



Archana Vajjala

@ArchanaVajjala

25 Tweets • 2021-09-01 20:09:56 UTC • [See on Twitter](#)

rattibha.com 

1/  Hello #medtwitter

This month's (Aug) @ASPNeph Radiology webinar was all about vesicoureteral reflux (VUR)

Here are some clinical pearls!

What's new!?

#Medtweetorial #nephtwitter #ASPNeph

#vesicoureteralreflux #vur

VUR - Against the flow!



#SchittsCreek

**WHY DON'T WE
JUMP RIGHT IN?**

2/ Let's get started with a poll!

Which one of these is true about VUR?

3/ Ans - All the above

PMID: 32022517

Let's quickly define vesicoureteral reflux

Retrograde flow of urine from the bladder into the upper urinary tract due to dysfunctional vesicoureteric junction (VUJ)

4/ Some interesting history facts :

- ◆ Galen & da Vinci: UVJ is a mediator of unidirectional flow of urine from kidneys to bladder

- ◆ Hutch(1952): Relationship between VUR & chronic pyelonephritis in paraplegic pts

- ◆ Hodson(1959): UTI & renal scarring ➡ high likelihood of VUR



Claudius Galen, from Prints Collection, Reynolds Historical Library, the University of Alabama at Birmingham

5/ What are the causes of Vesicoureteral reflux?

◆ Primary VUR

- Lack of VUJ maturation
- Most common

◆ Secondary VUR

- Organic obstruction or neurologic dysfunction

PRIMARY VESICoureTERAL REFLUX	SECONDARY VESICoureTERAL REFLUX
Lack of maturation of VUJ => Incompetent or inadequate closure => reflux	Defect in preventive reflux mechanism due organic obstruction and/or neurological dysfunction
Most common reflux	
Congenital anomalies of VUJ - Short intramural/intravesical ureter	Bladder outlet obstruction (anatomic/functional) High pressure within the bladder → reflux of urine through the UVJ Anatomic: - Posterior urethral valves - Urethral meatal stenosis Functional: - Bladder and bowel dysfunction - Neurogenic bladder - Cystitis
	Congenital anomalies of ureter: - Ureteral duplication (most common renal abnormality) - Ectopic ureter - Ureterocele
	Iatrogenic
	Ref: Rensing, Adam and Austin, Paul, "The diagnosis and treatment of vesicoureteral reflux: An update." Open Urology and Nephrology Journal.8,Suppl 3: M3. (2015).  @ArchanaVajjala

6/ VUR can be induced by multiple birth defects affecting urinary tract development:

- ◆ Ureteric budding
- ◆ Ureter differentiation & elongation, peristalsis
- ◆ UVJ formation
- ◆ Bladder & urethra development

 genes implicated:

RET

PAX2

ROBO2

KAL1

HOXA13

NIPBL

PMID: 28612055

7/ VUR

- ◆ Usually asymptomatic
- ◆ often presents with nonspecific signs & symptoms like failure to thrive, fever when UTI, lethargy, abdominal pain, voiding symptoms etc, especially with high grade VUR

8/ What are the Clinical consequences of VUR?

It was previously thought that VUR ➡ Recurrent UTIs
➡ Renal scarring ➡ CKD

⚡ Now it is increasingly recognized that children are born with dysplastic kidneys to begin with, which is associated with reflux-VUR, recurrent UTIs and CKD

9/ Poll

Which of these is the definitive method of diagnosing VUR and defining its severity?

