

# Signs and Symptoms

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# Abnormalities in urine volume and composition

↳ Normally = 800-2000 mL/24h

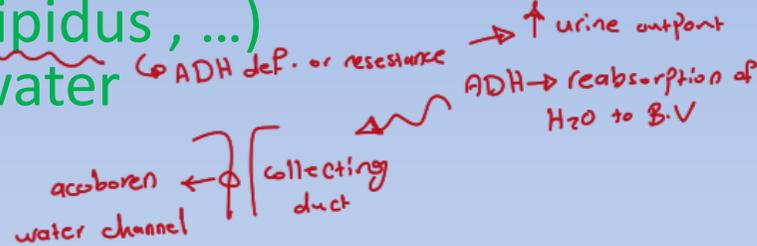
♣ **Polyuria**: abnormally **large volume** of urine, and is most commonly due to

① excessive fluid intake (more than 2.5-3 liters per 24 hrs).

② - External (Diuretics, Diabetes insipidus, ...)

③ - Renal: kidney fails to reabsorb water

- interstitial nephritis
- urinary tract infection
- renal tubular acidosis



♣ **Oliguria**: **reduction** in urine volume to <800 ml/day.

\* - Acute renal failure

♣ **Anuria**: **total absent** of urine production

\* - acute renal failure

♣ **Pneumaturia**: passing **gas bubbles** in the urine

- colovesical fistula, UTI, IBD

Colon & Bladder



.It is the presence of RBCs in the urine\*

↳ red urine  
**Macroscopic (gross)** hematuria is visible to the naked eye (overtly-bloody, smoky or blood clots) ↳ large amount

Microscopic or dipstick hematuria is when blood is identified by urine-microscopy or dipstick testing ↳ Not clear urine but Not red in color

>3 RBCs/HPF on urinalysis of at least two separate samples

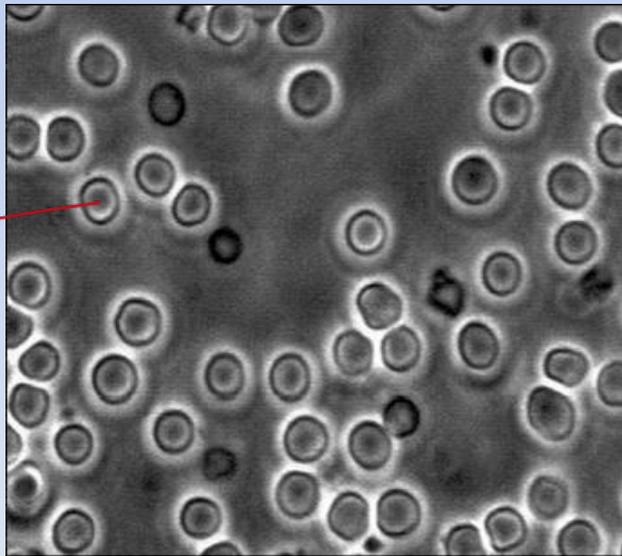
↳ High Power field

at two separated days.

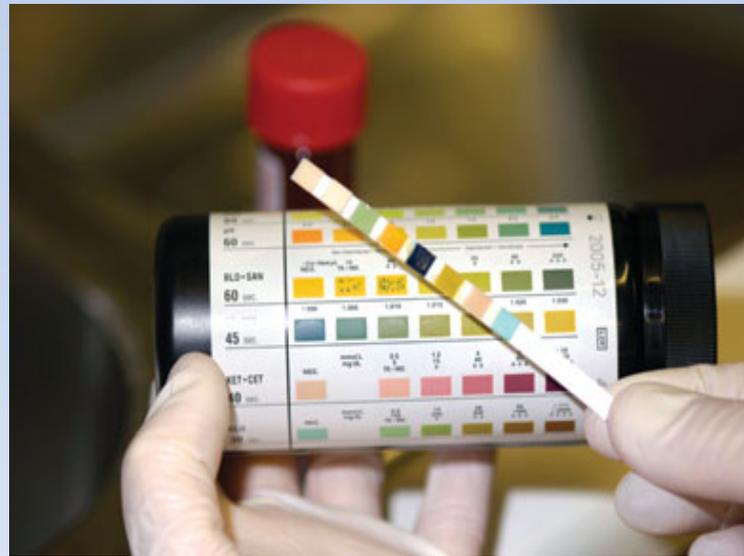


Coccola  
2/10/12  
glomerulonephritis  
(Streptococcus)

Gross Hematuria



RBC



Urine Microscopy

Dipstick urinalysis

: Causes of hematuria

: Recent Urological Interventions- iatrogenic → mc

Bladder Catheterization, urethral stent, Prostate

) biopsy

Trauma- <sup>مضيق</sup> Contraindication of Catheterization (Blood <sup>وجود</sup> penis meatus → (urethral injury) <sup>بدل على</sup>)

Radiotherapy, Chemotherapy-

Coagulopathies- (Bleeding tendency)

(false)

: Pseudo hematuria\*\*

menstruation → Menses, Drugs (Rifampicin), Dyes, Food (Beets), porphyria

↓  
Orange body color  
to red

نيسان



## 9.8 Causes of haematuria

### Painless

- Glomerulonephritis (mc)
- Tumours of the kidney, ureter, bladder or prostate\*
- Tuberculosis\*
- Schistosomiasis\*
- Hypertensive nephrosclerosis
- Interstitial nephritis (unless very acute/severe)
- Acute tubular necrosis
- Renal ischaemia (renovascular disease)
- Distance running or other severe exercise
- Coagulation disorders, anticoagulant therapy

### Associated with pain

- Urinary tract infection
- Renal stones with obstruction
- Loin pain-haematuria syndrome

### May be either

- Urinary tract infection
- Reflux nephropathy and renal scarring
- Adult polycystic kidney disease
- Renal stones without obstruction

\*Painless provided there is no acute obstruction of the urinary tract.

Parasite  
كاس جف  
Bladder Ca.

## Timing of Hematuria :

من بداية التبول  
urination

**Total** : Above bladder neck (bladder, ureters and kidneys)

**Terminal** : Prostatic urethra and neck of bladder

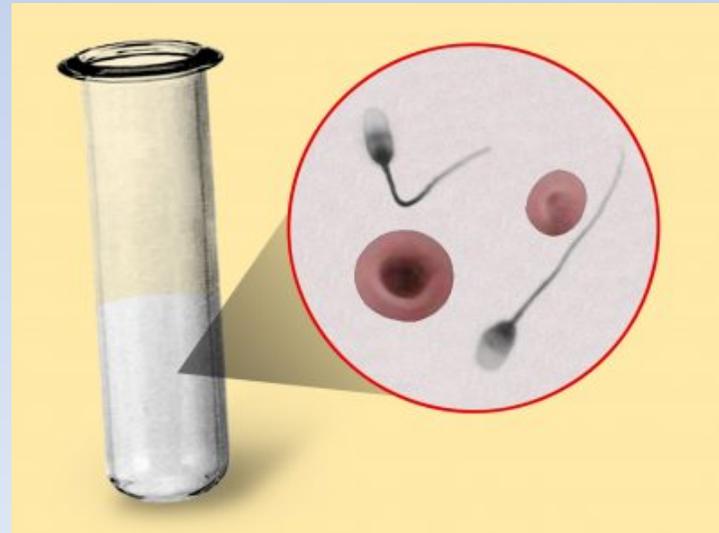
**Initial** : Anterior urethra

# Hemospermia

.It is the presence of blood in the semen

It can be ( bright red, coffee-colored, rusty, or darkened ) in-  
.appearance and may change as blood ages

کُل صائل لقتہ اجلا بپور لونه اخفت



# Causes

.Iatrogenic: after prostate biopsy , cystoscopy , prostate intervention-

Age < 40 : Inflammatory (prostatitis, epididymo-orchitis, urethritis, urethral condylomata ) / Idiopathic / Trauma / testicular or perineal .tumors   
 ↪ with STD

Age > 40 : prostate or bladder cancer / BPH with dilated veins in the prostatic - urethra / prostatic or seminal

vesicle (SV) calculi/ hypertension / carcinoma of the seminal vesicles

Rare causes : <sup>↪ Stone</sup> bleeding diathesis/ <sup>↪ Coagulopathy</sup> utricular cysts/ Müllerian cysts/ TB/ schistosomiasis/- amyloid of prostate or seminal vesicles/ following therapeutic injection of .hemorrhoids

# Nocturia and nocturnal polyuria

بعض من النوم عند يخل على الحمام

- **Nocturia** is the frequent need to get up and urinate at night. Enuresis (bed wetting) in that the person does not wake and the bladder empties. *Type of incontinence.*
- **Nocturnal polyuria (NP)** refers to a condition in which the rate of urine output is excessive only at night and total 24-hour output is within normal limits.
- Awakenings 2 or more times at night considered as nocturia

عدد المرات  
يأتي بجمع فيها  
ليتم على الحمام

at day  
Pr side  
at day

Baseline  
على صبحه  
ببحار

صحة جداً

# Lower Urinary Tract Symptoms

(Bladder & urethra)

• two phases of lower urinary tract function :

## 1. Storage phase (bladder filling and urine storage)

? accommodation and compliance

? no involuntary contraction



↓  
زيادة الحجم  
زيادة الحجم  
urine volume

## 2. Voiding phase (bladder emptying)

? coordinated detrusor contraction muscle in bladder

? with relaxation of outlet sphincters

? no anatomic obstruction



↑ upper urinary tract symptom

cause → systemic

( \* Pyelonephritis → loin pain, fever, vomiting... )

## Filling (Storage) or irritative symptoms :

**Frequency** : micturating more often with no-increase in the total urine output.

↑ عدد اعران  
less than 2h  
تحتاج يرجع على الحمام

- **Urgency** : a sudden strong need to pass urine

- **Dysuria** : painful urination → Burning sensation

- **Nocturia**

## Voiding or obstructive symptoms :

- **Poor stream** (unimproved by straining)

بمهل التدفق  
ضعيف صوته  
إذا اعدى من  
سنة على حاله  
تضعفت البول

- **Hesitancy** "difficulty in beginning the flow of urine"

(worsened if bladder is very full)

- **Terminal dribbling** : patient continues to leak urine after micturition has ceased

