Urinalysis Interpretation

Dorna Derakhshan

Pediatric Nephrologist

SUMS

How does urinalysis help:

- ✓Informative and non invasive
- ✓Outpatient and inpatient
- ✓Diagnosis of urinary tract infections
- ✓Diagnosis of acute and chronic kidney disease
- ✓Early diagnosis of kidney disease in asymptomatic patients

Specimen collection

- **Midstream urine after cleaning the external genitalia in toilet trained children and adults**
- **Urinary bag in infants and neonates**
- **Urethral catheterization**
- **Suprapubic aspiration**

- The specimen should be examined at room temperature within two hours of retrieval
- If not possible, the sample should be refrigerated at 2-8 ^{o}C and rewarmed prior to assessment
- In refrigerated samples crystal detection is more possible

Components of urinalysis

Gross assessment

Dipstick analysis

Microscopic examination

- **Urine color :**
- Normally pale yellow to dark yellow (according to concentration and fluid intake)

- **Turbidity**

- **Urine odor**

Urine Color :

Red/brown urine

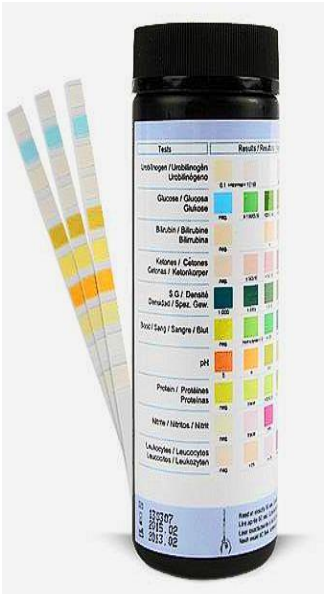
Green urine:
Amitriptyline
Pseudomonas UTI
propofol

White urine : phosphate crystals
Chyluria
propofol

Purple urine:
Cath induced infections

Black urine:
hemoglobinuria
Myoglobinuria
Alkaptonuria

Red urine



Heme-ve

- Drugs
- Metabolite
- Food coloring
- Beeturia
- Urate crystall

Heme+ve

Microscopy

>RBC/ HPF present

- Normal RBC → Non glomerular/ Menstrual
- Dysmorphic RBC and RBC cast → Glomerular

No RBC

Plasma centrifuge & muscle enzyme

- Hemoglobinuria
- Myoglobinuria

Gross assessment | Dipstick | Microscopic examination

- **Urine color** :
- Normally pale yellow to dark yellow (according to concentration and fluid intake)

- **Turbidity: Infection ,Crystalluria, Chyluria, Genital Secretions**

- Urine odor

Gross assessment | Dipstick | Microscopic examination

- Urine color :
- Normally pale yellow to dark yellow (according to concentration and fluid intake)
- Turbidity
- **Urine odor**

Keton :DKA

Boiled cabbage: tyrosinemia

MSUD

Mousy urine: PKU

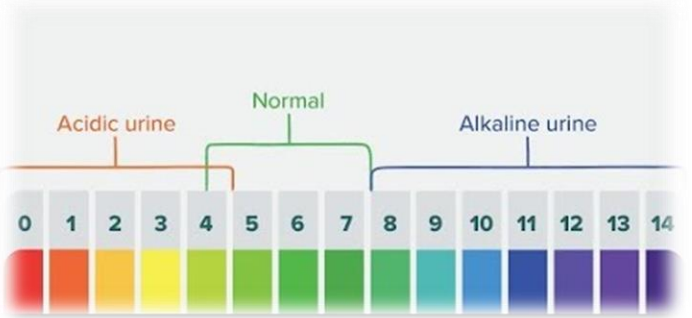
Sweety feet: isovaleric acidemia

Cat urine: multiple carboxylase def.

Rotten fish: trimethylaminuria

- **Semi-quantitative** assessment of urinary characteristics
- **The parameters:**
- PH
- Specific gravity
- Heme (blood)
- Leukocyte esterase
- Nitrite
- Protein (albumin)
- Glucose
- Urobilinogen
- Keton

Urine PH:



- Normal urine PH is 4.5 to 8
- The main clinical importance of urine PH is in patients with metabolic acidosis
- We expect increased urine acid secretion in case of acidemia
- If this does not happen → Renal tubular acidosis
- Proximal RTA: urine PH <5.5 (distal mechanisms are intact)
- Distal RTA: urine PH is > 5.5
- Urinary tract infections can increase urine PH → alkaline urine

Urine SG:

- SG is an indicator of urine osmolarity with a little difference:
  - Osmolarity is determined by the number of particles in the urine
  - The lowest possible SG is 1.003 (lowest urine osmolarity or maximal dilute urine :100 mosm/Kg)
  - Infants and neonates have normally lower urine SG
    - Immaturity of tubules for urine concentration
    - Urine frequency

Blood:

- Heme acts as a psudoperoxidase + reacts with the peroxide and a chromogen and change color
- The positive blood is seen in case of hemoglobinuria and myoglobinuria
- Hematuria which means RBC in urine should be documented by microscopy
- 5-10 RBC/ micolit in fresh urine = 5-10 RBC in HPF of centrifuged urine

False + ve :	**False –ve**
-Alkaline urine	-Vitamin C
-Contamination with detergents	-Formaline

Leukocyte esterase:

- Is released by lysed neutrophils and macrophages
- It indicated WBC presence
- UTI, Tubulointerstitial nephritis

Nitrite:

- Positive when a nitrate reductase bacteria causes UTI
- Nitrate → Nitrite

- Very specific for diagnosis of UTI esp with Enterobacteriaceae sp.
- Enterococci cause nitrite negative UTI

Protein:

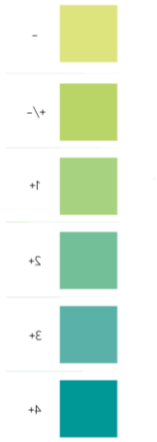
- Semiquantative measurement of albuminuria
- Non sensitive to non-albumin proteins (tubular proteinuria, immunoglobulins,…)

-Office screening for proteinuria

-Detects Albuminuria

Reported as:

- Negative
- Trace (10-29 mg/dl)
- 1+ (30-100 mg/dl)
- 2+ (100-300 mg/dl)
- 3+ (300-1000 mg/dl)
- 4+ (>1000 mg/dl)



False positive

- Very high urine PH (>7.0)
- Highly concentrated urine
- Contamination with blood
- Pyuria
- Prolonged dipstick immersion

False negative

- Low urine PH (<4.5)
- Dilute Urine
- Non Albumin proteinuria

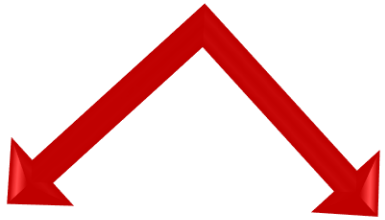
Glucose:

- Glucosuria may be caused by:
  - Generalized defect of proximal tubular in reabsorption: Fanconi syndrome
  - High plasma glucose (diabetes) : BS> 180 mg/dl
  - Isolated glucosuria

- **Urine microscopy mainly consists of examination of :**
  - Cells (RBC, WBC, Epithelial Cells)
  - Casts (RBC cast, WBC cast, Waxy cast, Broad cast, Hyaline cast)
  - Crystals (Calcium oxalate, Urate, Mg-ammonium-phosphate, Cystine,…)

Cells:

- **RBC:**
- Microscopic hematuria > 5 RBC / HPF in children
- Repeat urinalysis every 2 weeks for 3 times



Transient hematuria:

- Fever
- Exercise
- Trauma

Persistent hematuria:

- Renal stone
- UTI
- Labial adhesion
- Meatal stenosis
- Glomerulonephritis
- Malignancies (Wilm's tumor)
- Renal vain thrombosis
- Sickle cell
- Familial benign hematuria

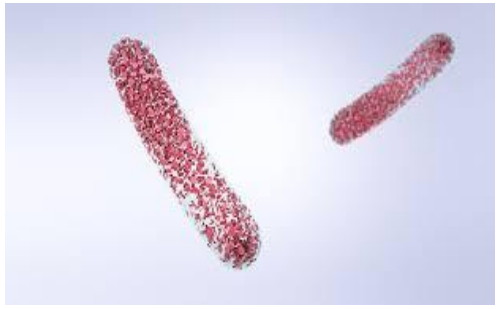
Cells:

- **WBC:**
  - Pyuria indicated presence of WBC in the urine
  - More commonly associated with urinary tract infections

Sterile pyuria:

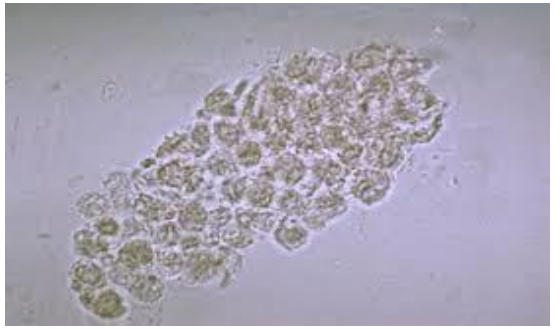
- Fever
- Glomerulonephritis
- Stone
- TIN (Eosinophils)
- Vaginitis
- STD
- TB

Casts:

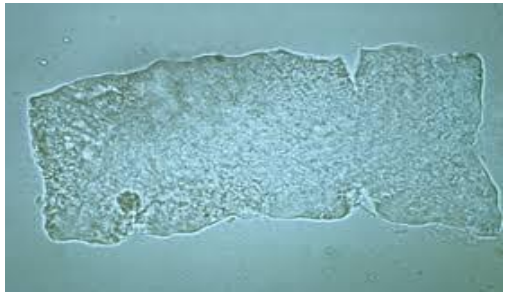


RBC cast : Glomerulonephritis

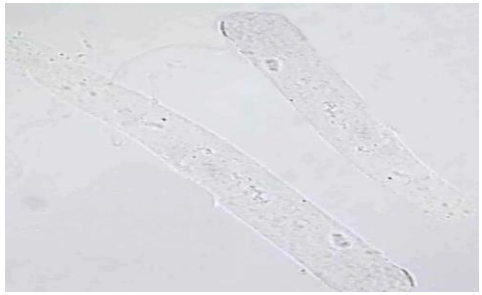
Granular cast: ATN



WBC cast : Acute interstitial Nephritis, GN



Waxy cast: non specific



Hyaline cast: generally non specific

Types of Crystal in Urine