10/ Ans - VCUG/MCUG

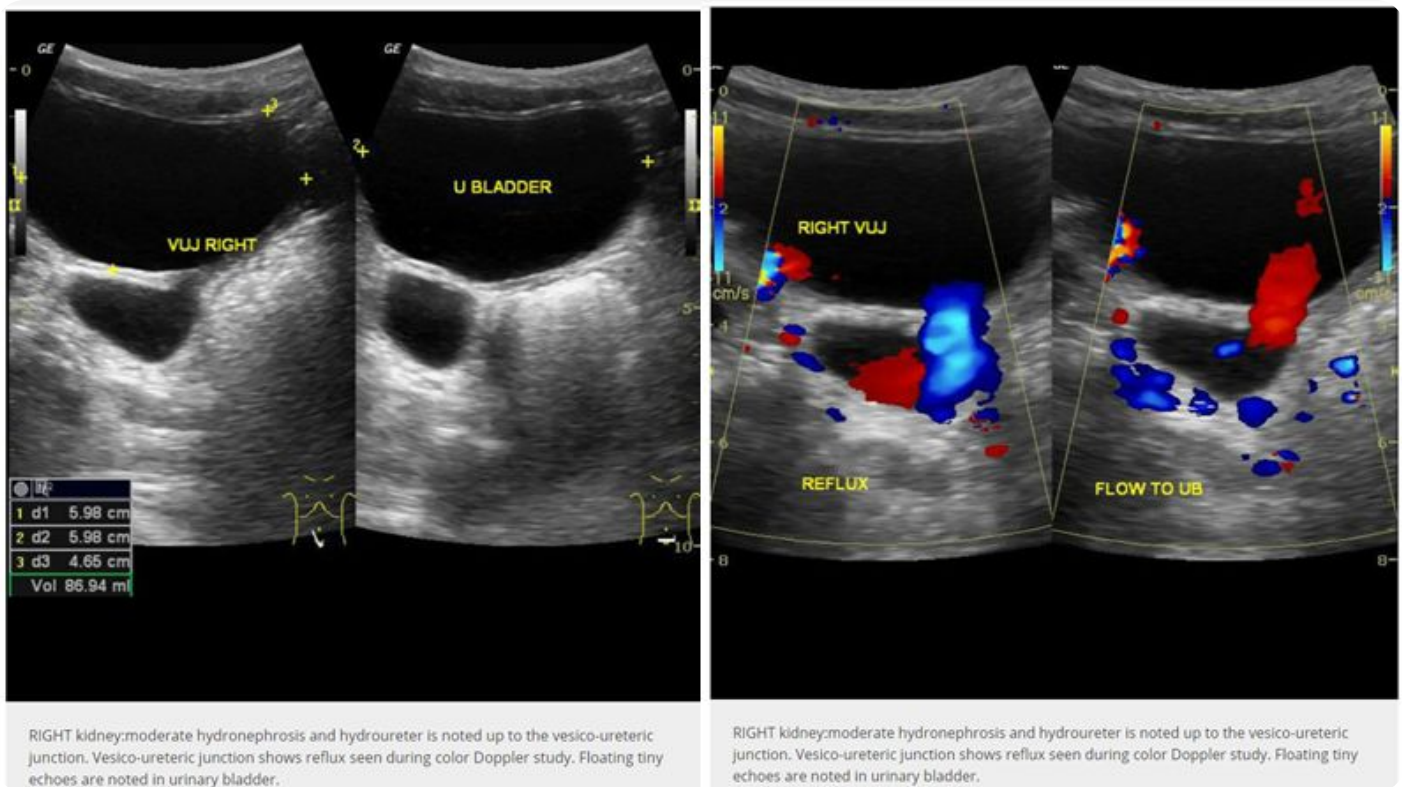
Let's look at how to proceed with imaging in a child with febrile UTI

Renal Bladder Ultrasound-RBUS

Initial imaging choice for fUTI & as a follow up scan to monitor disease progression