Post voiding dribbling

- **Urinary retention** : inability to completely empty the bladder

انجبا ص البول

منال بعد  
ما طلعت من الحمام يتحسونه من تحت كل الحمانه ولا يسهل ؟؟

# Urinary Incontinence

## Definition

تسرب

- involuntary leakage of urine

### ① Urgency Urinary Incontinence (UUI)

type	definition	mechanism
① Urgency Urinary Incontinence (UUI)	<p>Involuntary leakage accompanied by or immediately preceded by urgency</p> <p>سبباً مباكِرةً</p>	<p><u>Detrusor overactivity</u>: muscle of bladder</p> <p>CNS lesion, inflammation / infection (cystitis, stone, tumour), bladder neck obstruction (tumour, stone), BPH, idiopathic</p> <p><u>Decreased compliance of bladder wall</u></p> <p>CNS lesion, fibrosis, sphincter/ urethral problem</p>

urgency = contracted bladder  
 \* incontinence = overactive  
 بكميات كبيرة من  
 volume of  
 of urine

type	definition	mechanism
<p>② <b>Stress Urinary Incontinence (SUI)</b></p> <p><i>multiple pregnancy weakness of pelvic wall</i></p>	<p>Urine leakage associated <u>with increased abdominal pressure</u> from laughing, sneezing, coughing, climbing stairs, or other physical stressors on the abdominal cavity and, thus, the bladder</p> <p>Common in women, seen in men after prostate cancer surgery</p> <p><i>رطوبه زاید</i></p>	<p><b>Urethral Hypermobility</b> : weakness in pelvic floor</p> <p><b>Intrinsic sphincter-deficiency (ISD)</b></p> <p><i>ما يكون مسكك منيح</i></p> <p><i>Pelvic muscle</i> <i>عضلة حوض</i> <i>Urethra</i></p>
<p>③ <b>Mixed incontinence</b></p>	<p>A combination of stress and urge incontinence</p>	
<p>④ <b>Overflow incontinence</b></p>	<p>increased residual or chronic urinary retention leads to urinary leakage from bladder overdistention</p>	<p><i>Urine retention ← obstruction</i> <i>↓</i> <i>incontinence</i></p>
<p>⑤ <b>Functional incontinence</b> (<i>Nervous system</i>)</p>	<p>loss of urine related to deficits of cognition and mobility. (eg, delirium, psychiatric disorders, urinary infection, impaired mobility)</p> <p><i>Bed ridden pt</i></p>	
<p>⑥ <b>Continuous incontinence</b></p>	<p>associated with fistulas (vesicovaginal, urethrovaginal) and ectopic ureter inserted distal to external sphincter</p> <p><i>Bladder ١١ ureter ١١ Normally in trigon area.</i></p>	

# Overactive Bladder

- a symptom complex that includes urinary urgency with or without urgency incontinence, urinary frequency, and nocturia
- **Etiology**

etiology unknown

symptoms usually associated with involuntary contractions of the detrusor muscle. The overactivity of the muscle could be neurogenic, myogenic or idiopathic

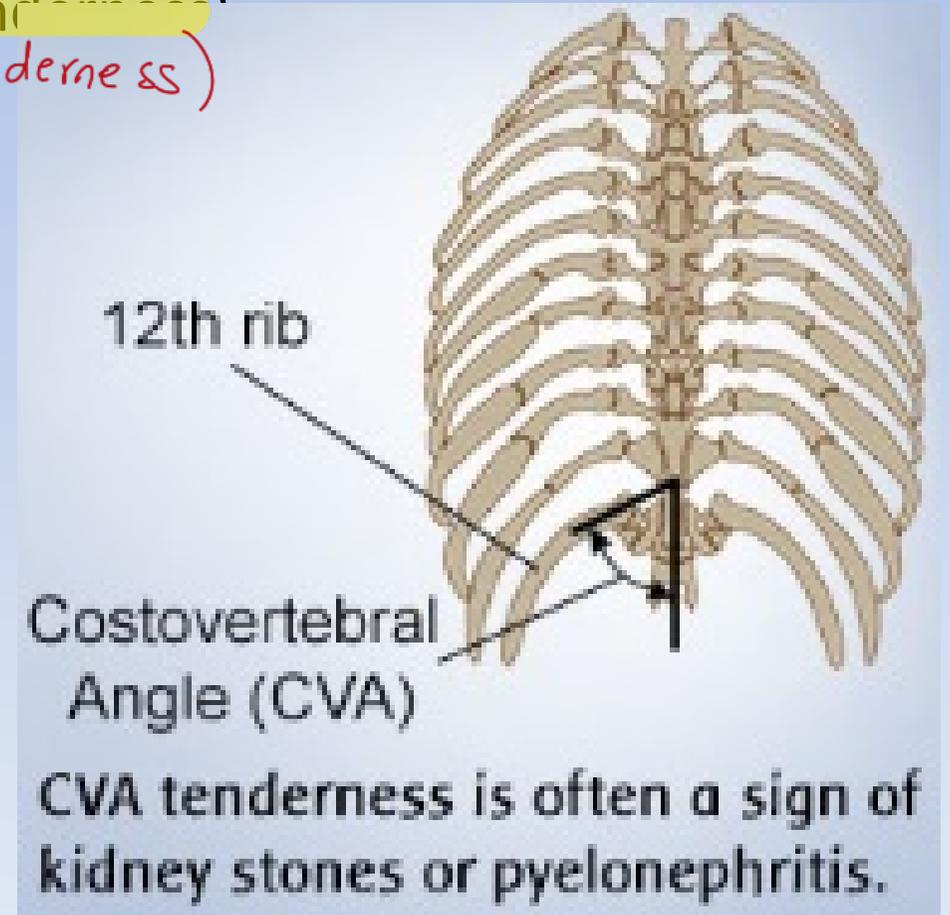
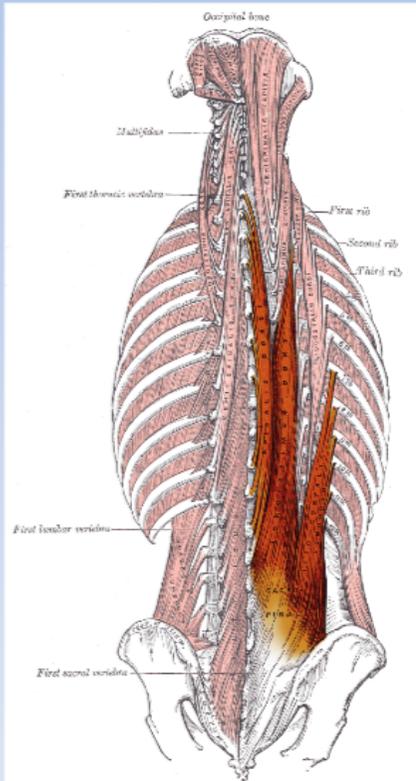
↳ innervation

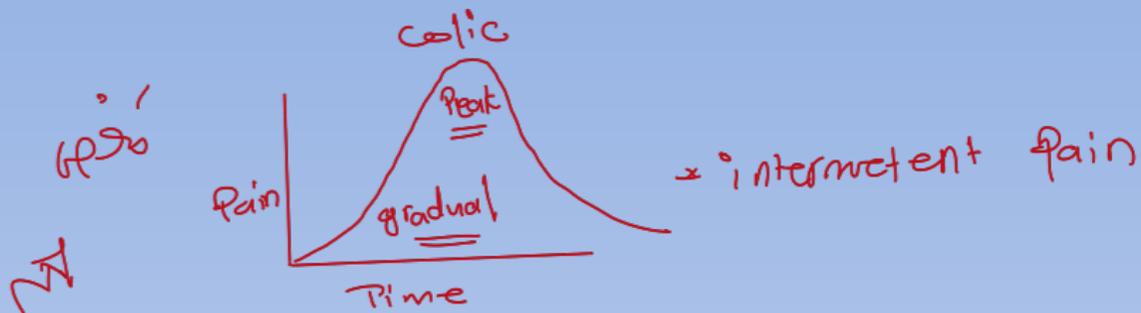
↳ muscle itself

# PAIN PRESENTATIONS

( renal, ureteric, vesical, urethral )

- **Renal angle pain** – dull ache between 12<sup>th</sup> rib and erector spinae muscle on the side of the affected kidney – pyelonephritis. (Refer renal angle tenderness + tenderness)





- **Renal colic** – due to **ureter obstruction** – a **severe pain** – **lumbar region**; radiates to **abdomen, groin, testes, thigh** – due to **stone or tumour**

- **Ureteric colic** – **spasmodic, severe pain** during the **passage of a renal calculus**; radiation path of renal colic; may be associated with **vomiting, sweating**.

Stone



- **Suprapubic pain from bladder / urethra** – is referred to **lower abdomen, perineum** and **glans penis in male**

## Urine analysis and Lab investigation

### Types of Analysis

- Visual examination
- Chemical examination
- Microscopic Examination
- Culture Cytological Examination

# Urine analysis

## I. Physical properties of urine

- **Volume, Colour, Odour, Reaction(ph), Aspect, Deposits, Specific Gravity.**

### • Volume

- Normal urine volume is **600/- 2000 ml/day**.
- Normally, **more urine is secreted during the day than at night.**

### Increased volume:

#### ❖ **Physiological increase:**

- **In winter.**
- **After excessive fluid intake.**

#### ❖ **Abnormal increase (polyuria):** More than 3 L/day

- **diabetes mellitus** (may reach 5 L/day)
- **diabetes insipidus** (10-15 L/day)

*cold*   
Pathological →

# Urine analysis

## I. Physical properties of urine: Volume

### Decreased volume:

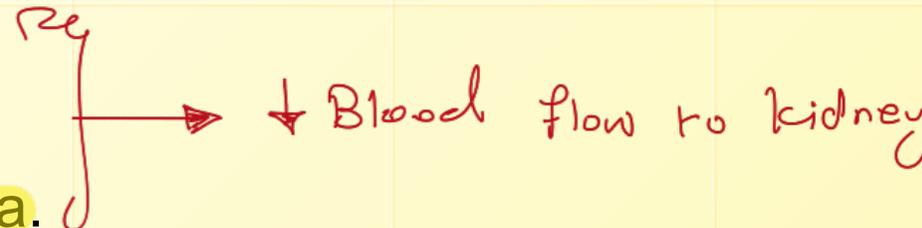
#### *Physiological decrease:*

- in summer due to increased sweating
- during fasting or restricted fluids in diet.

