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@SwastiThinks

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/ Hello #MedTwitter

This month’s @ASPNeph Imaging Webinar was about #RenalCalculi #LetsROCK!

Here's what I learned!

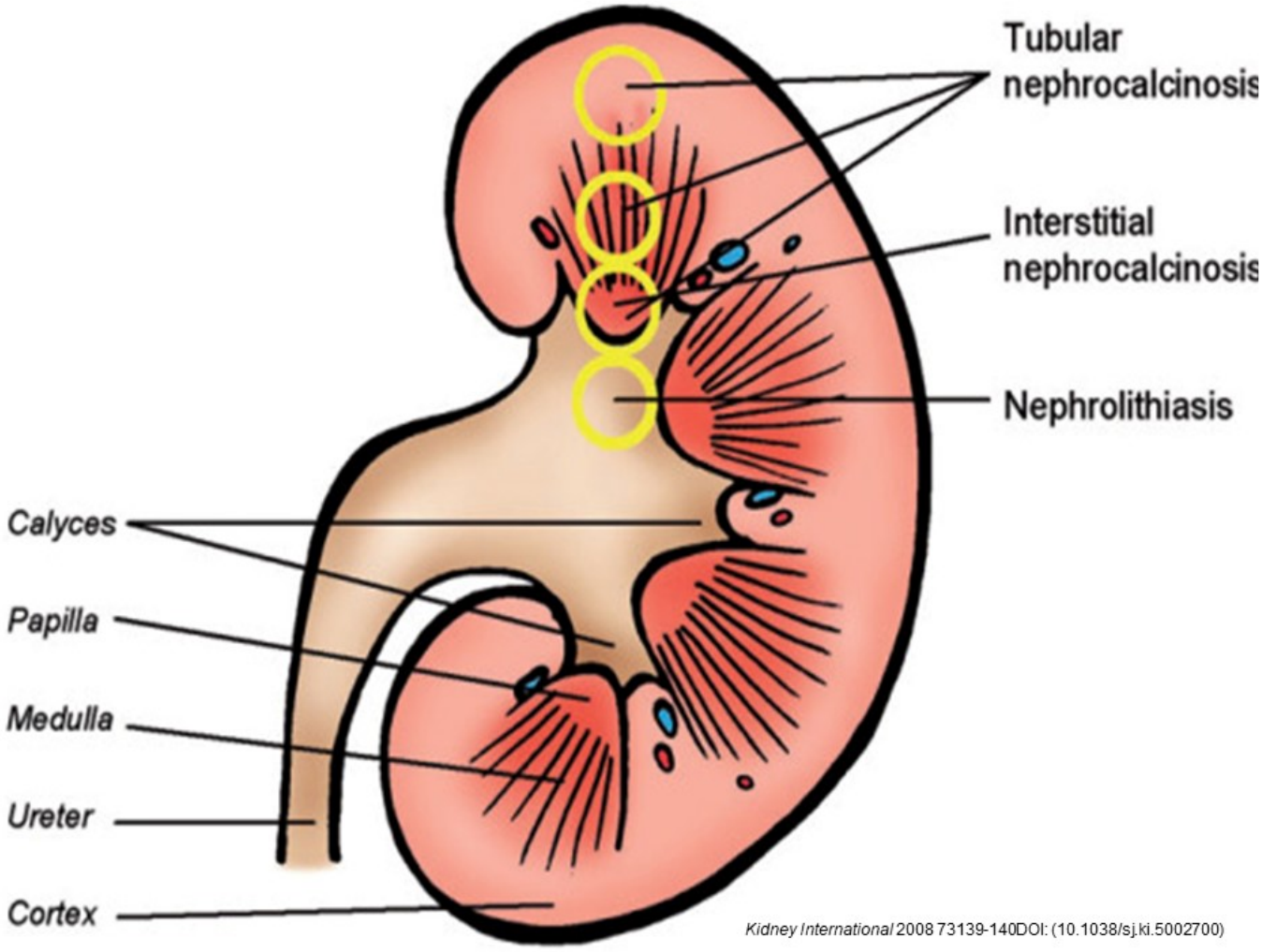
#Medtweetorial #nephtwitter #kidneystones

Let’s start with a poll! Which of the following is true about kidney stones in children?

Lets quickly dive into a couple of definitions

♦Nephrolithiasis: Deposition of stones in kidney collecting system

♦Nephrocalcinosis: Deposition of calcium in the kidney parenchyma and tubules



What are kidney stones made of?