Detects hydronephrosis & dilated ureter

Normal USG doesn't rule out VUR



11A/ VCUG/MCUG Voiding/Micturating cystourethrogram

Indications

◆ <6m

Fever $\geq 39^{\circ}\text{C}$ & atypical UTI

Renal anomaly on RBUS

◆ 6m-3y

Recurrent UTIs

Male infants with prenatally diagnosed b/l
hydronephrosis

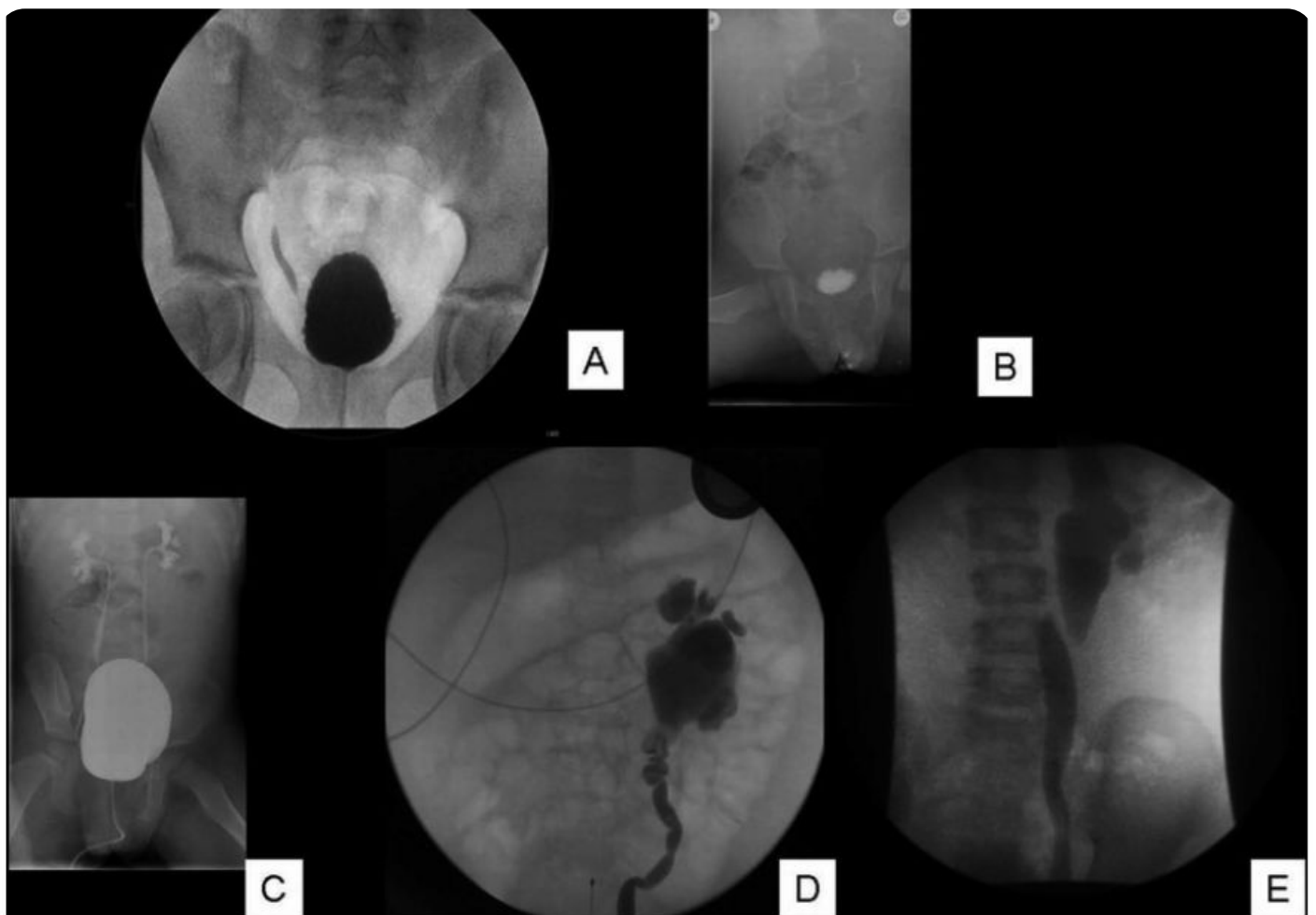
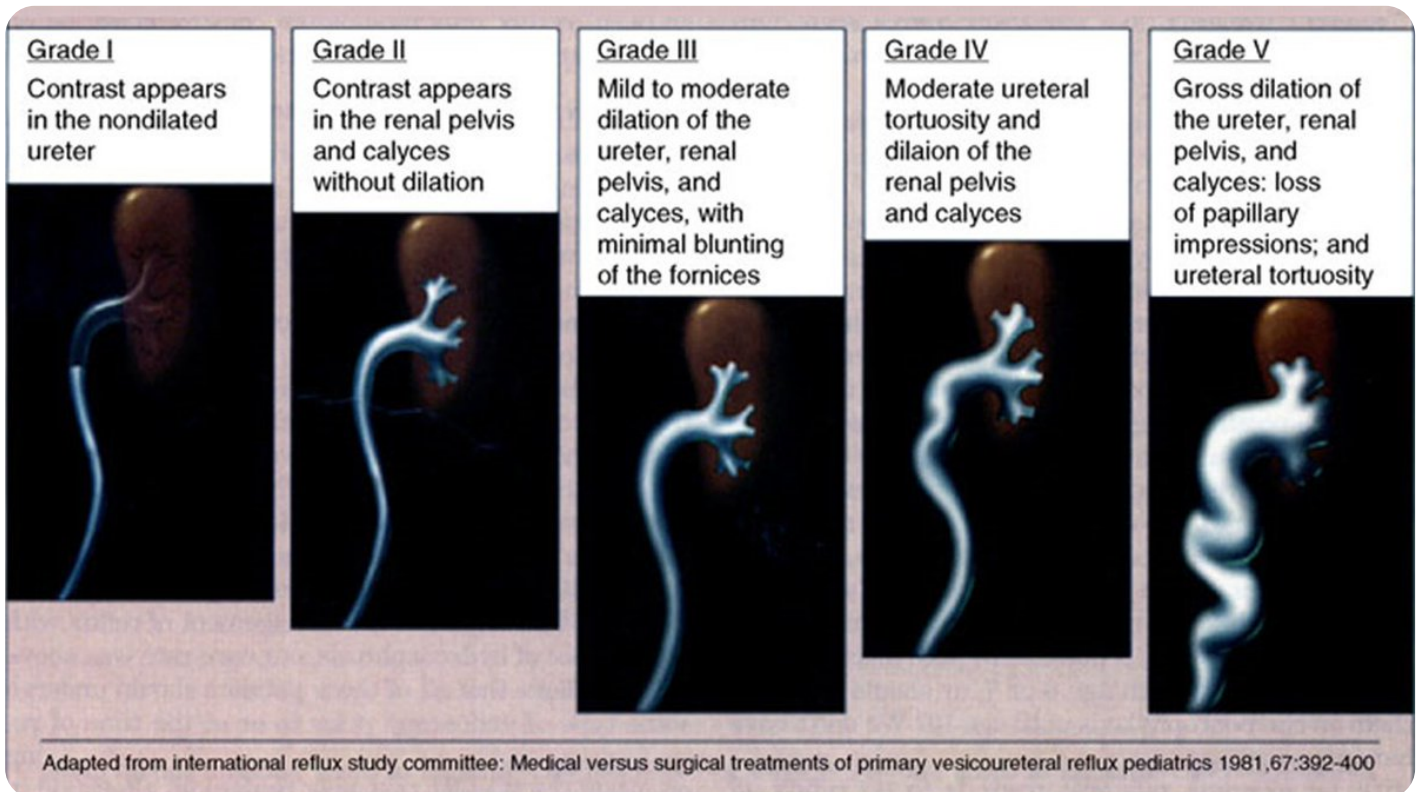
◆ >3y