#### *Abnormal decrease (Oliguria): Less than 200 ml/day*

- acute nephritis.
- heart failure.
- hemorrhage.
- vomiting and diarrhea.

in 3rd space of  
less water



**Anuria:** No urine at all. In late stages of renal failure and heart failure.

# Urine analysis

## I. Physical properties of urine: Color

- Normal color is **amber yellow** due to pigments called **urochromes** (derivative of urobilin or urobilinogen.)  
*اصفر غبري*
- Ingestion of food colored with dyes or colored drugs result in discoloration of urine. ↓

### Abnormal urine colors:

from  
Bilirubin



color	Condition or disease
colorless or pale yellow.	<p><u>Diabetes insipidus</u> (very diluted urine) * unconcentrated</p>
<p>deep orange.</p> 	<p>* <u>Fever</u>  dehydration  - laxatives  - vitamins  - chemotherapy</p>
<p>Greenish brown</p> 	<p><u>Obstructive jaundice</u> Conjugated bilirubin</p>
<p>red:</p> 	<p><u>Haemorrhage-reddish brown</u>  Blood, myoglobin, free hemoglobin  - blackberries, beetroot  - Drugs (rifampicin, ...)</p>
<p>Black</p>	<p><u>Alkaptonuria</u> → AR disease due to defect in enzyme  Drugs (L-Dopa, metronidazole, ...)</p>
<p>Blue Green</p> 	<p>Drugs / Dyes (propofol, fluorescein, triamterene)</p>

# Urine analysis

## I. Physical properties of urine: Color

**Alkaptonuria:** Rare inherited genetic disorder of phenylalanine and tyrosine metabolism. It is an autosomal recessive condition. It is due to a defect in the enzyme homogentisate 1,2-dioxygenase, which participates in the degradation of tyrosine.

جذله  
↳ Building up

## Odor

- Fresh urine is normally **aromatic (urineferous)**.

### Abnormalities:

Sweet

1. Fruity odor: uncontrolled DM & severe starvation

Amونيا

2. Ammoniacal odour: Urinary tract infection & Long standing exposed sample

جذله

Contamination اخذ العينات بوقت قصير و طرية و طراها

# Urine analysis

## I. Physical properties of urine: Reaction (pH)

- On **mixed diet**, it is **acidic**. Urinary pH varies between **4.5** and **8**, averaging between **5.5** and **6.5**.
- **Acidic urine:** - High protein diet due to excretion of excess phosphate and sulphate. - Ketoacidosis.
- **Alkaline urine:** - Vegetables and fruits. - Bacterial infection.

appearance ↙

Aspect: Normal urine is **clear (transparent)**.

- **On standing**, it turns **cloudy** due to precipitation of muco- and nucleoproteins and epithelial cells (present in traces in normal urine).
- It becomes **turbid and opaque** due to presence of **albumin**.
- **Exposed urine** is a good medium for bacterial growth as its pH becomes **alkaline**, resulting in precipitation of phosphates.

→ small amount

طلة تنز - بصر  
urine  
↓  
cloudy

خبات الحية  
بيرة ↙

بacteria

# Urine analysis concentration of urine kidney فريزاج

## I. Physical properties of urine: Specific gravity

- Normally it is 1.005 to 1.025.
- = density of the urine / density of water
- Ability of the kidney to concentrate urine

$$\frac{\text{urine density}}{\text{water density (1)}} = \text{urine density}$$

It varies *inversely* with the volume of urine, e.g.:

unconcentrated urine  
dehydration

- In diabetes insipidus, it is low (1.004).
- In fever, it is high (more than 1.030) due to small amount of urine.
- In diabetes mellitus, the specific gravity is 1.40 due to the presence of glucose.

\* very high gravity

# Urine analysis

## microscopic examination

- The examination includes:

### a) Organized elements

1-cells: RBCs, WBCs and pus cells, epithelial cells and neoplastic cells

2-parasites and ova: B, filariasis

3-bacteria, virus

5-casts.



### b) Non organized elements (crystalluria)

1-acidic urine: uric acid crystals, calcium oxalate.

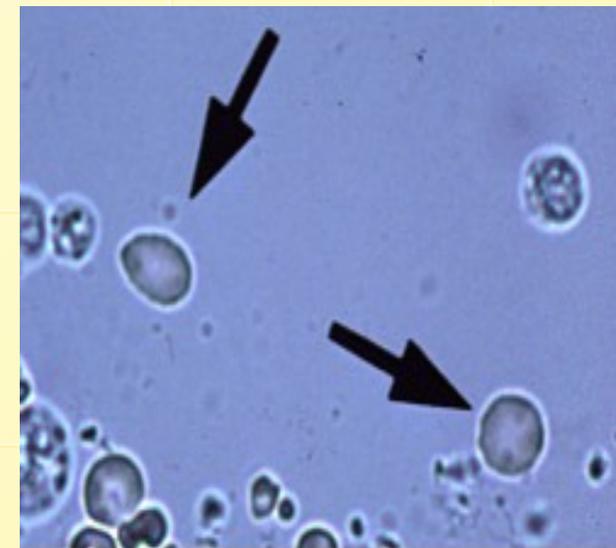
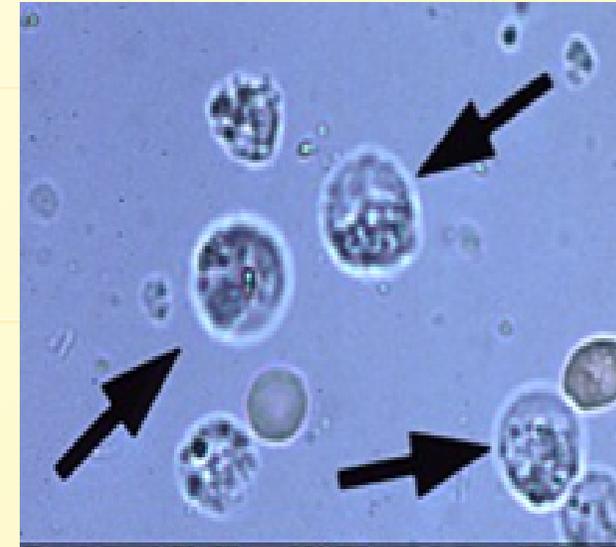
*↪ Pseudogout*

2-alkaline urine: <sup>Cd Crout</sup> amorphous phosphate, triple phosphate.

# Urine analysis

## microscopic examination: Cells

- **Pus cells:** *leucocytes*
  - Nucleus: disintegrated.
  - Normal urine contain from 2-4 pus cells.
  - Their presence in excess would point to infection and in such cases a culture of urine is indicated.
- **Red Cells:**
  - Nucleus: non-nucleated.
  - Normal urine contain from 0-2 red cells.
  - Their presence in excess is pathological and is due to the different causes of hematuria e. g. bilharziasis, urinary tumors, urinary stones or sometimes crystalluria.



nephron

- RBCs derived from the **glomerulus** are **dysmorphic** (they have been **distorted by their passage through the glomerulus**). RBCs derived from **tubular** bleeding (**tubulointerstitial disease**) and those from **lower down the urinary tract** (**urological bleeding** from the renal pelvis, ureters, or bladder) have a **normal shape**

## Dysmorphic Red Blood Cells



# Urine analysis

## microscopic examination: Cells

- **Epithelial cells:**
  - Shape: large irregular cells
  - Nucleus: large, intact and central.
  - Normal urine may contain few epithelial cells, but excess of these cells in urine is considered pathological and might point to the presence of an **inflammatory** condition.

*like interstitial nephritis*



# Urine analysis

## microscopic examination: Casts

سینا کی ال renal tubule کی ٹیوبوں

- The casts are the molds of renal tubules.
- **Normal urine** does not contain casts and so their appearance in urine is important and diagnostic for certain diseases.

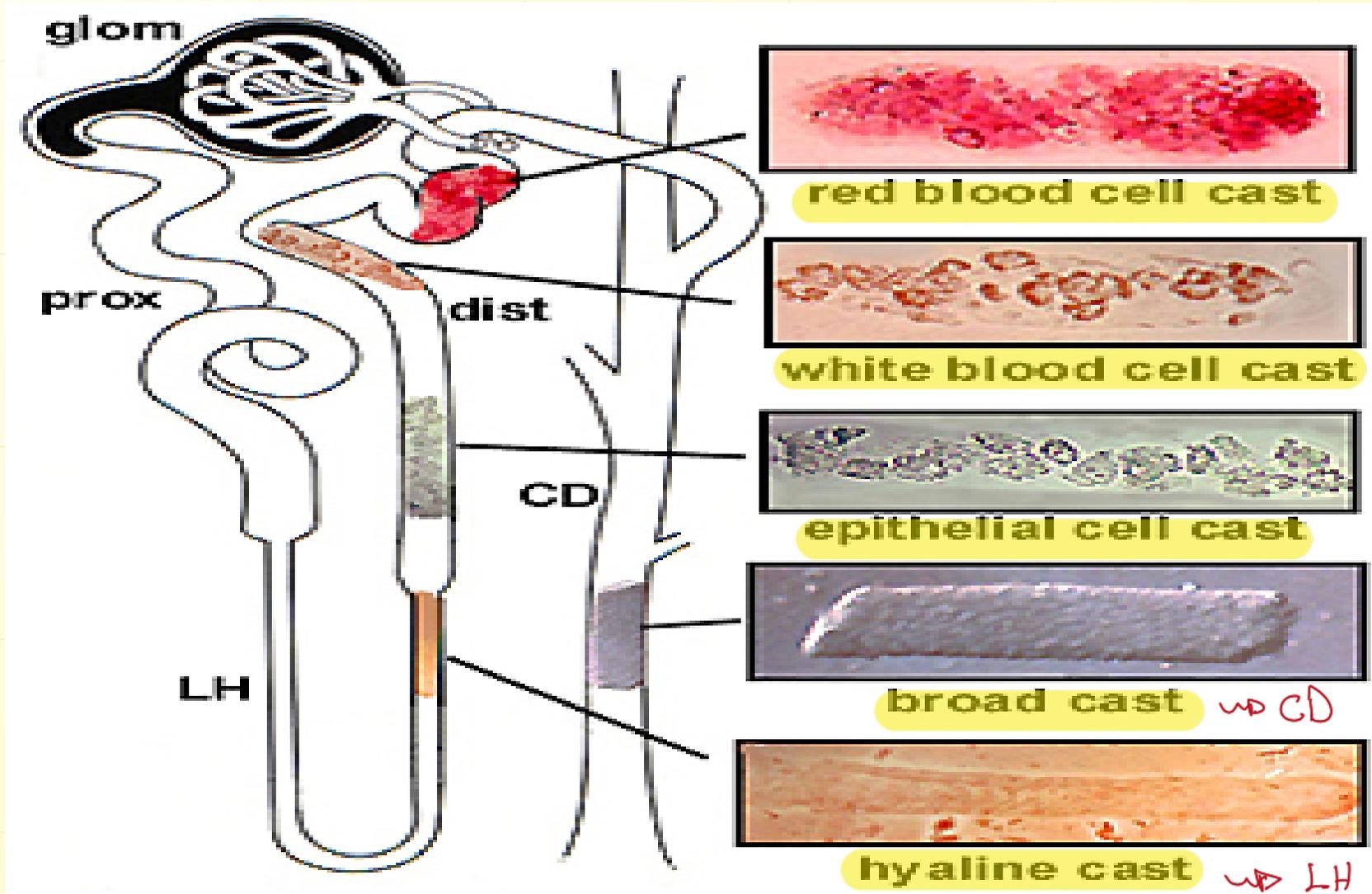
The material or cells that form a cast may have:

- come through a **damaged glomerulus**. RBC casts
  - been part of an **interstitial inflammatory infiltrate**. WBCs cast
  - have been **dead tubular cells**. اپنی casts
- The cast is expelled into the urine, and **maintains the shape of the tubule** in which it formed.
  - Casts reflect conditions of the **kidney proper** and **not the lower urinary tract**.

