

بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ





# Vesicoureteric Reflux

**Ihab El-Hakim**

*Professor of Pediatric Nephrology*

*Ain Shams University*

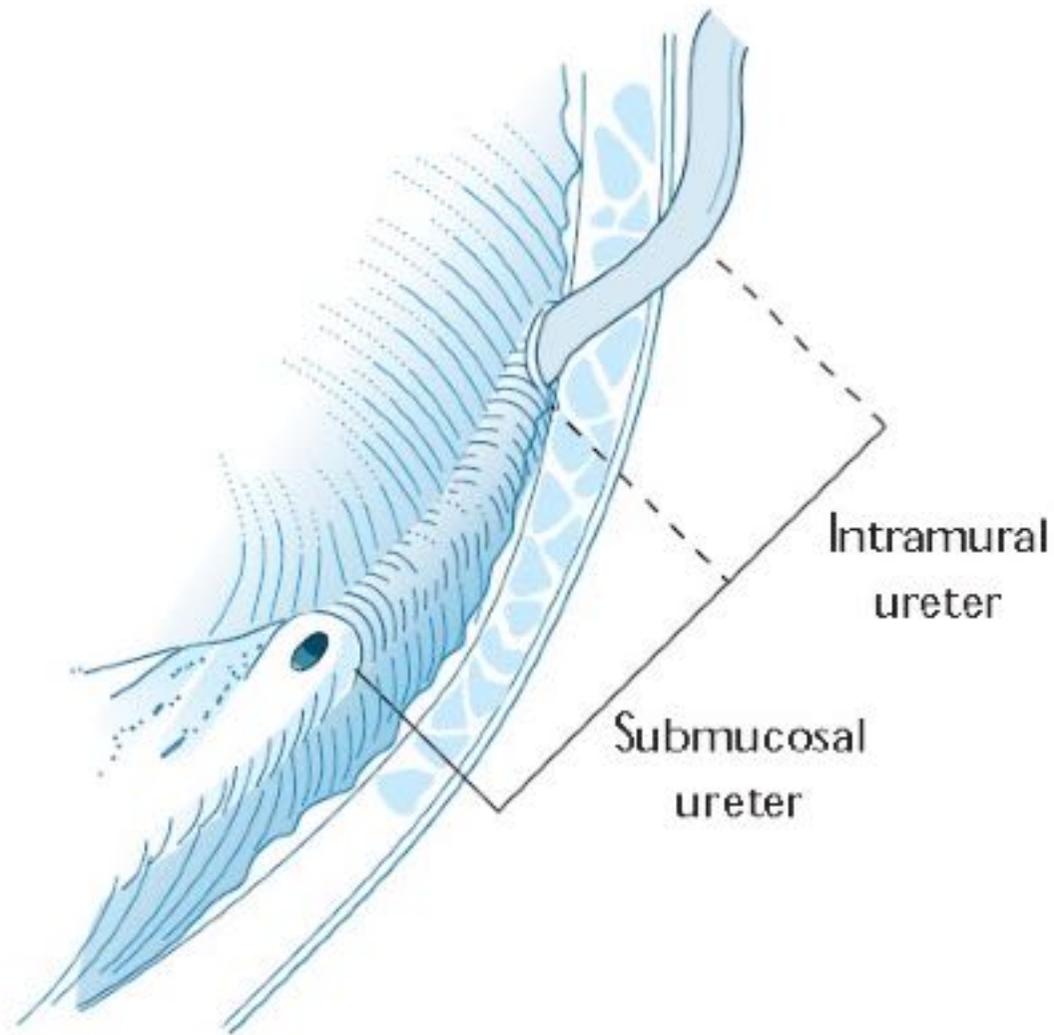
**No conflict of interest to declare**

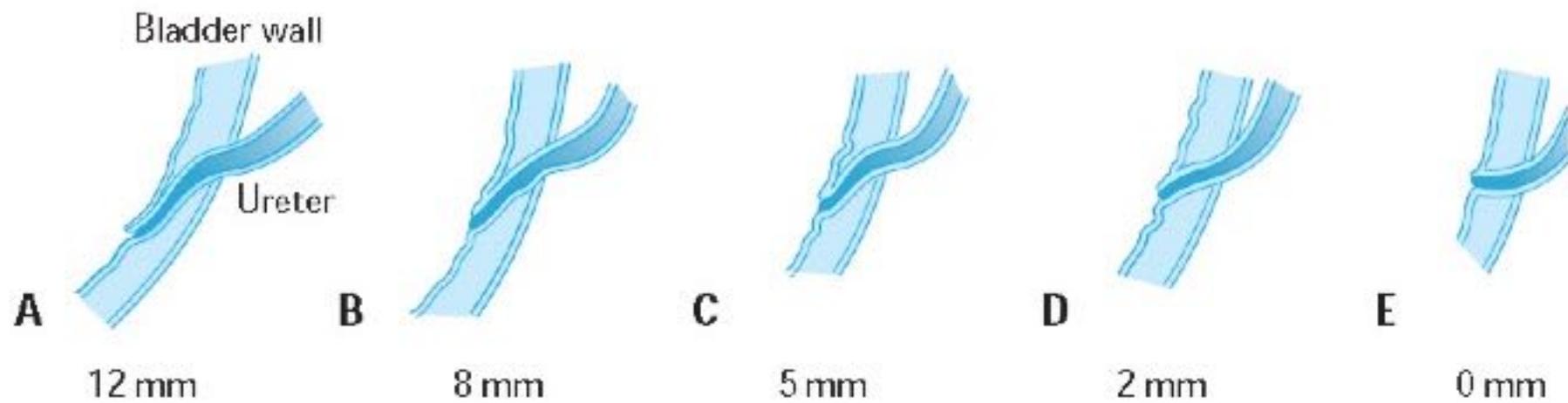
- Pathophysiology
- Diagnosis
- Medical treatment options
- Surgical treatment options
- How to proceed?

