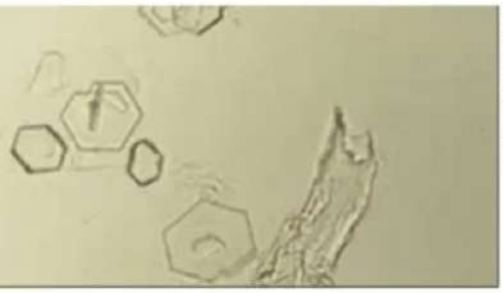
Abnormal Crystals

Looks like the tomb!

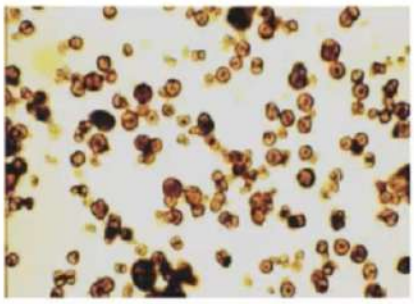


Triple phosphate: seen with chronic UTI (coffin lid)

Seen in :DM,Immunosuppressed who have urea split bacteria



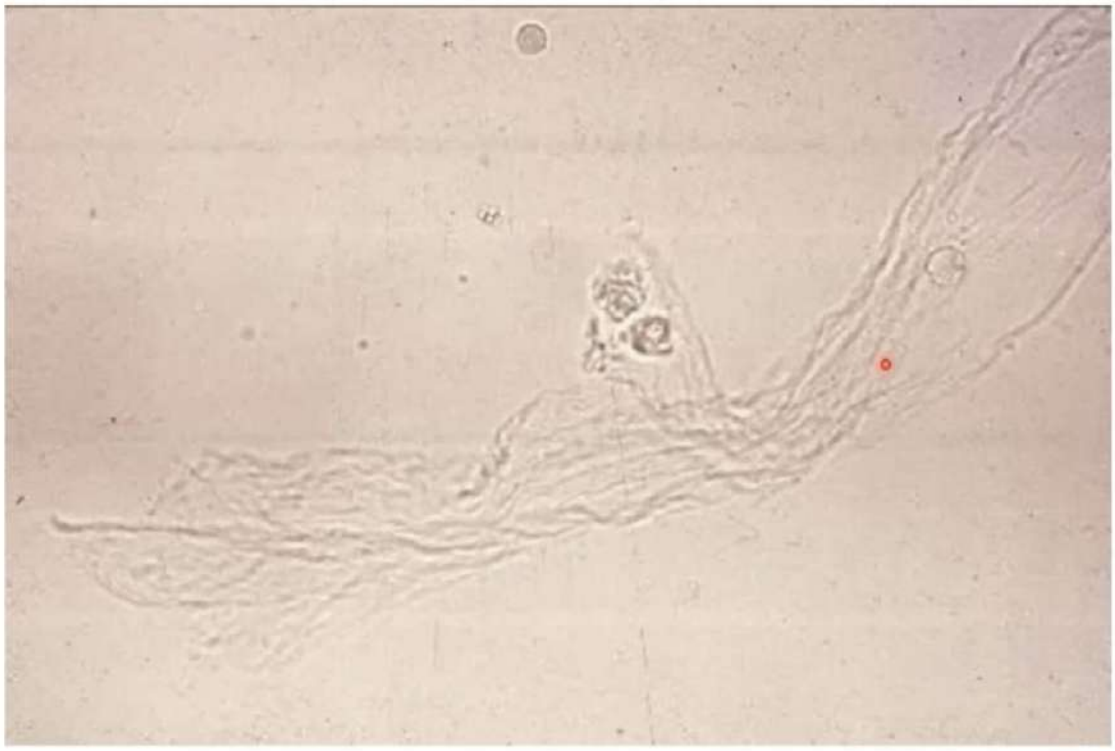
Cysteine: rare – AR genetic disorder of childre, teens; cause of stones



2,8-dihydroxyadeninuria: extremely rare

It’s rare don’t worry about it

Other



Mucous

Urinalysis in Decision Making

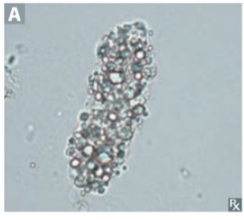
Most useful in:

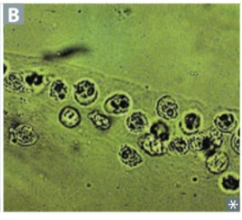
- Hematuria: red cell casts and/or clearly dysmorphic rbc's defines glomerular cause
- AKI: finding of blood, protein, debris and HG casts defines ATN

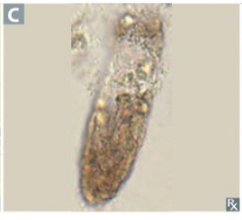
Presence of RBCs casts is always an indication of GN

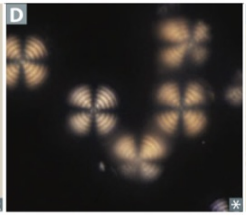
▸ RENAL—PATHOLOGY

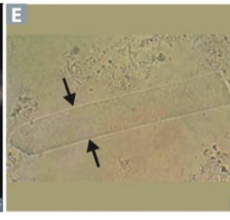
Casts in urine	Presence of casts indicates that hematuria/pyuria is of glomerular or renal tubular origin. Bladder cancer, kidney stones → hematuria, no casts. Acute cystitis → pyuria, no casts.
RBC casts A	Glomerulonephritis, hypertensive emergency.
WBC casts B	Tubulointerstitial inflammation, acute pyelonephritis, transplant rejection.
Granular casts C	Acute tubular necrosis (ATN). Can be "muddy brown" in appearance.
Fatty casts ("oval fat bodies")	Nephrotic syndrome. Associated with "Maltese cross" sign D.
Waxy casts	End-stage renal disease/chronic kidney disease.
Hyaline casts E	Nonspecific, can be a normal finding with dehydration, exercise, or diuretic therapy. Form via solidification of Tamm-Horsfall mucoprotein (uromodulin), secreted by renal tubular cells to prevent UTIs.











Nomenclature of glomerular disorders

TYPE	CHARACTERISTICS	EXAMPLE
Focal	< 50% of glomeruli are involved	Focal segmental glomerulosclerosis
Diffuse	> 50% of glomeruli are involved	Diffuse proliferative glomerulonephritis
Proliferative	Hypercellular glomeruli	Membranoproliferative glomerulonephritis
Membranous	Thickening of glomerular basement membrane (GBM)	Membranous nephropathy
Primary glomerular disease	1° disease of the kidney specifically impacting the glomeruli	Minimal change disease
Secondary glomerular disease	Systemic disease or disease of another organ system that also impacts the glomeruli	SLE, diabetic nephropathy