↓  
nephron

# Urine analysis

## microscopic examination: Casts



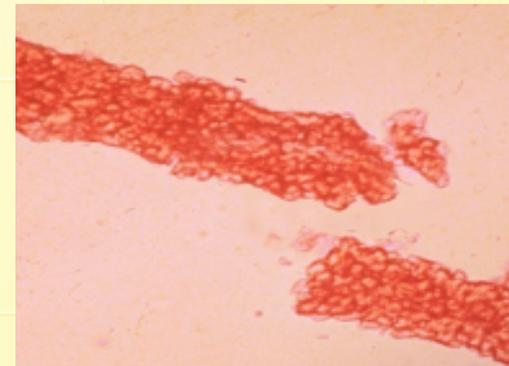
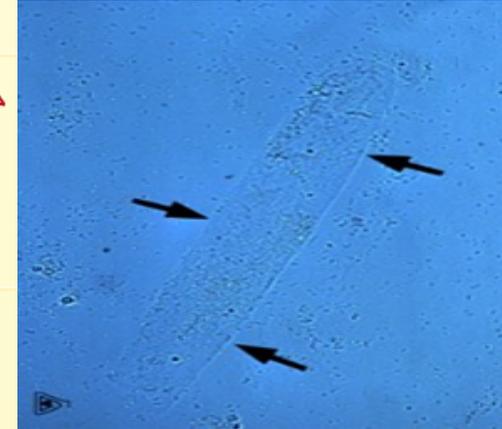
Type of  
Casts

$\rightarrow$  DT

# Urine analysis

## microscopic examination: Casts

- Hyaline casts:
  - They are colorless, homogenous and empty.
  - Excess of these casts may be present in any type of *nephritis* and also in *heart failure*.
- Blood casts:
  - Simply, they are hyaline casts full of red blood corpuscles.
  - They are present in *acute nephritis*.
- Pus casts:
  - They are hyaline casts full of pus cells.
  - They are present in *pyelonephritis*.



# Urine analysis

## microscopic examination: Casts

- Epithelial casts:

- They are hyaline casts full of renal epithelial cells.
- They are also present in acute nephritis.



EPITHELIAL CAST

- Granular casts:

- They are hyaline casts full of granules.
- They are present in chronic nephritis.



- Fatty casts:

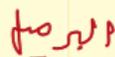
- They are hyaline casts full of oil globules.
- They are present in sub-acute nephritis.

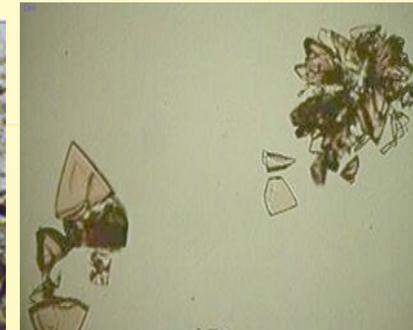
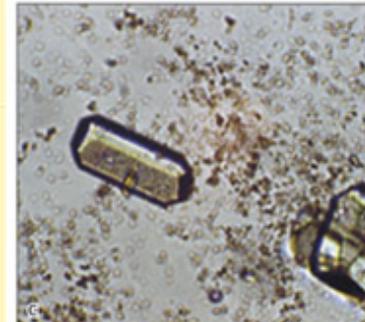
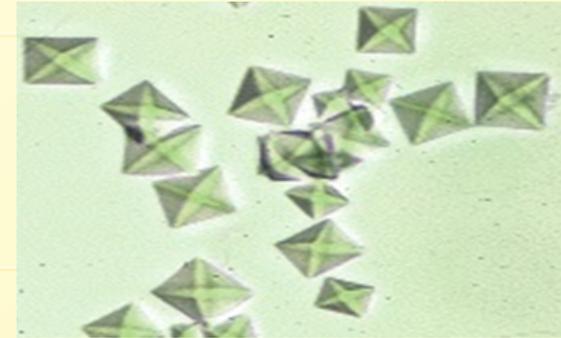


# Urine analysis

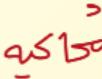
## microscopic examination: Crystals

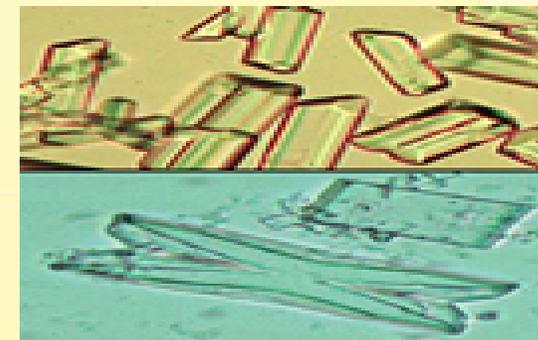
### Crystals in acidic urine:

- Calcium oxalate:
  - Shape: envelope shaped or in the form of dumb-bells. 
  - Color: colorless.
- Uric acid:
  - Shape: various forms e.g. rosettes or barrels. 
  - Color: brownish or colorless.

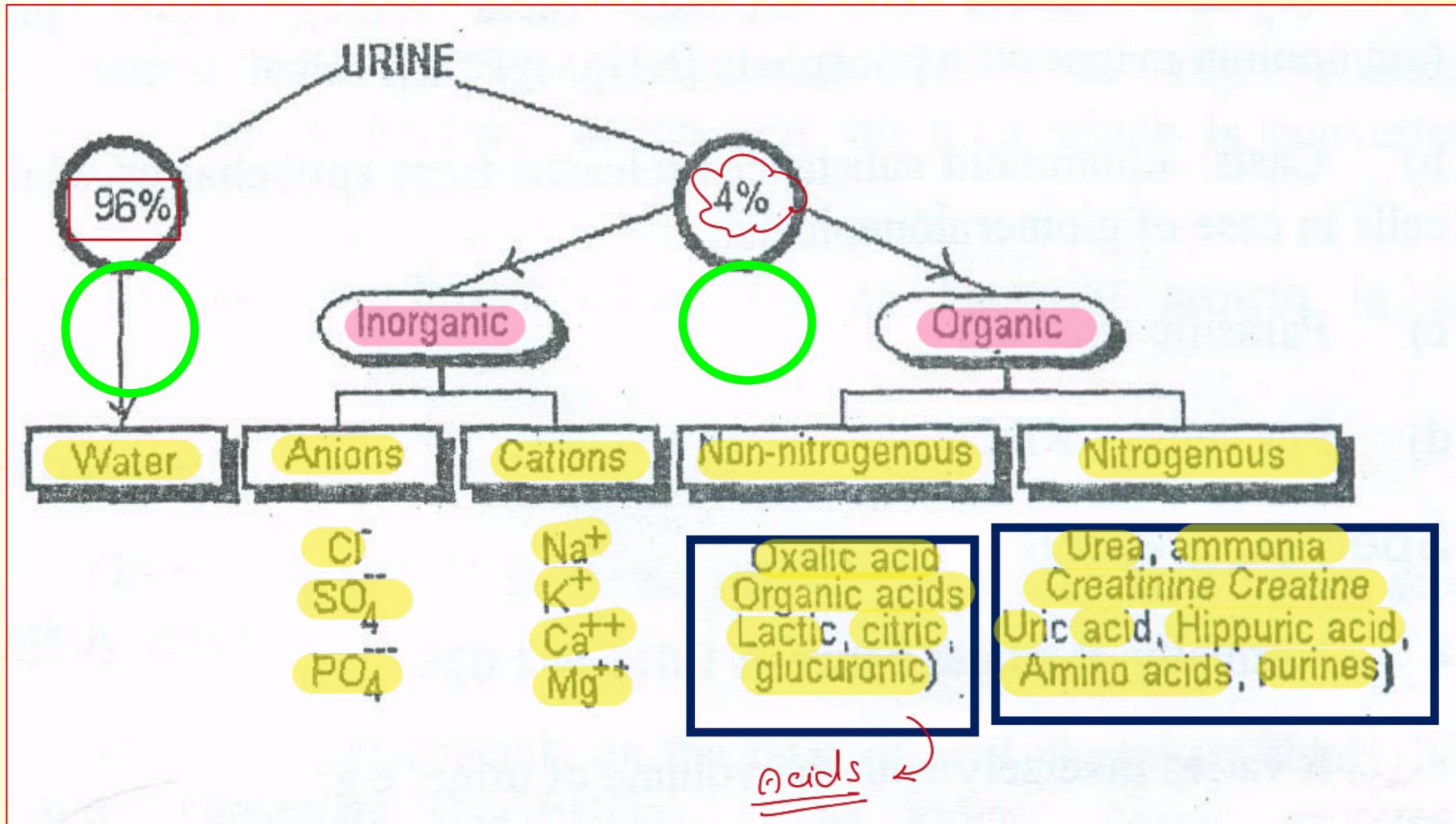


### Crystals in alkaline urine

- Triple phosphate:
  - Shape: prismatic 
  - Color: colorless



# Normal constituents of urine



دقيقة نتائج ان urine ونبينا different

color حسب الالوان

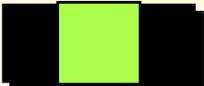
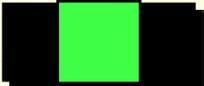
الموجوده في urine

