

Urinary Stones

- * 1/90 of urinary stones are radiopaque
- * 1/17 of people who have stone disease ^{due to} metabolic disorder
[Hypercal: ارتفاع الكالسيوم]
- * main cause of urinary stone disease is dehydration
- * commonest stone is Ca oxalate
- ~~2nd commonest~~ * Ca containing stones $\rightarrow$ oxalate
 $\rightarrow$ phosphate

[1] * Ca oxalate 1/75

- ↳ Radio-opaque (X-ray عكس)
- ↳ consist in wide range of urinary pH.
- ↳ underlying met disorder
- ↳ 1/25 no met. disorder (لا يوجد اضطراب أيضي)

[2] * Ca phosphate stones:

- ↳ Incidence is less than Ca oxalate
- ↳ always associated with met abnormality
- ↳ أسباب Ca. ph. stones: ① Hyperparathyroidism
② Renal tubular acidosis
[most common RTA has Ca phosphate stones is RTA type 1]

[hypokalemia
met Acidosis
Urinary pH > 6] treat

③ Medullary sponge kidney

- ↳ Drug abuse as: Carbonic anhydrase inhibitors (Acetazolamide)
glaucoma ارتفاع ضغط العين
- Topiramate
migraine صداع نصفي

- ↳ Formed at alkaline pH
- ↳ Radio opaque on Xray

[3] Struvite Stones (Triple phosphate stones):

- MAG → magnesium, Ammonium, phosphate
- associated with infection by urea splitting organism (urease producing organisms) : as *Klebsiella*, *proteus*
- [Ammonia ← urea splitting by urease producing organism] [منه ← يفتت اليوريا بـ إنزيم اليورياز]
- & Bicarb → Alkalinization → stones [معدن الحصى]

Ps :: *E. coli* & *Pseudomonas* extremely rare to be urease producing

- *E. coli* 1/89 of UTI causes

↳ Alkaline urine

[4] Uric acid stones 1/6

- ↳ 1/50 of cases idiopathic
 - ↳ > 1/50 of cases associated with normal serum and urinary uric acid
 - ↳ $\downarrow$ solubility of uric acid [تقليل ذوبانية حمض اليوريك]
 - ↳ Acidic pH.
- So target is (control Alkalinization)

[5] Cystine stones

- ↳ Faint radio opaque stones
- ↳ very hard
- ↳ has resistance to ~~ESWL~~ ESWL (extracorporeal shock wave lithotripsy) [لا يتأثر بالموجات الصادمة] (Adduction, Anesthesia)
- ↳ Autosomal Recessive defect
- [defect in Renal Reabsorption of some Aminoacids COLA (cystine, ornithine, lysine, Arginine)]
- stones [حصى] cystine [سليكون] & [لا يذوب في الماء] Soluble in AA
- ↳ Acidic urine
- ↳ Management: Alkalinization (target pH 7-7.5)

* Rare stones

① Ammonium acid urate

- Associated with malabsorption
- Mcc of AAU is laxative abuse

② Drug Induced stones as triamterene (K-Sparing)

③ Indinavir ∴ protease inhibitor drug

- Antiviral drug
- Used in tt of HIV

لیگنڈ → سبب

(PS): Imaging of choice for radiological evaluation for stones is CTU without contrast

[CTU show all the types of stone, even very small < 3mm
except indinavir stone can't be visualize)

- ④ Matrix stone :
- radiolucent
 - Alkaline urine
 - small stones
 - organism → proteus

* Causes of stone formation:

→ Mcc is dehydration

- others :
- Hereditary disorders (RTA1)
- Cystinuria → AR
- Drugs: Allopurinol may lead to zanthin stones

- Acidic pH
- tt: extraction of stone

* oxaluria → dietary

→ Hepatic ∴ bcz liver is responsible for synthesis and met of oxalate

- Alanine glycooxalate aminotransferase enzyme → hyperoxaluria

* Alanine glyco oxalate amino transpherase enzyme:

- dif. lead to hyperoxalurea
 - Co factor of it is B6 (pyridoxine)
 - Primary hyperoxaluria → precipitation in liver, kidney → Renal failure → need kidney transplantation
- بما قبل أنك تشبه راجل liver transplant

hyperoxaluria - لو شكت في عين عينا
Progressive stone formation - غابة بون young age
Deterioration of kidney function -

Confirm C is liver Biopsy - أول استي عمل له
Dx
kidney transplant liver transplant -

نقص فيتامين C
causes it

* vit C → Met. to Oxalate
[عن الالفه من]