Usually not indicated unless there is strong suspicion or
Hypertension

11B/ VCUG findings and grading

⚡ Findings: Retrograde reflux of the contrast into the
ureters during micturition is diagnostic of VUR.

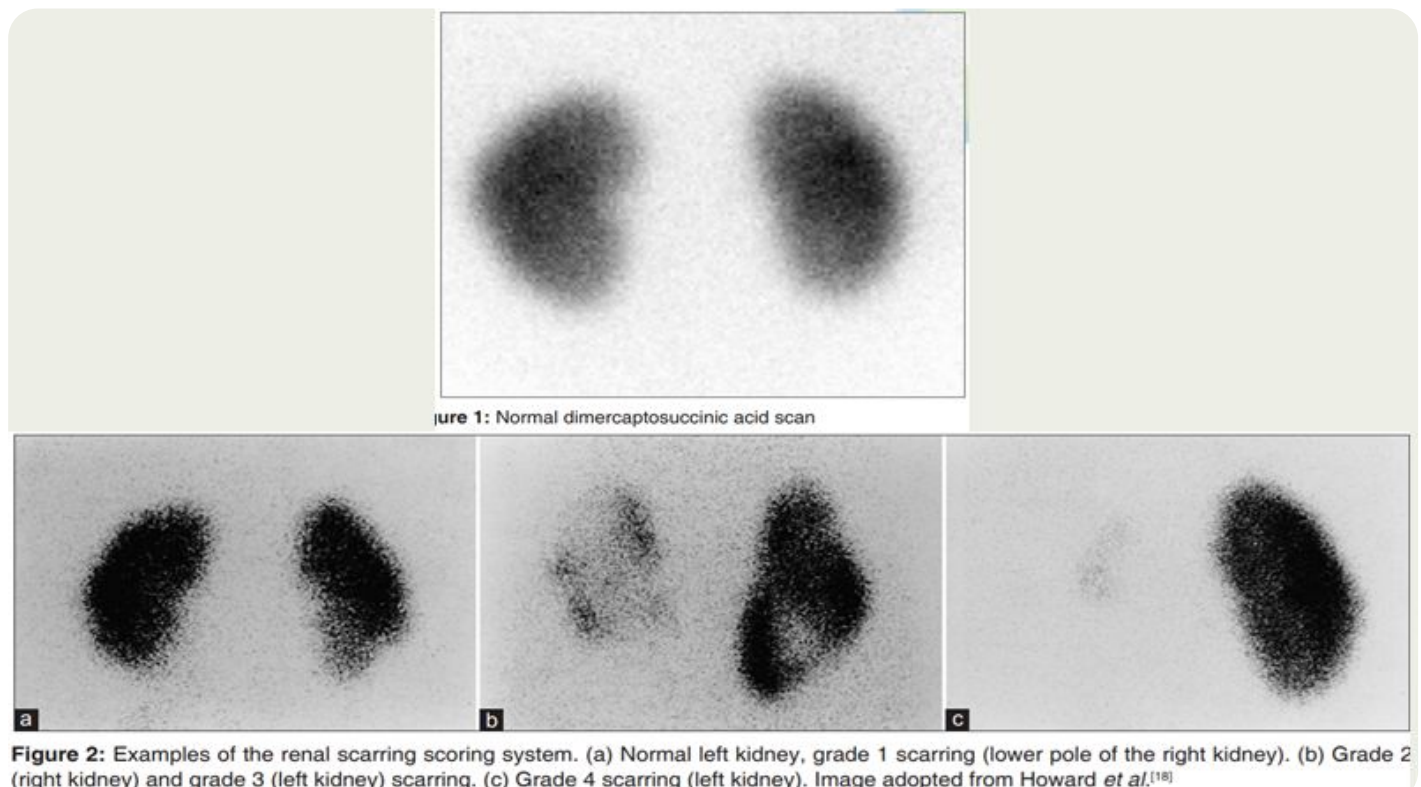
⚡ Grading: Divided in to 5 grades based on the severity
of VUR on VCUG