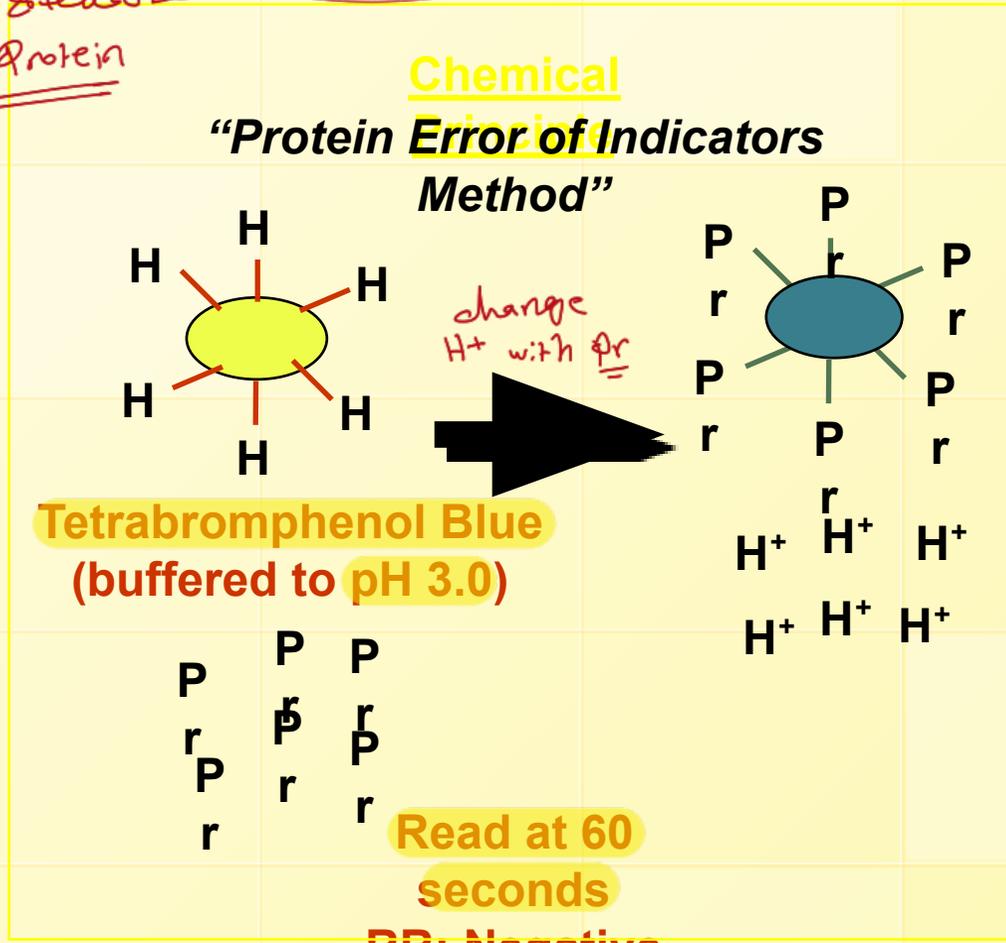
# The Urine Dipstick:

Protein Normally 150 mg/dL

subtle Protein

A dipstick test is based on a tetrabromophenol blue dye color

-  Negative
-  Trace
-  + (30 mg/dL)
-  ++ (100 mg/dL)
-  +++ (300 mg/dL)
-  ++++ (2000 mg/dL)



سوال ۱  
C

	Neg.	Trace 15	Small 70	Moderate 125	Large 500			
<b>Leukocytes</b> 120s	Neg.					cells/ $\mu$ l		
<b>Nitrite</b> 60s	Neg.		Positive Any degree of uniform pink color					
<b>Urobilinogen</b> 60s	3.2 Normal	16	32 +	64 ++	128 +++	$\mu$ mol/l		
<b>Protein</b> 60s	Neg.	Trace $\pm$	0.3 +	1.0 ++	3.0 +++	g/l		
<b>pH</b> 60s	5.0	6.0	6.5	7.0	7.5	8.0	8.5	
<b>Blood</b> 60s	Neg.	Non hemolyzed 10 Trace	Hemolyzed 10 Trace	25 Small	80 Moderate	200 Large	cells/ $\mu$ l	
<b>Specific Gravity</b> 45s	1.000	1.005	1.010	1.015	1.020	1.025	1.030	
<b>Ketone</b> 40s	Neg.		Trace 0.5	Small 1.5	Moderate 4.0	8.0 Large	16	mmol/l
<b>Bilirubin</b> 30s	Neg.			Small 17	Moderate 50	Large 100	$\mu$ mol/l	
<b>Glucose</b> 30s	Neg.	5 Trace	15 +	30 ++	60 +++	110 ++++	mmol/l	

# Abnormal constituents of urine

1. Proteins.
2. Sugars.
3. Ketone bodies
4. Bile
5. Blood
6. Porphyrins

# Proteinuria

↓ Proteinuria ← tubulointerstitial and glomerular diseases. → high proteinuria.

- Estimation of proteinuria helps in differentiating between tubulointerstitial and glomerular diseases.
- **Normally** excretion in most healthy adults is between 20-150 mg of protein in urine over 24 hrs.
- Proteinuria more than 3.5 gm/day is taken to be diagnostic of nephrotic syndrome.
- Panels of protein measurement including albumin, macroglobulin, IgG and β 2- microglobulin have been employed in differential diagnosis of prerenal and postrenal disease.
- It is recommended the use of the protein/creatinine ratio in 24 hour urine collection.

Pregnant women ↓ proteinuria

# Abnormal constituents of urine

## 2. Sugars

sugar	In urine	notes
<b>Glucose</b>	<b><u>glucosuria</u></b>	Normally not more than 1 g/day ① <b>diabetes mellitus</b> , when level of glucose in blood more than kidney threshold (180 mg/dl). <b>renal glucosuria</b> ” which is due to disorders of glucose reabsorption in tubules. even its level in blood is normal
<b>Fructose</b>	<b><u>fructosuria</u></b>	
<b>Galactose</b>	<b><u>galactosuria</u></b>	* <b>congenital galactosemia</b> (deficiency of galactose-1-phosphate uridyl transferase enzyme).
<b>Lactose</b>	<b><u>lactosuria</u></b>	pregnancy and lactation
<b>Pentose</b>	<b><u>pentosuria</u></b>	ingestion of food containing large amounts of pentoses. <b>congenital pentosuria</b> due to inability to metabolise L-Xylulose.

# Abnormal constituents of urine

## 3. Ketone bodies (ketonuria)

- Normally 3-15 mg are excreted in urine per day.
- Ketonuria is the presence of excessive amounts of ketone bodies in urine (acetone, aceto-acetate, 3-hydroxybutyrate).
- This may occur in:
  - uncontrolled diabetes mellitus DKA
  - prolonged starvation.
  - Aceto-acetate and 3-hydroxybutyrate are eliminated as salts thus depleting the alkali reserve which results in **acidosis.** \*

# Abnormal constituents of urine

## 4. Bile

- Bile pigments : appear in urine in **hepatic, obstructive and haemolytic jaundice.**
- Bile salts: Bile salts appear **only** in **obstructive jaundice.**

## 5. Blood

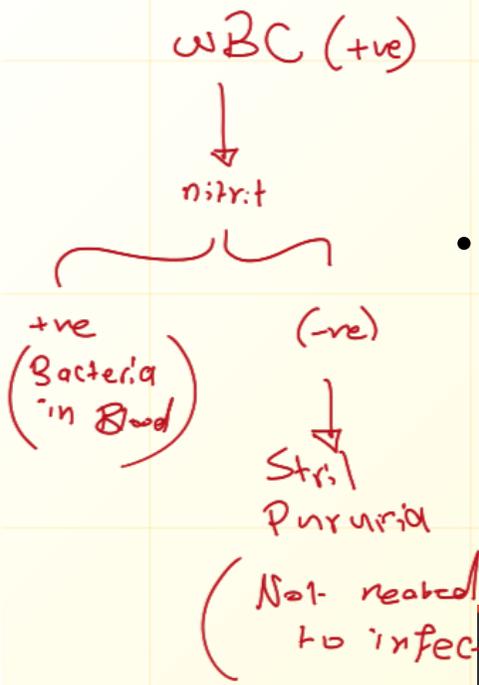
**Hematuria in:** - **blood diseases.** - **renal stones.** - **renal tumors.** ( **Microscopic > 3** )