* Life style and ~~den~~ immobilization (star) ?
b/c it's associated with Demineralization of the Bone
HyperCa

* thiazide: → used to treat hypercalcemia
b/c it's ↑ Absorption of Ca in proximal & distal tubules + Inhibit of Na reabsorption
→ SE: - Hypokalemia → Acidosis
Hypocitruemia

thiazide نستخدمه
For prevention to stone related hypercalcemia
Alkaline as first
K-Citrate

* UTI $\rightarrow$ urease producing organism

[Acetohydroxamic acid] $\rightarrow$ Inhibits urease enzyme

extraction

* GI causes: $\rightarrow$ UC, CD (IBD)
Short Bowel syndrome
 $\rightarrow$ cause enteric hyperoxaluria

* Hypercalcaemia:

[الحماض]

- $\rightarrow$ Absorptive Hypercalcaemia $\rightarrow$ $\uparrow$ Intestinal Absorption of Ca
- $\rightarrow$ Renal hypercalcaemia $\rightarrow$ $\downarrow$ Ca reabsorption in nephron
- $\rightarrow$ Resorptive Hypercalcaemia $\rightarrow$ the only type that has surgical management
 $\rightarrow$ caused by hyperPTH.
- $\rightarrow$ Hyperuricosuria $\rightarrow$ Associated with uric acid stones
- $\rightarrow$ Hypocitraturia $\rightarrow$ Associated with wide range of urolithiasis
as uric acid stones, Ca oxalate stones

* Hypercalcaemia:

[PS 1/2] $\rightarrow$ $\rightarrow$ $\rightarrow$

types $\rightarrow$ Absorptive
 $\rightarrow$ Renal leak
 $\rightarrow$ Resorptive

* Hyperuricosuria:

$\rightarrow$ 70% dietary, $\rightarrow$ 30% overproduction
 $\rightarrow$ in myeloproliferative diseases
!! like potatoes -
- excessive uric acid
• Storage diseases
• Malignancy

(5)

* Cystinuria:

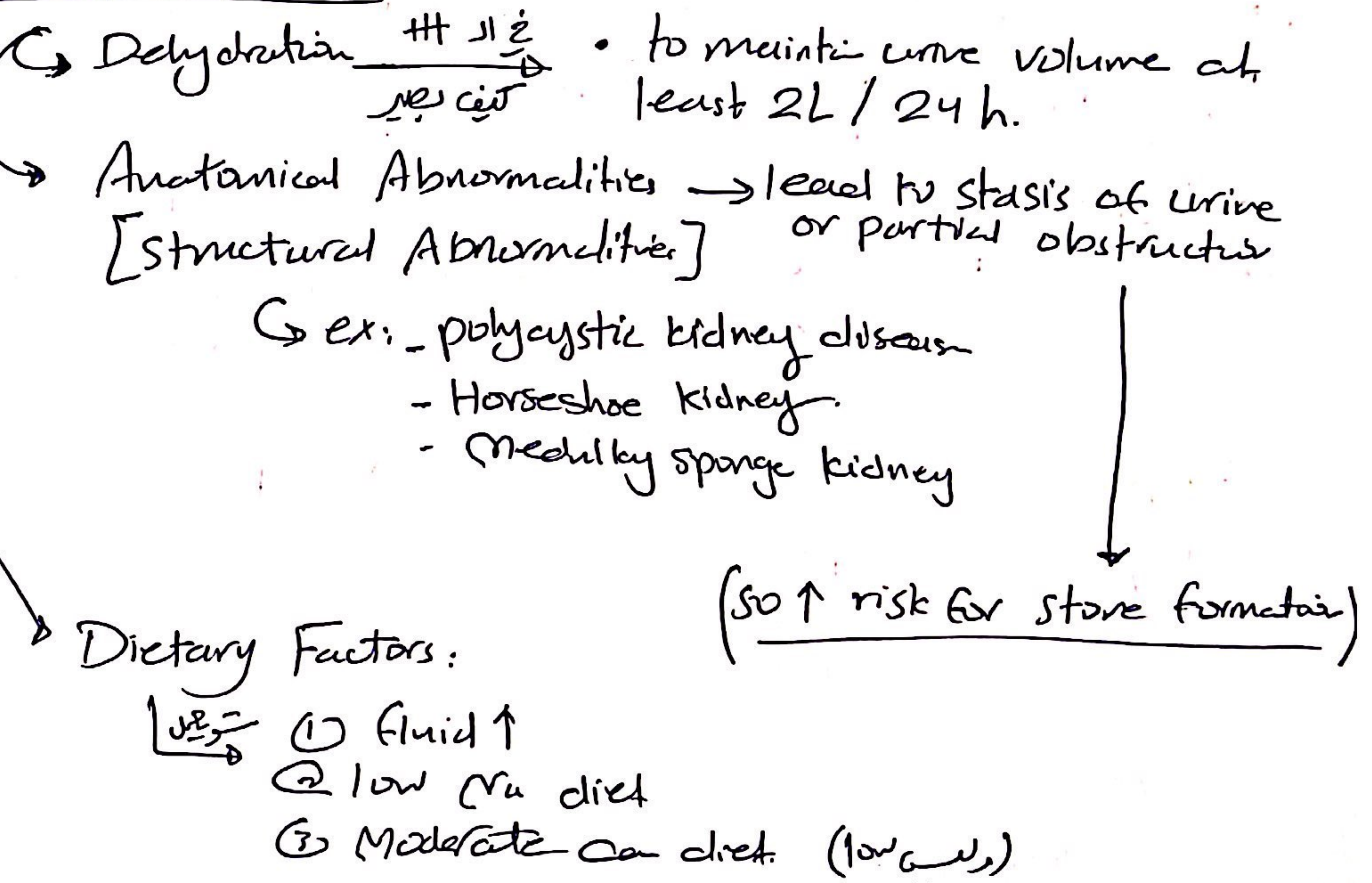
- AR defective leading to Impaired reAbsorption of AA Cystine ——— (COLA)

