PEDIATRICS

24

LECTURE PACKAGE

SUBJECT: Urinalysis

DOCTOR: Round’s notes, Nelson’s

DONE BY: Doa’aAlzoubi - Hop

URINALYSIS

☐ How to perform test ?

- Urine sample should be examined within 2 hours
- Should be refrigerated if not read immediately

☐ How are urine samples collected?

- For children who are toile trained ,
  - ✓ MSU (mid-stream urine sample), is usually collected.
- In younger children who are not toile trained and cannot urinate on request, an MSU is usually not possible. Several methods can be used:
  - ✓ clean catch
  - ✓ bag collection
  - ✓ catheter sample
  - ✓ SPA (suprapubic aspirate)

MSU (mid-stream urine sample)

After appropriate cleansing of the external genitalia , The child needs to start passing urine into the toilet and then his mother or the nurse catch some of the **middle part** of the urine stream in a sterile container ,, allowing the initial portion to escape ,,, the initial stream cleans or flushes the urethral orifice and meatus of resident bacteria .

Clean-catch specimen

** This involves 'catching' a sample of clean urine from an infant or young child as they urinate.

** Instruction to the mother or the nurse doing it ::

- give your infant a drink or breast feed to help fill the bladder

(because it is difficult to time with the child , breastfeeding may help to fill and release the bladder)

- clean the child's genital area with soap and water
- leave your child's nappy off and wait for them to urinate and quickly catch a small amount in a sterile container

Bag collection

- It is done by the nurse or the mother in the house
- Instructions to the mother :

* you attach a plastic bag, which has a sticky strip, over your baby's genital area after cleaning very well with soap and water (for boys, the entire penis can go in the bag; for girls the bag goes over the labia)

* you can put a nappy on, over the bag .

* urine collects in the bag when your baby urinate .

* sometimes it can take several attempts to get some urine .

* transfer the urine sample from the bag into the sterile container (from your doctor)

URINALYSIS

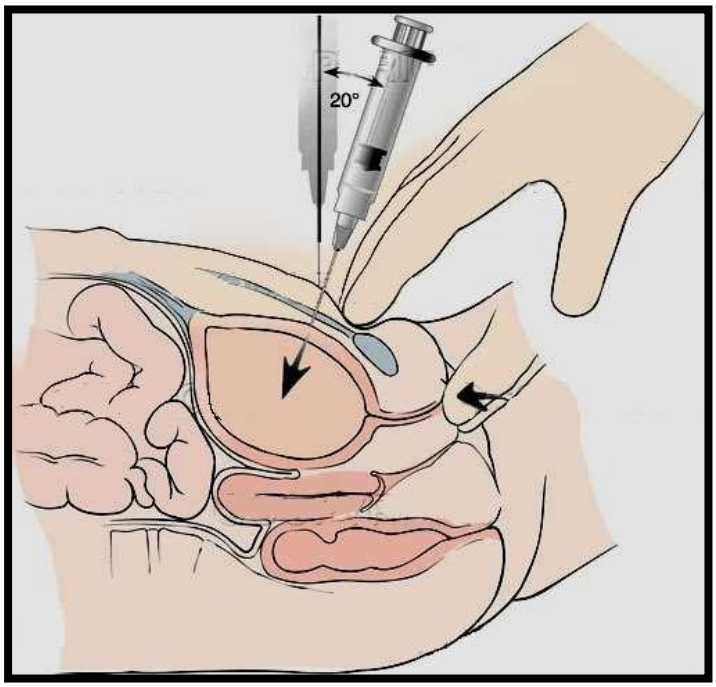
⌦ A bag urine sample is often contaminated by germs from the skin; this can make it look like the child has a UTI ,even if he don't really .

Catheterization

A doctor or nurse passes a fine plastic tube (catheter) into the urethra and bladder so that they can collect a urine sample into a sterile container .

Suprapubic Aspiration

Involves putting a needle into the bladder just above the pubic bone , urine is collected straight from the bladder via the needle into the syringe .