**Hemoglobinuria:** which is **less** common, is due to **excessive** hemorrhage in the urinary tract.

## 6. Porphyrin

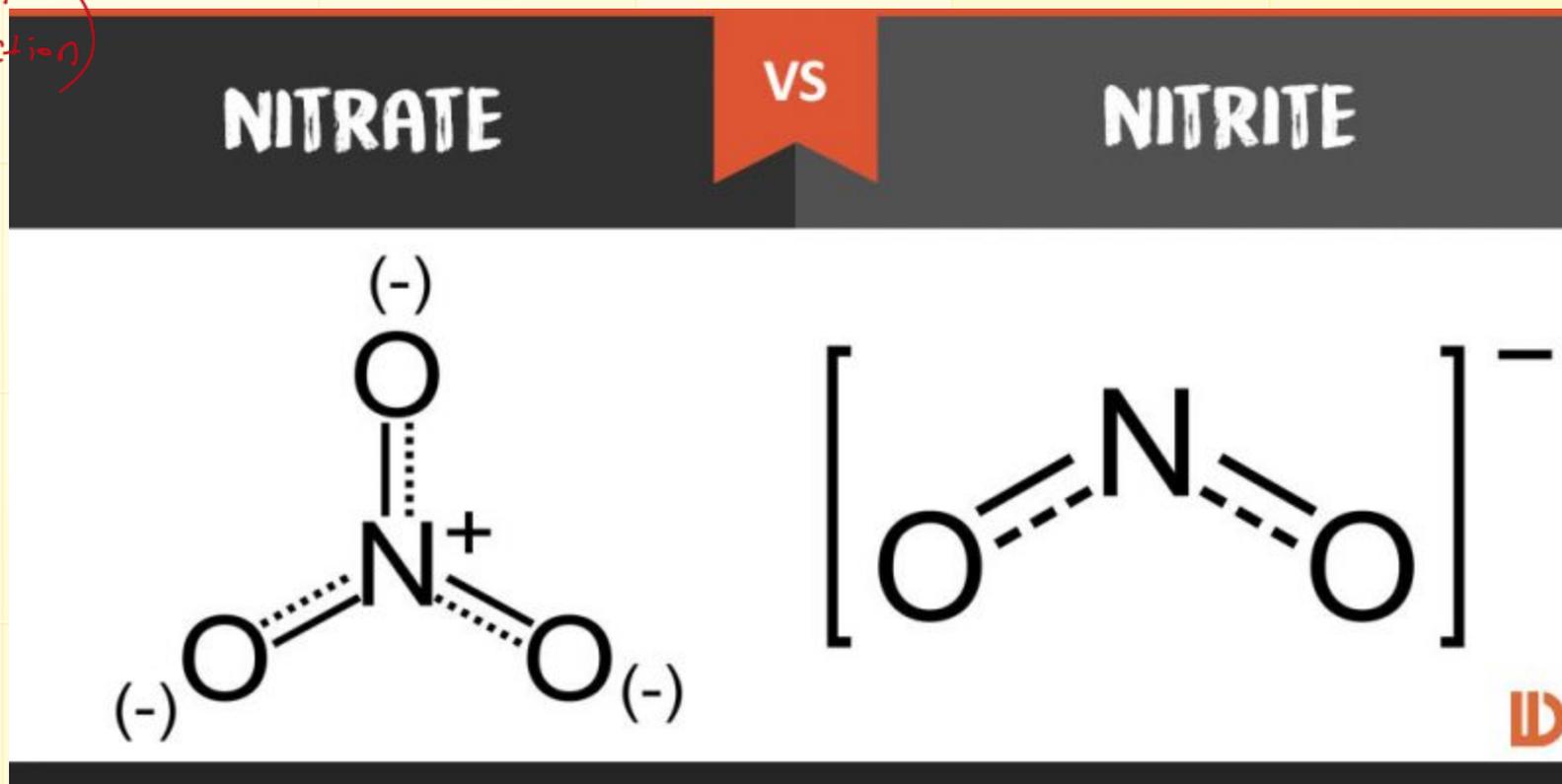
**Porphyrias:** the occurrence of **uroporphyrins** as well as **increased** amount of **coproporphyrins** in urine .

# Nitrite testing → infection??



- Nitrites in the urine suggest the possibility of **bacteriuria**. They are not normally found in the urine. Many species of **gram-negative bacteria** can **convert nitrates to nitrites**, and these are detected in urine by a **reaction with the reagents on the dipstick** that form a **red azo dye**. It is less accurate in urine containing **fewer than 105 organisms/mL**.

لانه قليل ممكن ما  
يرسل على وجود  
علائق نقل  
Culture



*Escherichia coli, Klebsiella, Proteus, Enterobacter, Pseudomonas*



*Staphylococcus, Streptococcus, Haemophilus*

# • White blood cells

- Leukocyte esterase activity detects the presence of WBC in the urine.
- **Leukocyte esterase** is produced by neutrophils and causes a color change in a **chromogen salt** on the dipstick. Not all patients with bacteriuria have significant pyuria. *WBC in urine*
- \* **False negatives** are due to concentrated urine, glycosuria, presence of urobilinogen, and consumption of large amounts of ascorbic acid. **False positives** are due to contamination

## Urine leukocyte esterase

Leuk. Esterase color chart



Reaction A:



Reaction B:



# Urinary cytology

- Causes of a positive cytology report :
- **Urothelial malignancy** ( transitional cell carcinoma [TCC], squamous cell carcinoma, adenocarcinoma )
- **Previous radiotherapy** [ especially if within the last 12 months ]
- **Previous cytotoxic drug treatment** [especially if within the last 12 months; e.g., cyclophosphamide, busulphan, cyscospirin]
- **Urinary tract stones**

# URINALYSIS

Reference  
Range

Normal  
urine

Name: \_\_\_\_\_ Date: \_\_\_\_\_

Appearance: Clear Blood: 0-2 RBCs

Color: yellow Bilirubin: Negative

Protein: ≤150 mg/d Ketones: None

Spec Grav: 1.005-1.025 Glucose: ≤130 mg/d

Sediment: \_\_\_\_\_ Urobilinogen: 0.5-1 mg/dL

Bacteria: None RBC: ≤2 RBCs/hpf

WBC: ≤2-5 WBCs/hpf Crystals: Occasionally

Casts: 0-5 hyaline casts/lpf Epithelium: ≤15-20 cells/hpf

pH: 4.5-8 Nitrite: Negative

# IMAGING STUDIES

**Done by: Abdallah Dalal**

# TOPICS

**1- Ultrasound**

**2- Plain abdominal radiography (KUB)**

**3- Intravenous pyelography (IVP)/(IVU)**

**4- Voiding cystourethrography [ VCUG ]**

**5- Urethrography**

**6- Retrograde pyelography**

**7- CT**

**8- MRI**

# ULTRASOUND

- Non-invasive method.
- Painless and safe.
- Provides good images of the **kidneys and bladder** but poor images for the ureter.

## Uses of ultrasound:

### 1-Renal:

- Assessment of hematuria
- Determination of nature of renal mass [ **cystic** . **Solid** ]
- **Hydronephrosis** .
- Allows **ultrasound-guided nephrostomy** insertion [ hydronephrosis , infected or obstructed kidneys , renal impairment ].

### 2-Bladder

- Measurement of **post-void residual urine volume**.
- Allows **ultrasound-guided** placement of a **suprapubic catheter**

### 3-Prostate:

- transrectal ultrasound (TRUS) <sup>for</sup> (Prostate)
- Measurement of prostate size
- To assist prostate biopsy
- Investigation of azoospermia (can establish the presence of ejaculatory duct obstruction).

### 4-Urethra

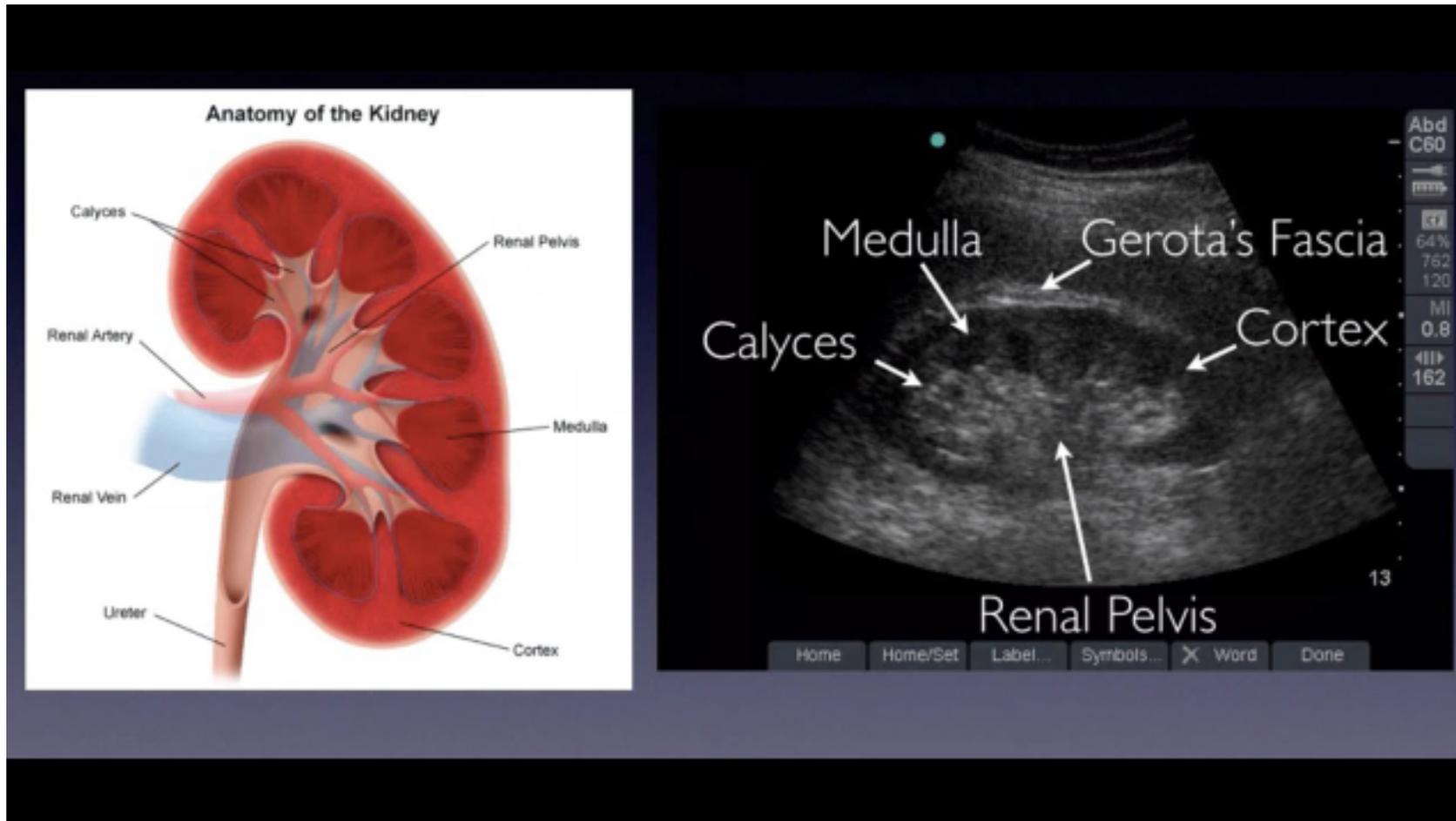
- Can image the urethra and establish the depth and extent of spongiofibrosis in urethral stricture disease.