• لماذا يتكون الحصى why stones form

* Key point in stone formation is Supersaturation.

- Oxalate : محفز promoters of crystallization
- Urate
- Calcium

* Etiological Factors



⑥

* Approach:

- ① History
- ② Examination
- ③ Investigation
- ④ Management

* History:-

- Symptoms are related to location of stones
- Upper uretric stones $\rightarrow$ Flank pain radiated to groin
- Mid uretric stones $\rightarrow$ pain radiated to Flank laterally
(Mimicking diverticulitis, cholecystitis)
- Lower uretric stones $\rightarrow$ associated with irritative lower urinary tract symptoms as frequency, nocturia, urgency.

* Attack of the pain (episode) lasts 45 min.

* pain caused by $\frac{\text{obstruction}}{\text{obstruction}}$ impacted stone $\rightarrow$ back pressure effect $\rightarrow$ distension in renal capsule $\rightarrow$ $\uparrow$ hydrostatic pressure

- Sites of stone impaction at ~~urethra~~ ^{ureter}
 - $\rightarrow$ • Junction b/w pelvis & ureter
 - $\rightarrow$ • where ureter crossing iliac v.
 - $\rightarrow$ • Uterovesical junction

* Associated Symptoms:

- Hematuria (microscopic $\bar{w}$ ic)
- Nausea & vomiting.
- Signs & symptoms of complications:
 - Infection. (Fever, --)
 - Obstructed pyelonephritis
 - Sepsis etc etc

⑦

* Complications of stone disease :-

- complete obstruction $\rightarrow$ Back pressure effect
- long standing obstruction $\rightarrow$ Hydronephrosis & thinning of parenchyma
- Bilateral stone disease $\rightarrow$ AKI
- Infection / sepsis

(Anuria: $< 0.5 \text{ ml/kg/h}$
or $< 400 \text{ cc/12h}$)

* Examinations :-

* general examinations-

- $\hookrightarrow$ Assessment of Hydration status : lips, axilla...
- Fever signs on patient
- Neck swelling ? (bcz of $\uparrow$ PTH)

* local examination:

- $\hookrightarrow$ - costovertebral angle tenderness
- palpable mass $\rightarrow$ In late presentation
- suprapubic swelling $\rightarrow$ If there is impacted stone at urethra

* Investigations

* Laabs :

- urine analysis $\begin{cases} \text{PH} \\ \text{RBC} \\ \text{WBC} \end{cases}$
- urine culture
- CBC (leucocytosis or not)
- KFT (If there is indication For urgent Intervention or not)
- If $\uparrow$ KFT $\rightarrow$ electrolytes (K)

(8.)