14. Grades of vesicoureteral reflux according to the grading system of the International Reflux Study. (a) Grade 1 ureter only (b), Grade 2 into undilated pelvis (c), Grade 3 into mildly dilated pelvis, (d) Grade 4 into dilated calyces, and (e) Grade 5 into very dilated pelvis and blunting of all calyces.

12/ DMSA Renal Scan

- ◆ Nuclear imaging method using radioactive DMSA (dimercapto succinic acid)
- ◆ Assess cortical tissue, renal function and scarring
- ◆ Indicated for treatment monitoring and as a follow up scan to look for worsening renal function



13/ MAG3 Renal Scintigraphy (radionuclear cystourethrography)

- ◆ Nuclear medicine scan using MAG3 (mercaptoacetyl triglycine)
- ◆ Detects UVJ and UPJ obstruction
- ◆ Measures differential renal function

PMID: 25126000

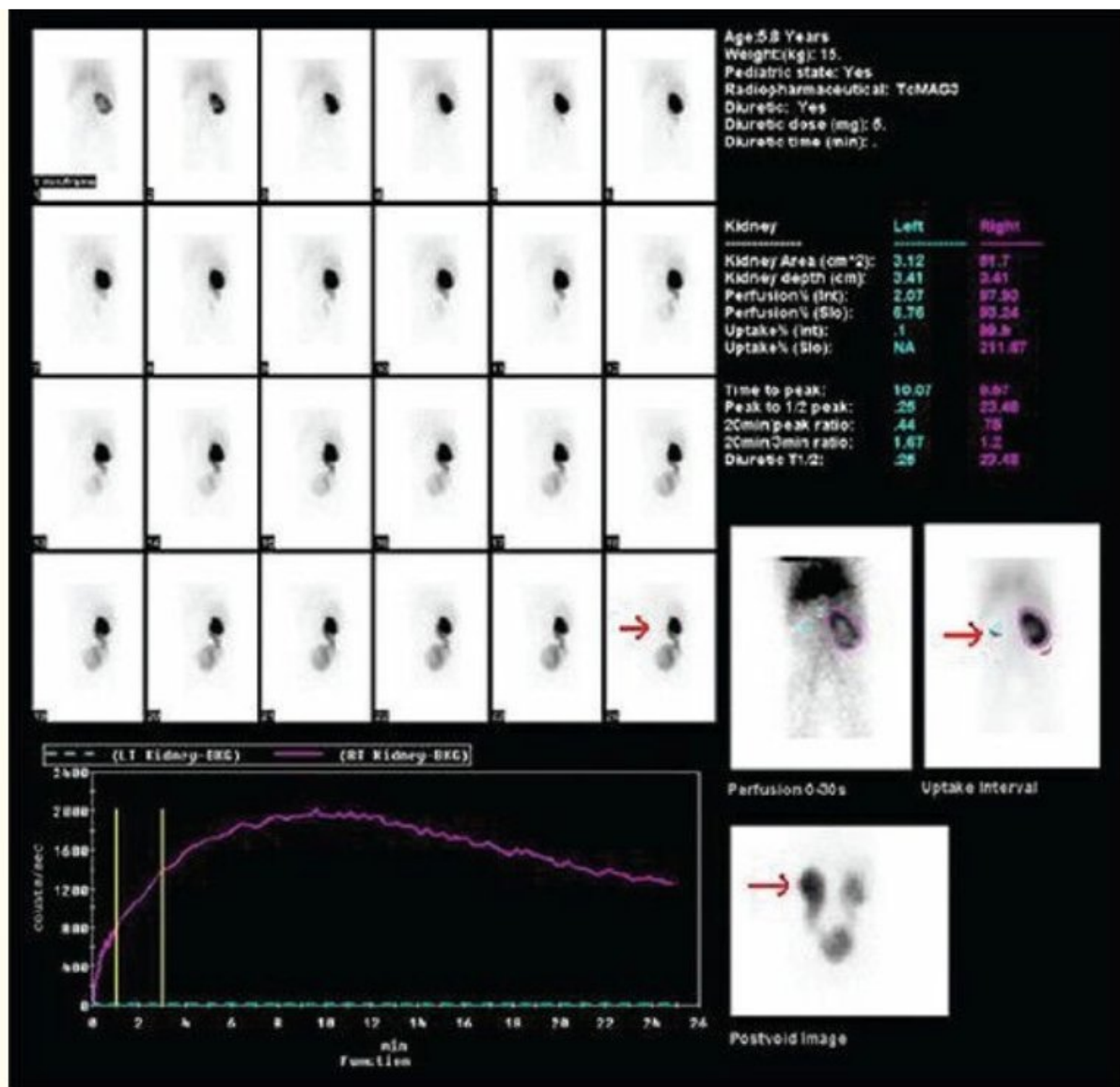


Figure 3

^{99m}Tc MAG3 renal scintigraphy showing fair functioning hydronephrotic right kidney with partial outflow clearance whereas left kidney is not visualized in dynamic images. Post-void image showing appearance of left kidney and ureter indicative of vesicoureteral reflux

14/ Treatment options

Over the last few years Individualized, risk-based approach to the management of VUR with an overall shift to more conservative management has been noticed