Urinalysis

① Macroscopic Examination

② Chemical Analysis (Urine Dipstick)

③ Microscopic Examination

※ Macroscopic Examination

Odor :

- ✓ Ammonia-like: (Urea-splitting bacteria)
- ✓ Foul, offensive: Old specimen, pus or inflammation
- ✓ Sweet: Glucose
- ✓ Fruity: Ketones
- ✓ Maple syrup-like: Maple Syrup Urine Disease

Color **:**

- ✓ Normal : slight yellow
- ✓ Colorless : Diluted urine
- ✓ Deep Yellow : Concentrated Urine, Riboflavin
- ✓ Yellow-Green : Bilirubin / Biliverdin
- ✓ Red : Blood / Hemoglobin
- ✓ Brownish-red : Acidified Blood (Acute GN)
- ✓ Brownish-black : Homogentisic acid (Melanin)

Turbidity**:**

- ✓ Typically cells or crystals.
- ✓ Microscopic examination will determine which is present.

⌘ Microscopic Examination

1) Casts

** Erythrocyte Casts: Glomerular diseases **

Leukocyte Casts: Pyuria, glomerular disease

** Degenerating Casts:

- Granular casts: Nonspecific (Tamm-Horsfall protein)

- Hyaline casts: Nonspecific (Tamm-Horsfall protein)

- Waxy casts: Nonspecific
- Fatty casts: **Nephrotic** syndrome **(oval fat body casts)**

2) RBC

** Dysmorphic Vs Normal

➔ Dysmorphic RBCs: suggest glomerular disease

3) Epithelial cells

- squamous epithelial cells: if present, suggest *contamination*
- transitional epithelial cells: normally present
- renal tubular cells: suggests *renal pathology* ,, few are normal .

4) WBC

** > 5 Per High Power Field (HPF) >> Abnormal !

** **Pyuria** (leukocyturia of >10 white blood cells [WBCs]/mm3) suggests infection, but also is consistent with urethritis, vaginitis, nephrolithiasis, glomerulonephritis, and interstitial nephritis .

5) Crystals

- **Calcium oxalate crystals**: retractile square envelope shape, vary in size

- **Uric acid crystals**: yellow to orange-brown, diamond- or barrelshaped
- **Triple phosphate crystals**: can be normal, but also associrated with alkaline urine or UTI (Proteus): colorless, coffin lid appearance
- **Cystine crystals**: colorless, hexagonal shape, in acidic urine diagnostic of cystinuria

6) *Bacteria*

Bacteriuria → More than 10 per HPF

⌘ Urinalysis Dipstick Urinalysis

1- *Urine Specific Gravity*

Purpose: urine osmolality and represents patient's hydration status and concentrating

ability of their kidneys

Normal: 1.003-1.030

Increased USG: glycosuria, SIADH

Decreased USG: diuretic use, **Diabetes**

Insipidus , adrenal insufficiency, aldosteronism, impaired renal function .

NOTE: if intrinsic renal insufficiency, USG fixed at 1.010

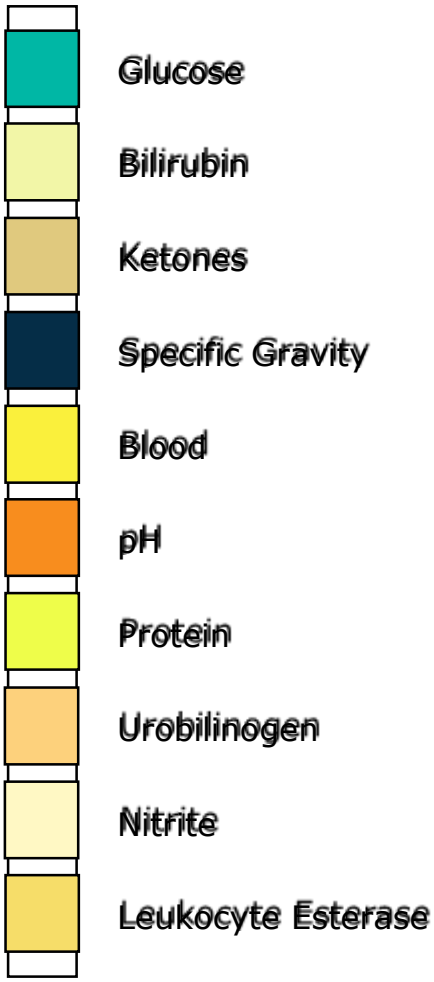
2- *Urinary pH*

Purpose: urinary pH reflects serum pH except in renal tubular acidosis (RTA), useful for diagnosis/management of UTIs and calculi