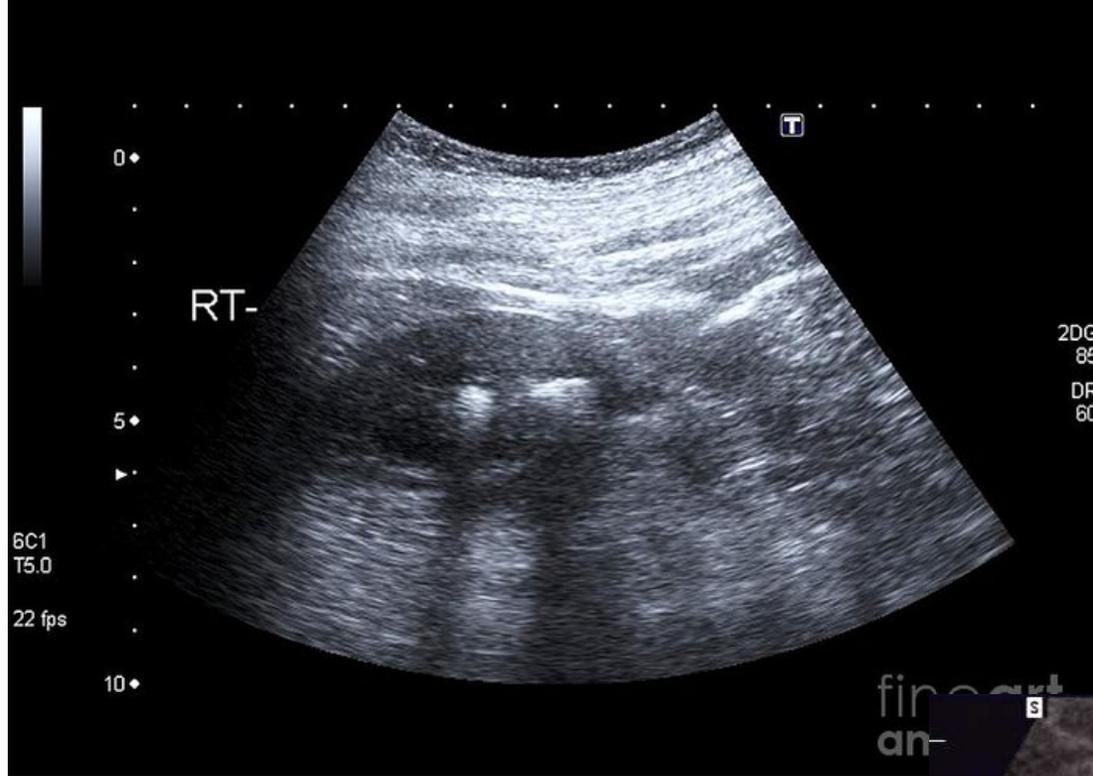
US in urethrography  
US in urethra (US)

### 5-Testes

- Assessment of the patient complaining of a lump in the testicle (or scrotum).
- When combined with power Doppler can establish the presence or absence of testicular blood flow in suspected torsion.
- Assessment of testicular trauma.
- Investigation of infertility — varicoceles and testicular atrophy may be identified.

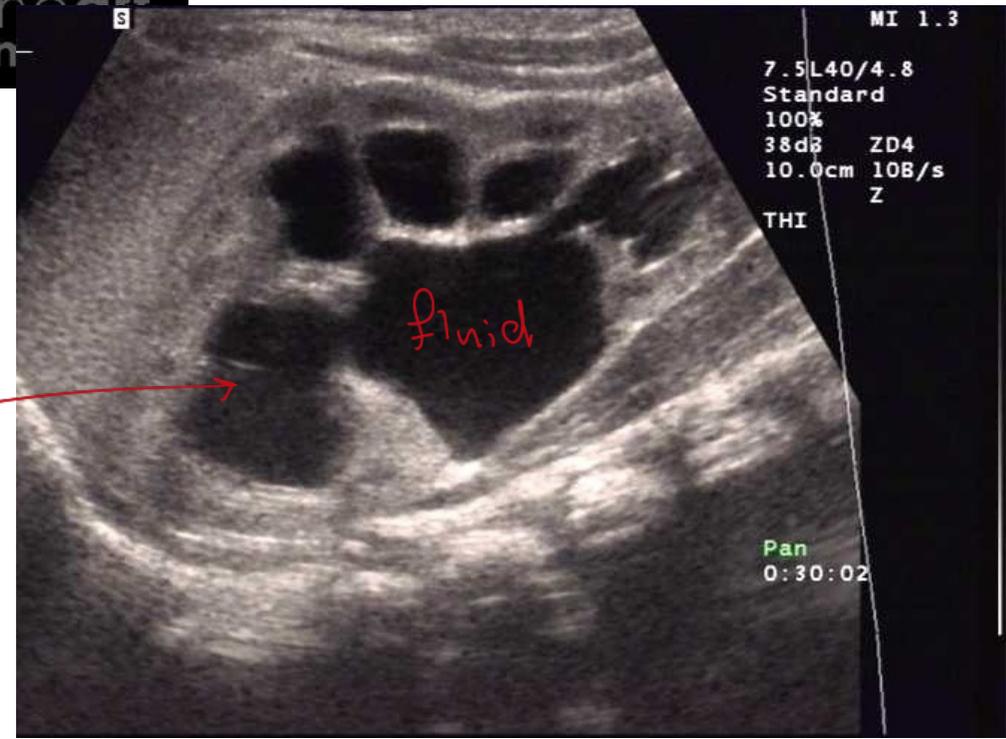
# NORMAL RENAL ULTRASOUND





# Kidney stones

# Hydronephrosis



# PLAIN ABDOMINAL RADIOGRAPHY (KUB)

ureter  
Kidney Bladder

- Requires special **preparation**.
- Used as initial test for detection of **urinary stones**.
- **Not useful in uric acid stones** and **small stones**.
- Affected by **bowel gases**.

**Note:** there are other opacities that may be confused with stone. (**calcified lymph nodes** or **phleboliths**)



Stone in vein

Bladder

تفريقه بين ابيض و البصير في منطقة Bladder

لا لازم يكون واضح

تفاوت

- **Differences between KUB and plain abdominal xray**

1- from xiphoid to suprapubic

2- psoas shadow is seen

3- need preparation

4- most common type of renal stones > calcium oxalate

# INTRAVENOUS PYELOGRAPHY (IVP)/(IVU)

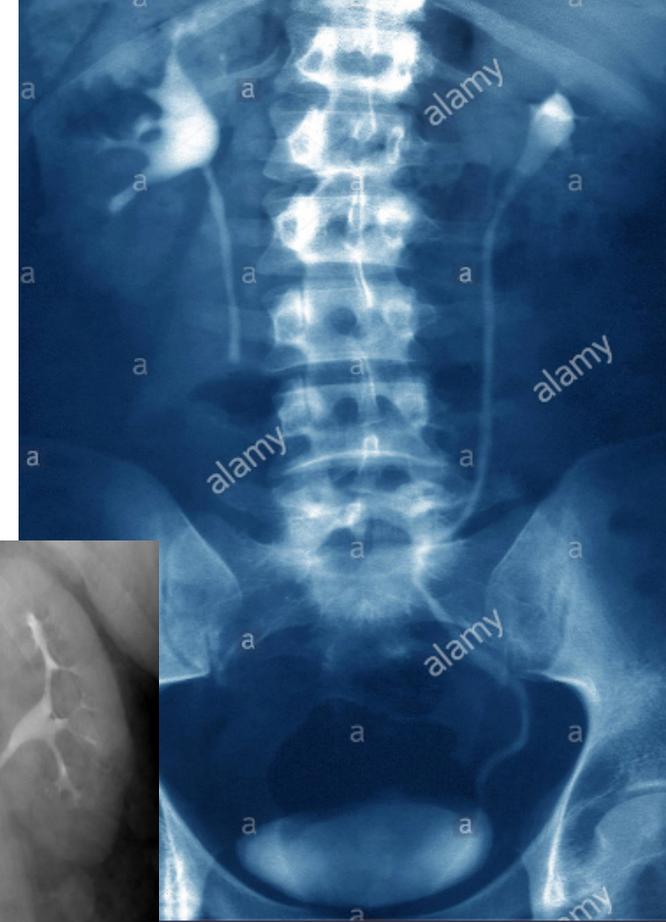
- Is a radiological procedure used to visualize abnormalities of the urinary system, including the kidneys, ureters, and bladder by using intravenous contrast.
- After a preliminary control film of the abdomen, 50ml of contrast medium is injected intravenously.
- Films after 5, 10, and 15 minutes are taken and reveal contrast in the pelvi-calyceal systems, ureters, and in the bladder.
- Post-micturition film is taken to assess bladder residual volume.

# USES OF IVP

- Haematuria.
- Renal colic.
- Suspected stone in the ureters.
- Renal trauma.

## Side effects of administration of intravenous contrast media :

- These occur in 1% of patients given nonionic and 5% given ionic contrast media.
- **anaphylactic reaction** — hypotension with flushing of the skin (marked peripheral vasodilatation).
- **edema** (face, neck, body, and limbs), bronchospasm, and urticaria.
- Rarely, cardiac arrest can occur.



my stock photo

www.alamy.com

# VOIDING CYSTOURETHROGRAPHY (VCUG) (MCUG)

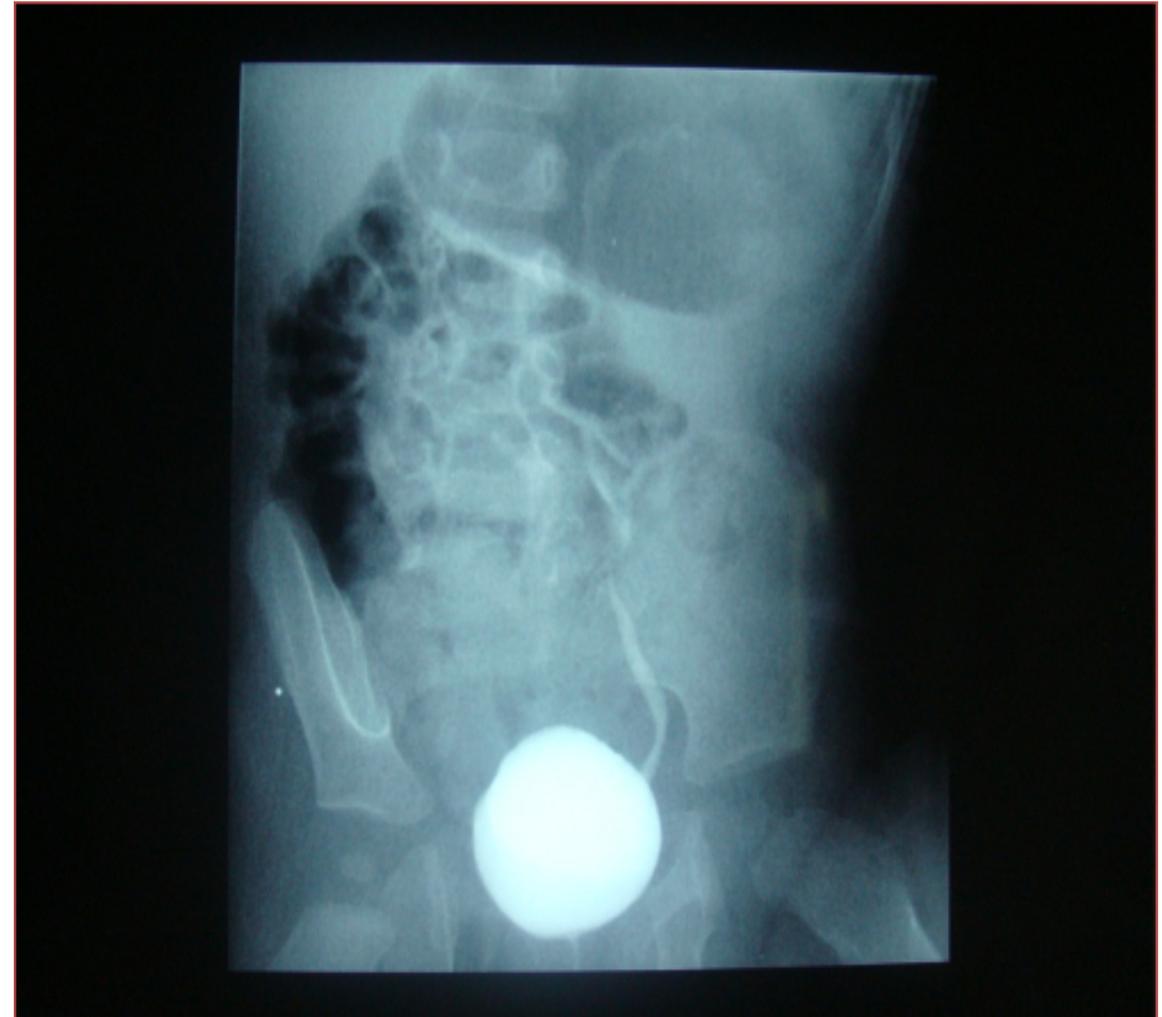
- Is the study of the urinary bladder and urethra with contrast medium.
- The bladder is filled with contrast via a urethral catheter. Films of the bladder are obtained.
- After removal of the catheter, patient is asked to void and films are taken during micturition to assess the bladder neck and urethra, as well as reflux. (VUR)