TREATMENT OPTIONS FOR VESICoureTERAL REFLUX

Conservative Treatment

- For VUR Grade I–III in children < 5 years
- Close surveillance with urinalysis & renal imaging
- Long-term Antibiotic prophylaxis
 - Children > 3m: Trimethoprim sulfamethoxazole, nitrofurantoin
 - Infants < 3m: amoxicillin
- Correction of voiding dysfunction
 - Behaviour modification (timed voiding, Prevention of constipation)

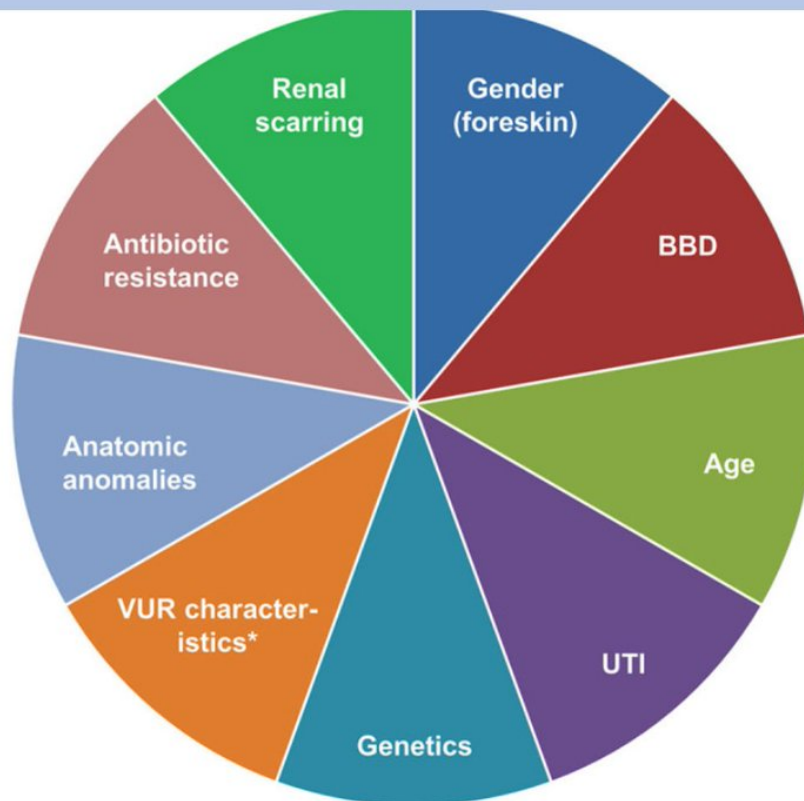
Surgical Treatment

- Indications
 - VUR ≥ grade IV
 - Bilateral grade III VUR in children > 6 years
 - Worsening renal function/breakthrough urinary tract infections despite prophylactic antibiotics
- Subureteric Transurethral Injection (STING procedure)
- Surgery: Ureteral Reimplantation

Läckgren G, Cooper CS, Neveus T, Kirsch AJ. Management of Vesicoureteral Reflux: What Have We Learned Over the Last 20 Years? Front Pediatr. 2021;9:650326. Published 2021 Mar 31. doi:10.3389/fped.2021.650326

@ArchanaVajjala

PMID: 33869117



Factors to consider in a risk-based approach to the management of VUR. *Grade, bladder volume at onset of reflux, ureteral diameter ratio. BBD, bladder/bowel