♦️Calcium oxalate (45-65%)
♦️Calcium Phosphate (14-30%)
♦️Struvite (13%)
♦️Cystine (5%)
♦️Uric acid (4%)
♦️Other (4%)

Why do we care about kidney stones in children?
Stones can be-

⚡Symptomatic (pain, infection, bleeding, obstruction)
⚡Could be a marker of underlying metabolic or structural problems
⚡Can recur
⚡Can be associated with progressive worsening of kidney function

What are the metabolic causes of kidney stones?

Metabolic abnormalities can result from genetic or dietary factors. These are some of the metabolic causes of kidney stones in children👇👇

Stone composition	Disorders	Abnormal protein/Disease
Calcium Oxalate	Primary hyperoxaluria type 1	AGXT, Alanine-glyoxylate-aminotransferase
	Primary hyperoxaluria type 2	GRPHR, Glyoxylate reductase/hydroxy pyruvate reductase
	Primary Hyperoxaluria type 3	4-hydroxy-2-oxoglutarate aldolase
	Secondary Hyperoxaluria	Oxalate hyperabsorption via gut secondary to malabsorptive disorders: Cystic fibrosis, short gut syndrome
Cystine	Cystinuria type A	rBAT
	Cystinuria type B	$B^{0+}AT$
	Cystinuria type A/B	rBAT and $B^{0+}AT$
Uric Acid	Lesch-Nyhan syndrome	HPRT, Hypoxanthine-guanine-phosphoribosyltransferase
	Glycogenosis type 1 A	G6PC, Glucose-6-phosphatase
	Glycogenosis type 1 B	SLC37A4, Glucose-6-phosphatase transporter
	Phosphoribosyl-phosphatase synthetase 1 superactivity	PRPS I
	Secondary Hyperuricemia	Tumour Lysis Syndrome (TLS)
2,8-Dihydroxyadenine	AR	APRT, Adenine-phosphoribosyl-transferase
Xanthine	AR	XDH, Xanthine oxidoreductase or dehydrogenase
Calcium Phosphate	Distal Renal Tubular Acidosis (RTA)	Multiple genes, both AR & AD inheritance
	Bartter Syndrome type 1	NKCC2, Sodium-Potassium-Chloride-cotransporter
	Bartter Syndrome type 2	ROMK, Renal Outer Medullary Potassium Channel
	Bartter Syndrome type 3	CLC-Kb, Chloride channel
	Bartter Syndrome type 4	BSND/Barttin
	Lowe Syndrome (Oculo-Cerebro-Renal Syndrome)	OCRL1, Phosphatidylinositol-4-5-biphosphate-5-phosphatase
	Dent's disease	CLCN5, Chloride/H+ antiporter
	AD Hypocalcemic hypercalciuria	CaSR, Calcium sensing receptor
	Familial Hypomagnesemia with Hypercalciuria & nephrocalcinosis	claudin 16, claudin 19
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What is true about infection stones?

Struvite stones can enlarge & fill the renal calyces, producing a "staghorn" appearance

Consultant: Volume 50 - Issue 10 - October 2010

Don’t forget to take medication history which can lead to stones in 1-2% cases

Mechanism	Medications associated with stones (selected)
Hypercalciuria	Frusemide
	Topiramate
	Vitamin D/ Calcium
	Glucocorticoids
Precipitation of drug/metabolite in urine	Ampicillin
	Triamterene
	Sulfonamides
	Acyclovir
	Indinavir/Lopinavir
	Ceftriaxone
Metabolised to oxalate	Ethylene glycol
	Vitamin C
Increased urine uric acid	Probenecid
Change of urinary pH	Acetazolamide, Topiramate & other carbonic anhydrase inhibitors
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Kidney stone can present with:

⚡Abdominal pain

⚡Classic loin to groin pain

⚡Haematuria (mostly painful, sometimes painless)

⚡UTI

⚡Obstruction

⚡AKI

⚡CKD

⚡Incidental finding (nephrocalcinosis/ nephrolithiasis)/Asymptomatic

Imaging in kidney stones:

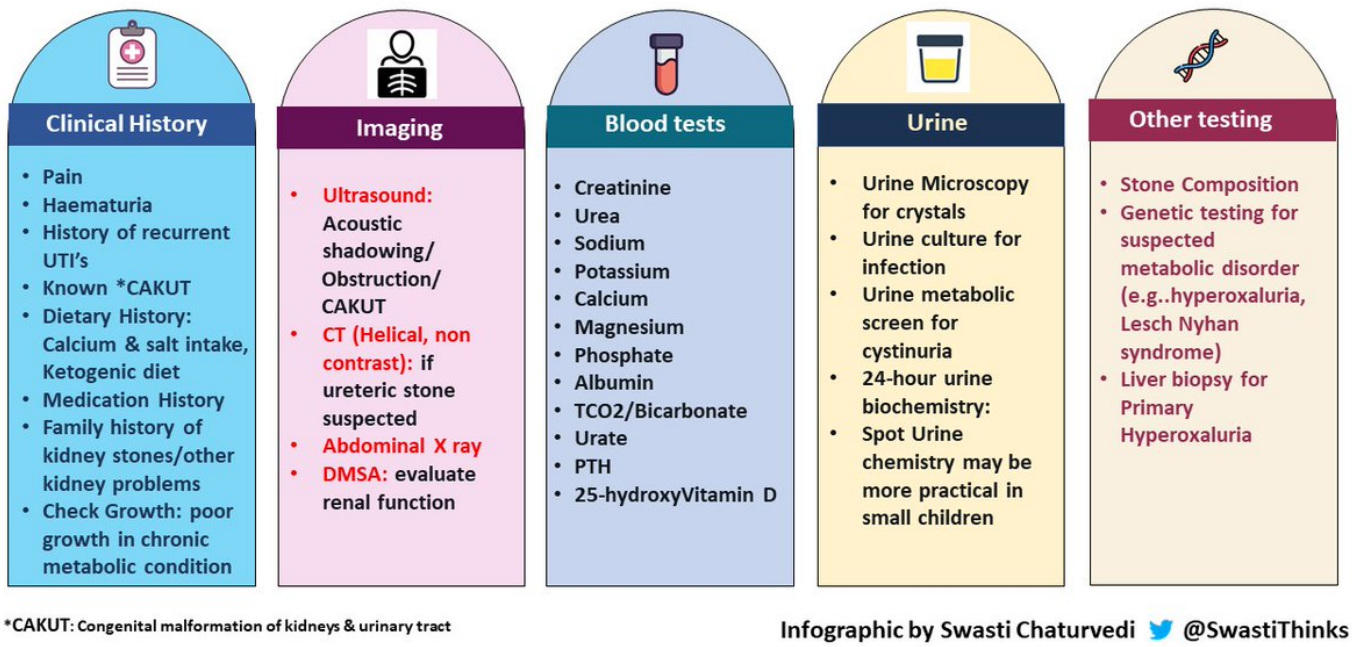
🔸 Ultrasound → non invasive, Acoustic shadowing/Obstruction

🔹 CT (Helical, non contrast): if ureteric stone suspected

🔸 Abdominal X ray (***Purine stones can be radiolucent)

🔸 DMSA Scan- evaluate renal function

Further stone work up involves clinical history, blood and 24-hr or spot urine tests. Here is my infographic on paediatric kidney stone work up 👇👇



Age dependent normal values for Spot urines may be analysed as creatinine ratios (mmol/mmol) with 95% centile normal values. 24 hr urine collection can be done in older child.

Spot urine solute-creatinine ratios: 95th centile mmol/mmol

Age (years)	Ca/creat	Oxalate/creat	Urate/creat	Mg/creat
0.1-1	2.2	0.16	1.5	2.2
1-2	1.5	0.13	1.4	1.7
2-3	1.4	0.10	1.3	1.6
3-5	1.1	0.08	1.0	1.3
5-7	0.8	0.07	0.8	1.0
7-10	0.7	0.06	0.6	0.9
10-14	0.7	0.06	0.4	0.7
14-17	0.7	0.06	0.4	0.6

Matos *et al.* J Pediatrics, 1997 Aug;131(2):52-7.
Matos *et al.* AJKD 1999 Aug;34(2):e1.