* Imaging :-

→ CT non contrast → (1) very sensitive
(2) Accurate characterization for kidney stone :
• (کن) → US (اذا لمتنا اتي) → CT

- Size
- location
- degree of hydronephrosis
- Anatomy of it
- location of ureter
- density of the stone

(اذا كنت تفضل مع كعب :-)

Bone / + 1000

air / - 1000

soft tissue / 10-30

stone / (كعب)

→ US ⇒ US is the imaging of choice in pediatric & pregnant
→ (كعب) :-

- operator dependent
- visualize stone if it is in kidney, bladder

(لكن اذا كان في ureter فلا يري)

او لربح complication احشترق او complication

- not accurate in assessment of size of stone

- In pregnancy → there is physiological hydronephrosis most commonly on Rt side.

مجبور لو احببت ان تميز بين hydronephrosis و كعب احشترق
اعرف هل هو physiological و patho. !

- X-ray

9

transabdominal
trans vaginal US urine jet

* If urine jet is absent on US, so ureter is obstructed mostly bcz of pathological cause [not physiological]

* X ray spine KUB [kidney, ureter, Bladder]
RUT [kidney urinary tract]

* Radioopaque stones ? X ray

- As:
- Ca stones
 - Struvite
 - cystine (but faint)

* stones missed in KUB: - Radiolucent stones

- Uric acid stones
- Ammonium acid urate
- Matrix stone
- Indinavir
- triamterene

! لول
Lool

* قبل CT كيف كانوا يشعروا الحيا؟

- (US) Hydronephrosis

(KUB) stone

لكن لو كانت Radiolucent كيف به يشعروا؟

By IVP Filling defect

but there is dx Stone
tumor

لكن دماغ
أبداً

* Imaging modality of choice for stones is CT without contrast

* Management of Stone diseases:

* Indication for urgent Ht:

↳ ① Obstruction & Infection → Urgent decompression

- Stone في شل أو Stone كمن في حوض أو Compression في

pyonephrosis or Hydro

- (double J stent) or Nephrostomy tube

↓
- General Anesthesia

↓
- Local Anesthesia
- Contraindicated if the patient is Anticoagulated
- preferred if the patient has sepsis.
- Morbidity ↑

↳ ② Obstruction in solitary kidney, or Bilateral obstruction

↳ ③ Patient can't tolerate oral fluids (persistent vomiting) →

AKI because of pre renal / dehydration

• Renal / NSIADS

• post renal / Obstruction

↳ ④ No response for ordinary Analgesia.

* Management depends on

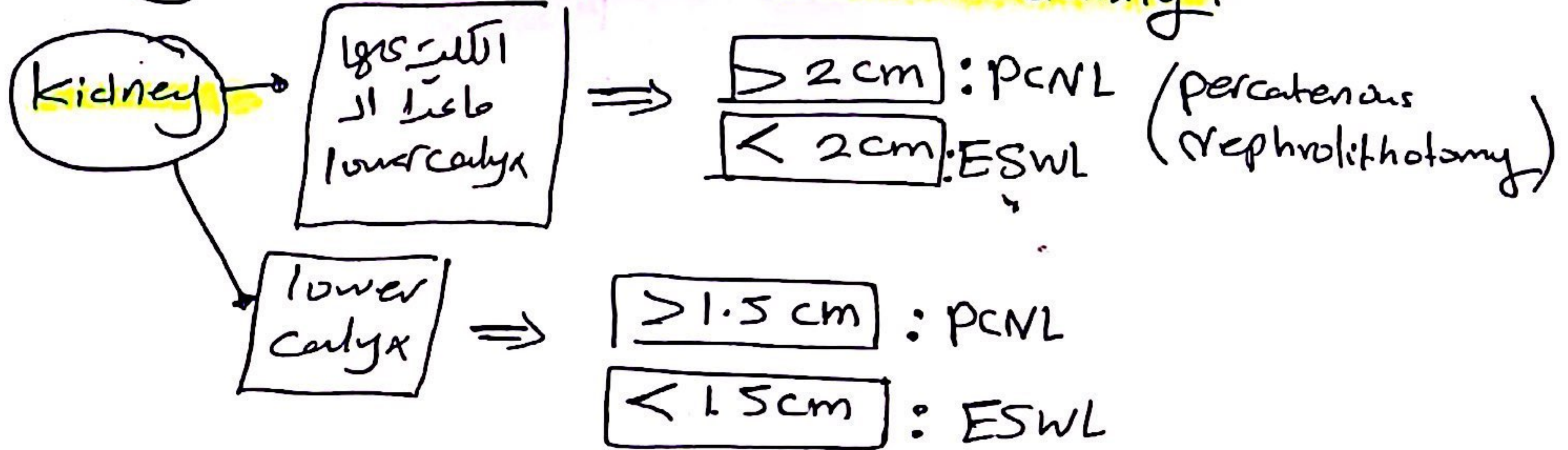
- ① Size
- ② Location of the stone.
- ③ density