↪ from ureter  
to kidney

## **Reflux have five degrees:**

1. **to lower ureter.**
2. **to ureter and kidney without hydronephrosis.**
3. **mild hydronephrosis.**
4. **moderate hydronephrosis.**
5. **severe hydronephrosis.**

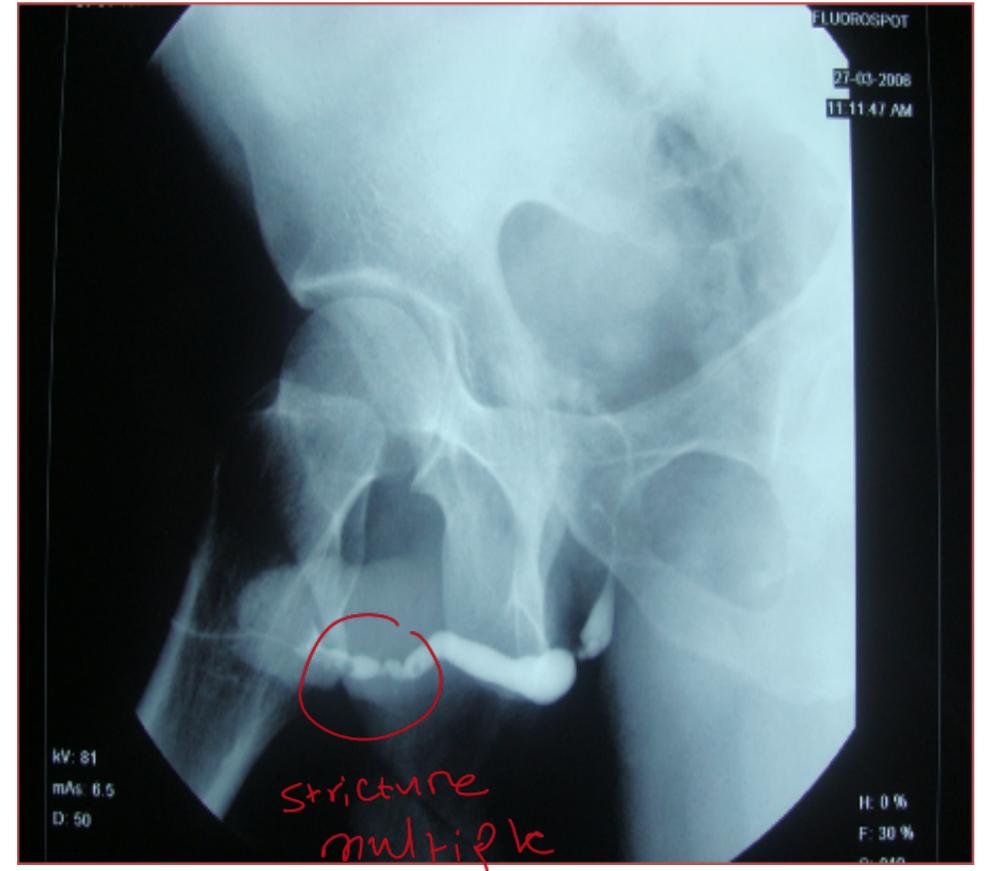
Stage 2 reflux



# URETHROGRAPHY

- The adult male urethra can be studied by **ascending urethrogram**.
- Contrast is injected through foley catheter inserted into the **meatus**.
- Films are taken to the urethra in **oblique position during contrast injection**.
- The most common indication for urethrogram is **urethral strictures**.

Multiple urethral strictures



# RETROGRADE PYELOGRAPHY

*From ureter to kidney*

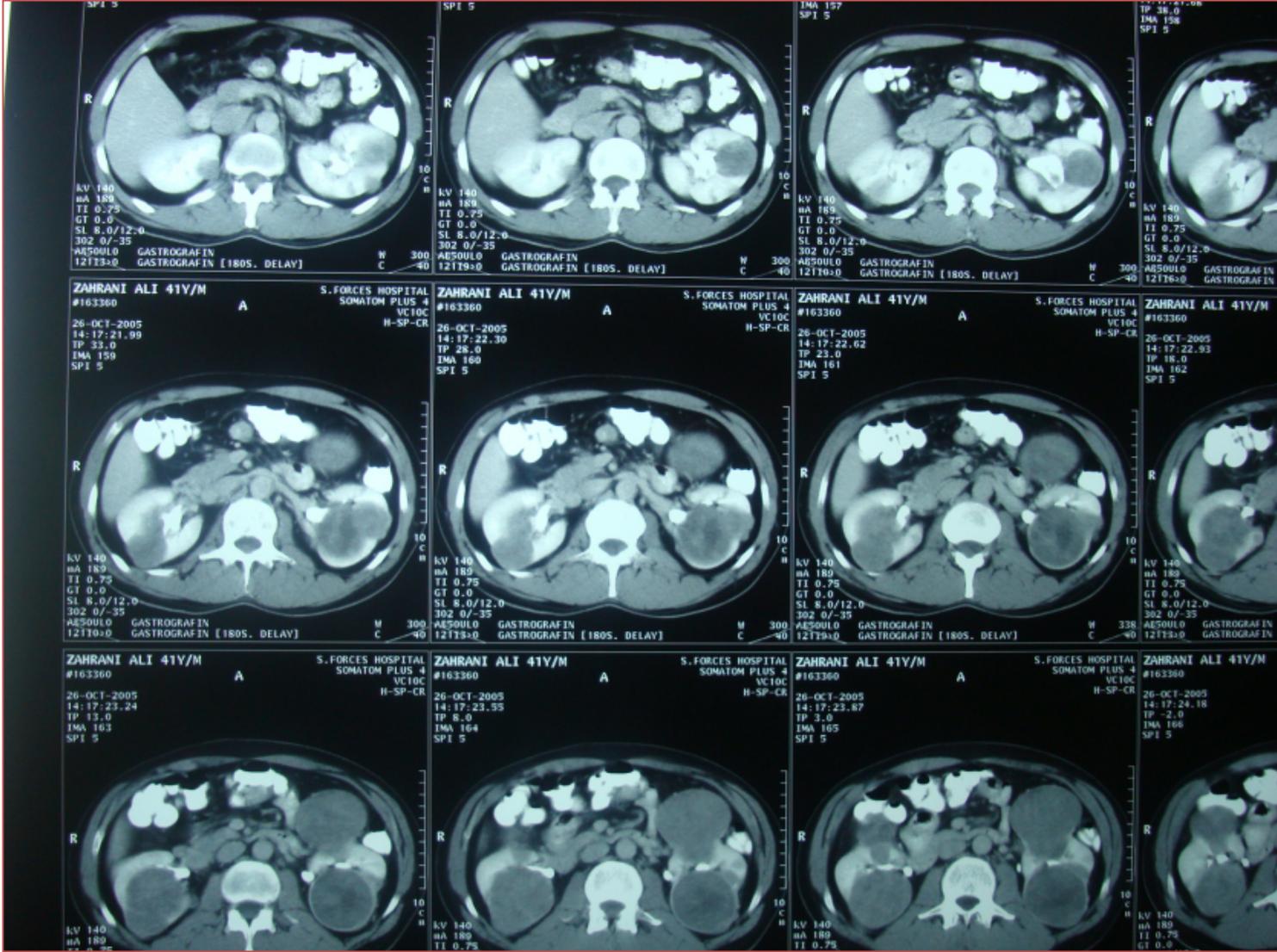
- This study consists of **retrograde** instillation of contrast into the ureters by a ureteric catheter inserted into the ureter via a cystoscope.
- detection of ureteric and renal pelvic TCCs or radiolucent stones in patients with persistent hematuria in whom other tests have shown no abnormality.
- diagnose the presence and site of ureteric injury (**obstruction**, **ureteric leak**) in cases of **ureteric injury** (e.g., after hysterectomy or caesarean section).

# CT SCAN

**CT** is excellent modality for assessment of:

- Renal masses.
- Obstruction.
- Retroperitoneal disease.
- Staging of renal and bladder neoplasms.
- Tumor invasion into the renal vein or IVC
- Evaluation after trauma or surgery.

# BILATERAL RENAL CELL CARCINOMA



# MRI

## When should MRI be used to evaluate the kidneys?

When a **renal mass** or **abscess** is suspected but **intravenous contrast cannot be administered**, because of either **contrast allergy or abnormal renal function**, in this case MRI can be performed.

**Gadolinium**, the contrast agent for MRI, can be safely administered in such circumstances.

# \* LEFT RENAL CELL CARCINOMA