Calcium	**Less than 0.1 mmol/kg/day (4mg/kg/day)**
Oxalate	**Age 1-3 months: less than 0.2 mmol/day**
	Age 1-10 years: less than 0.5 mmol/day
	Age > 10 years: less than 0.6 mmol/day
Cystine	**Less than 0.4 mmol/day (adult)**
Uric acid	**1.5-4.5 mmol/day (adult)**
Creatinine	**≥ 0.1 mmol/kg/day**

Don't forget to look for urine crystals

- Calcium oxalate dihydrate: Bipyramidal/envelope
- Calcium oxalate monohydrate: Dumbell
- Cystine: Hexagonal
- Struvite: Coffin-lid
- Uric acid crystals: Pleomorphic

https://www.renalfellow.org/2019/07/10/urine-sediment-of-the-month-common-crystals/

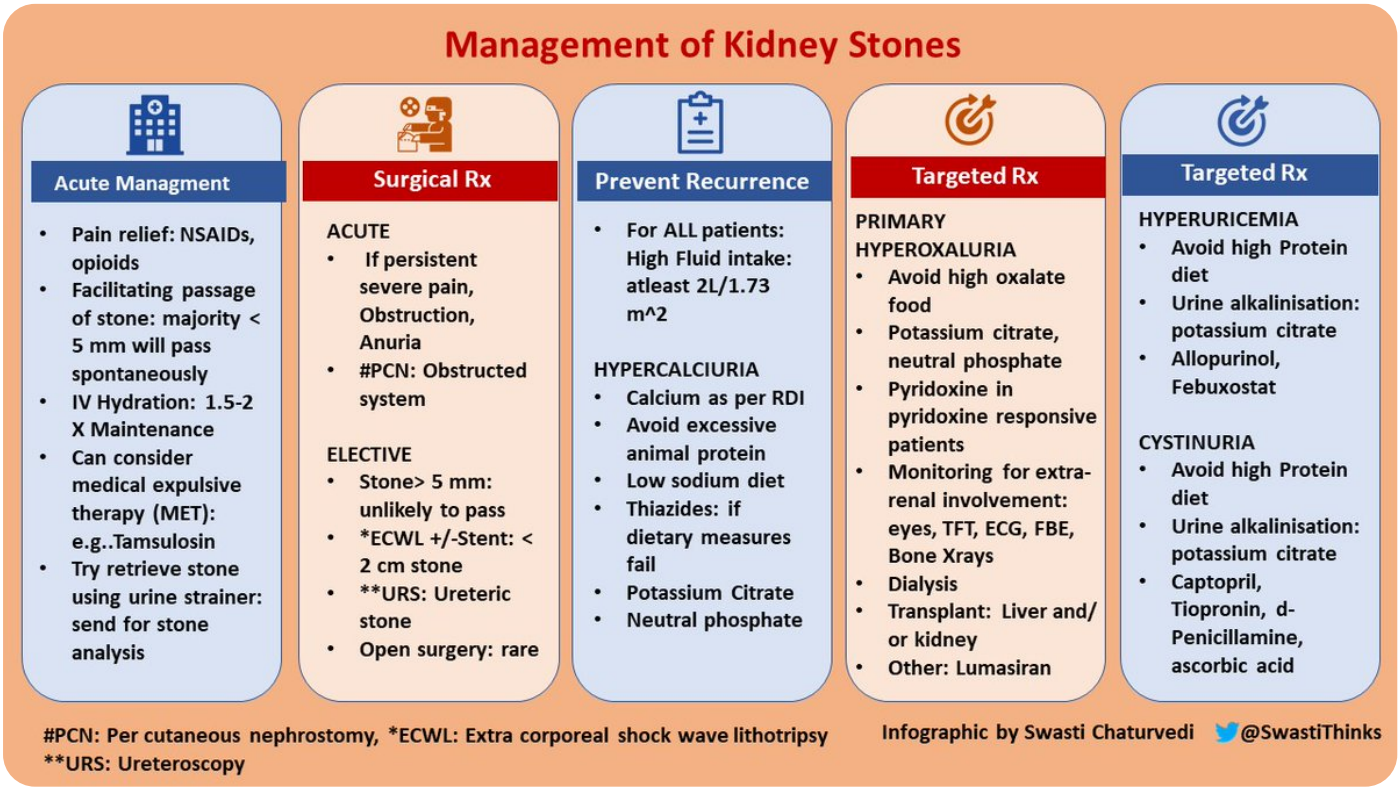
Management of stones involves:

♦Acute Management

♦ Urological procedure if indicated

♦Work up for specific cause & targeted Rx to prevent recurrence

Here is my infographic on management of paediatric kidney stones 👇👇



That’s all folks!

For a case-based clinical discussion with radiology expert login to @ASPNeph website, June webinar. Answer questions to get #MOC2credits #Membereducation #ASPNFOAMgroup
Until next time…
@RoshanPGeorgeMD @basalely @drM_sudha @priti899