وأيضاً

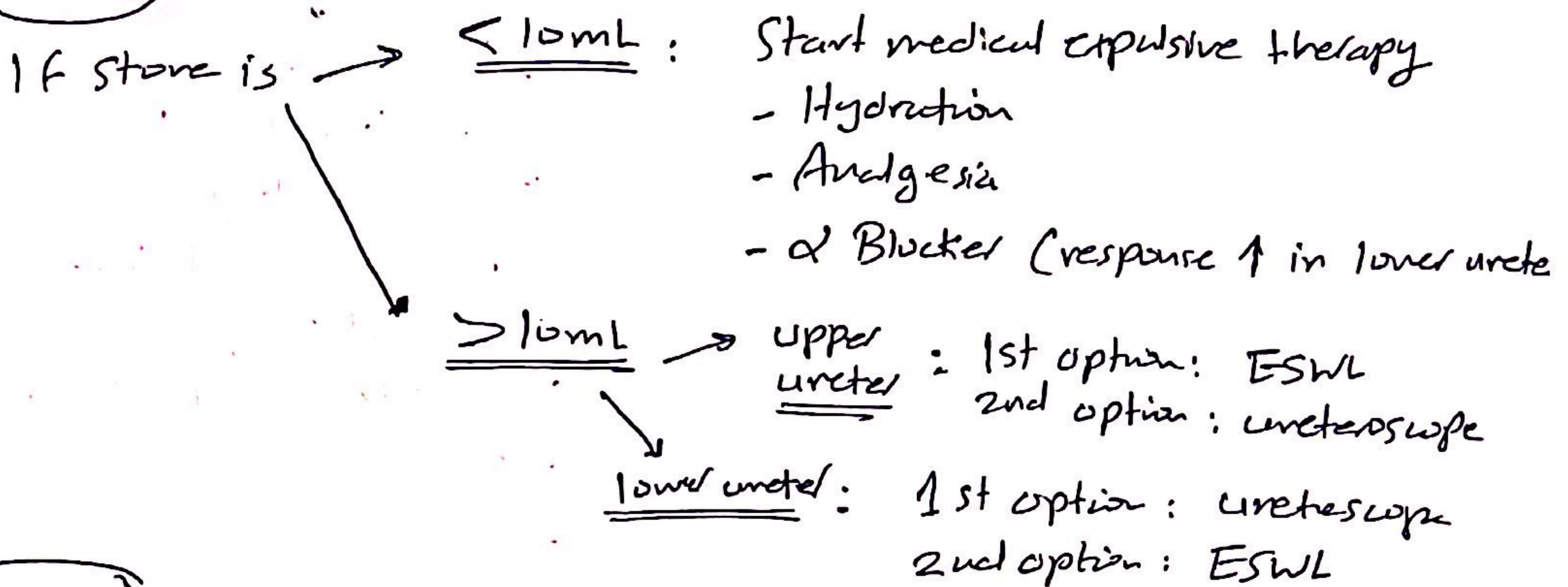
- ① Hydration
 - ② Analgesia
 - ③ medical expulsive therapy (α Blocker)
- [dependent on stone width / size]

* Stone < 5 mm → Incidence of spontaneous passage 1/70
 → Give tamsulosin (α Blocker)
 - ↓ ~~MS~~ contraction (MS relaxation)
 - ↑ passage 1/30
 ∴ ↓ pain

* Management depends on location and density:



Ureter



Bladder

Guideline ...
 depends on patient age, gender, associated diseases ...

3 cm كمن في الحوض ...
 ← 3 cm : Transurethral cystoscopy → Stone ...
 > 3 cm : ... Stone ...

* Metabolic evaluation of the stone disease:-

- Should be done ^{1 month} after dealing stone, infection & stent _{cult}

- Met. work up
فحص الدم

Appropriate:

1st episode مع عيار

عيار ع

History
examination
Investigation

- UA
- chemistry
- KFT
- electrolyte

Extensive:

عيار ع

- Risk for stone recurrence
- 1st stone ^{موجود} life threatening condition

في م

- large stone
- multiple
- Solitary kidney
- Associated with infection
- Unusual composition
- Ca oxalate
- congenital abnormality

مقبل للمبار

- History
- Exam.
- Invest.

الزئبق ال Ca عالي في السليم
stones are Ca phosphate
PTH

- 24 h urine collection.