15/ Here is a table summarizing @AmerAcadPeds and NICE guidelines for the diagnosis and management of UTI in children 📌





<https://www.emjreviews.com/microbiology-infectious-diseases/article/urinary-tract-infection-in-children-a-review-of-the-established-practice-guidelines/>

Parameters	AAP guidelines (2011)	NICE guidelines (2007)
Diagnosis of UTI <ul style="list-style-type: none">- Using dipstick urinalysis- Using microscopic urinalysis and urine culture	<ul style="list-style-type: none">- Bacteriuria with or without pyuria- $\geq 5 \times 10^4$ CFU/mL (from SPA and catheter urine specimens)	<ul style="list-style-type: none">- Positive leucocyte esterase or nitrite test*- Colony count of any Gram negative bacilli or $>10^3$ CFU/mL of a Gram-positive coccus (from SPA urine specimen)- $>10^5$ CFU/mL (from catheter urine specimen)- $\geq 10^5$ CFU/mL (from 'clean-catch' or midstream urine specimen)
Radiological Investigation of UTI† <ul style="list-style-type: none">- RBUS- DMSA renal scan- VCUG (or MCUG)	<ul style="list-style-type: none">- Recommended in febrile infants with first UTI- Not recommended as routine investigation for first febrile UTI- Not recommended as routine investigation for first febrile UTI	<ul style="list-style-type: none">- Recommended in atypical or recurrent UTI in children aged <6 months- Recommended in children aged 6 months to 3 years with atypical or recurrent UTI‡- Not recommended in children aged 6 months to 3 years with atypical or recurrent UTI‡
Treatment and follow-up of UTI <ul style="list-style-type: none">- Route of antibiotics/duration- Follow-up routine urine culture- Follow-up antibiotic prophylaxis	<ul style="list-style-type: none">- Parenteral route for 48 hours (for critically ill patients) and switch to oral route if clinical improvement occurs. 7-10 days as the total duration of therapy- Not recommended**- Not recommended	<ul style="list-style-type: none">- For children aged <3 months: parenteral route for 2-3 days before a switch to oral route if clinical improvement occurs. 10 days as the total duration of therapy- For children aged >3 months with upper UTI: oral route using antibiotics with low-resistance pattern. 7-14-day duration of therapy§- For children aged >3 months with lower UTI: oral route for 3 days- Not recommended- Not recommended

16/ Treatment - EAU guidelines

The European Association of Urology guidelines prominently state that “there is no consensus on the optimal management of VUR or on its diagnostic procedures, treatment options, or most effective timing of treatment”

PMID: 28243965

**EAU GUIDELINES FOR TREATMENT OF VUR**

Infants less than 1 year	Children 1-5 years with Grade III - V VUR	Children with Lower Urinary Tract Dysfunction (LUTD) & VUR
<ul style="list-style-type: none">➤ First line Option 1 : Antibiotic prophylaxis	<ul style="list-style-type: none">➤ First line for Grade III & IV VUR - Antibiotic Prophylaxis➤ High Grade VUR/ Breakthrough Infections - Ureteral reimplantation	<ul style="list-style-type: none">➤ Initial Management - Focus on LUTD➤ Surgical Options Low Grades of VUR (up to Grade III) - Endoscopic treatment➤ High-Risk Patients with Renal Impairment - Aggressive multidisciplinary approach

Reference: Tekgül S, Riedmiller H, Hoebeke P, et al. EAU guidelines on vesicoureteral reflux in children. Eur Urol. 2012;62(3):534-542. doi:10.1016/j.eururo.2012.05.059 @ArchanaVajjala