Normal: slightly **acidic** usually (5.5-6.5)

Alkaline urine: suggest urea-splitting organism

Acidic urine: uric acid calculi



3- *Blood*

Testing: for **peroxidase activity**, will be positive in hematuria (presence of RBC) , myoglobinuria (myoglobin) , hemoglobinuria (hemoglobin)

-if positive: *must look at **microscope*** to confirm presence of RBCs

Types: glomerular, renal, urologic

4- *Protein*

Normal: (<4 mg/m^2/hour or $U_{Pr/Cr}$ < 0.2)

Proteinuria >>

Criteria: >150 mg/day (10-20 mg/dL) or (>4 mg/m^2/hour or $U_{Pr/Cr}$ > 0.2)

Nephrotic proteinuria in children : is defined as protein greater than 40 mg/m^2/hour or $U_{Pr/Cr}$ greater than 2.0. or > 350 mg/dL in 24 h .

-microalbuminuria= 30-150 mg/day (sign of early renal disease)

Normal urinary proteins: albumin, serum globulins, proteins secreted by the nephron

Testing: Reagant sensitive to albumin, but can miss low levels of globulins

- **Dipstick results:**

- **Trace = Normal**
- **1+ = up to 30 mg/dL**
- **2+ = up to 100 mg/dL 3+ = up to 300 mg/dL**
- **4+ = up to 1,000 mg/dL or more .**

Types: transient and persistent
Protienuria detected by dipstick should be confirmed by quantitation, either with a 24-hour collection or by the protein/creatinine ratio .

5- Glycosuria

Normal: almost completely reabsorbed in proximal tubule

Criteria: occurs at approximately 180-200 mg/dL (level in blood)
Elevated: DM, Cushing's syndrome, liver and pancreatic disease, Fanconi's syndrome .

6- Ketonuria

Normal: not present in urine

Testing: presence of acetic acid through a chemical reaction **Causes**: uncontrolled diabetes, pregnancy, carbohydrate-free diets, starvation

7- Nitrites

Normal: Not present in urine

Testing: bacteria that reduce urinary nitrates to nitrites

-*Positive test*: can be gram negatives or gram positive organism (negative > positive)

-Indicate significant number (>10,000/mL)

-*Negative test*: Can't R/O UTI because non-nitrate reducing organism cause UTIs .

8- Leukocyte Esterase

Testing: presence of neutrophils

9- Bilirubin

Normal Bilirubin: no detectable amounts
-*Unconjugated bile* : not water soluble, doesn't pass through glomerulus -*Conjugated bil*e : water soluble, indicates possible liver dysfunction or biliary obstruction

10- Urobilinogen

Normal Urobilinogen: only small amounts

-*Urobilinogen*: end product of conjugated bile after metabolized by intestine, small amount reabsorbed into portal circulation and filtered by glomerulus

URINALYSIS

Increased urobilinogen: hemolysis, haptocellular disease

Decreased urobilinogen: antibiotic use, bile duct obstruction

~ The END ~

This lecture is not for memorizing ,read it and take a general idea,, understand the basics of UA ,, It is very difficult to understand many other things mentioned in the lectures or the rounds without understanding the basics ,,,

Important things that you need to memorize for the purpose of the exams will be mentioned in other lectures …

We added it to the package because we know it is very hard to gather all these information,,since they are not mentioned in any book

I did my best to make it as useful & simple as possible !!

Good luck (: Doa'a

Samarah Al Zou'bi

Resources : round's notes , Nelson essential ,

https://pedclerk.bsd.uchicago.edu/page/urinalysis-what-does-it-all-mean

http://www.kidshealth.org.nz/urine-tests