17/ Let's look at #RIVUR study

2-year, multisite, RCT

607 children with VUR

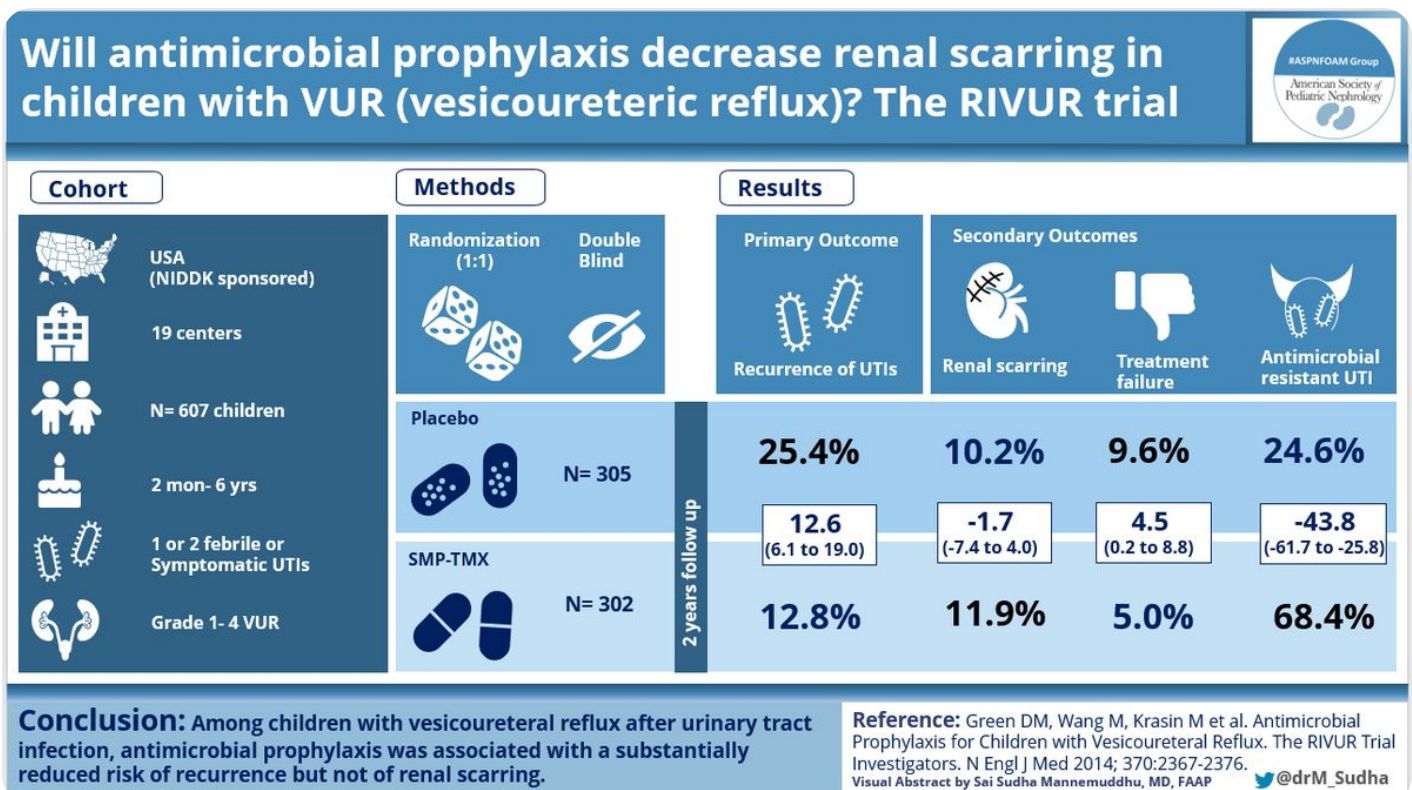
Did antibiotic prophylaxis prevent recurrent UTIs

(primary) & scarring in kidneys (secondary) ?

Conclusion: Prophylaxis prevented recurrent UTI but not scarring

VA by @drM_sudha

<https://www.nejm.org/doi/full/10.1056/nejmoa1401811>



18A/ @AmerMedicalAssn & @AmerAcadPeds

recommendations :

AMA - Recommends annual evaluation of BP, height, weight, urine analysis, and RBUS until the abnormality resolved or is no longer clinically significant

18B/ AAP - All infants with fUTIs undergo renal & bladder ultrasonography. VCUG is indicated if RBUS reveals hydronephrosis, scarring, high-grade VUR, obstructive uropathy & in some atypical/complex clinical situations. Not recommended routinely after a first fUTI

PMID:20650499

19/ Prognosis:

Cystic dysplasia and VUR can lead to -

- ◆ Recurrent UTIs
- ◆ Scarring in the kidneys
- ◆ Hypertension
- ◆ CKD and eventually ESKD

PMID: 28612054

20/ That's all folks!

For a case-based clinical discussion with radiology expert
login to @ASPNePh website, August webinar. Answer
questions to get #MOC2credits #Membereducation
#ASPNePhFOAMgroup

21/ Special thanks to @SwastiThinks @drM_sudha
@priti899 for your help in publishing my first tweetorial!

Until next time....



These pages were created and arranged by Rattibha services
(<https://www.rattibha.com>)

The contents of these pages, including all images, videos, attachments and external links published (collectively referred to as "this publication"), were created at the request of a user (s) from Twitter. Rattibha provides an automated service, without human intervention, to copy the contents of tweets from Twitter and publish them in an article style, and create PDF pages that can be printed and shared, at the request of Twitter user (s). Please note that the views and all contents in this publication are those of the author and do not necessarily represent the views of Rattibha. Rattibha assumes no

responsibility for any damage or breaches of any law resulting from the contents of this publication.