Vesicoureteral reflux (VUR) denotes the retrograde flow of urine from bladder to the kidneys, most commonly the result of anatomic abnormality of vesicoureteral junction.

## Anti-reflux mechanisms

- The intramural and the submucosal course of the ureter.
- The normal development of the trigone provides support to the distal ureter.
- Symmetric muscle contractions and unidirectional ureteric peristalsis
- Extracellular matrix
- The presence of greater numbers of interstitial cells of Cajal (a type of pacemaker cell) at the ureterovesical junction.





## **Associated Conditions**

- Multicystic dysplastic kidney
- Renal agenesis
- Renal ectopia
- Ureteral duplication and ectopia.

CRC Press  
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Third Edition

# Clinical Pediatric Nephrology



Edited by  
Kanwal K. Kher • H. William Schnaper  
Larry A. Greenbaum

## Vesicoureteral reflux

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TEJ K. MATTOO

2017

## **Primary VUR**

isolated abnormality.

## **Secondary VUR**

in association with other CAKUT, including renal dysplasia, obstructive uropathy or neurogenic bladder.

- Incidence of VUR diagnosed after UTI is 36-49% in newborns and infants, and 8-50% in children.
- VUR diagnosed because of antenatal hydronephrosis has a high rate of spontaneous resolution (59% by age 4 years), even in those with grades IV and V reflux.
- The incidence of VUR in asymptomatic siblings of index cases is 32-45%. The incidence of VUR in the offspring of parents with known VUR in one study was 66%.
- VUR disappeared in more than 80% of undilated and approximately 40% of dilated ureters.
- Negative predictive factors for reflux resolution include: breakthrough febrile UTI, bladder dysfunction, renal cortical abnormality.

**Table 48.1** Congenital versus acquired reflux nephropathy in children

	Acquired RN	Congenital RN
Time of occurrence	Postnatal	Prenatal
UTI before diagnosis	Common	Uncommon
Age distribution	All pediatric age groups	Mostly in younger children
Gender distribution	Predominantly females	Predominantly males
Grade of VUR	Mostly high-grade	Mostly high-grade
Dysplastic features on renal histopathology	No	Yes

# Pathophysiology

## **A Primer on Congenital Anomalies of the Kidneys and Urinary Tracts (CAKUT)**

[Vasikar Murugapoopathy](#)<sup>1</sup> and [Indra R. Gupta](#)<sup>✉1,2</sup>

Table 1.

Categories of CAKUT disorders

Type of Anomaly	CAKUT Disorder	Definition
Kidney number	Renal agenesis	Unilateral or bilateral, kidney and outflow system fail to form
Kidney size and morphology	Renal hypoplasia	Unilateral or bilateral, kidney shape is normal, but smaller in size and reduced number of nephrons
	Renal dysplasia	Unilateral or bilateral, kidney shape and tissue differentiation is abnormal,

Outflow abnormalities	Ureteropelvic junction obstruction	Unilateral or bilateral, junction between kidney and ureter is obstructed, preventing drainage of urine from pelvis of the kidney
	Vesicoureteric reflux	Unilateral or bilateral, junction between ureter and bladder is defective, resulting in urine backflow from bladder

Outflow abnormalities	Ureteropelvic junction obstruction	preventing drainage of urine from pelvis of the kidney
	Vesicoureteric reflux	Unilateral or bilateral, junction between ureter and bladder is defective, resulting in urine backflow from bladder
	Duplex collecting system	Unilateral or bilateral, duplication of ureter and kidney pelvis, can be accompanied with duplicate kidneys; outflow system may reflux or exhibit obstruction
	Megaureter	Unilateral or bilateral, distension of ureter resulting in defects in impaired urine flow
	Posterior urethral valves	Membrane that forms in urethra preventing emptying of bladder, limited to males

Type of Mutation	Genetic Factor	Gene Function/Consequence of Mutation	Associated Defects in Humans
Single gene polymorphism	<i>HNF1β</i>	Transcription factor, autosomal dominant	Multicystic renal dysplasia, renal hypoplasia, renal cysts, and diabetic syndrome ( <a href="#">17</a> )
	<i>PAX2</i>	Transcription factor, autosomal dominant	Renal hypoplasia, <b>VUR</b> , renal coloboma, FSGS ( <a href="#">15</a> )
	<i>SIX1</i>	Transcription factor, autosomal dominant	Renal hypodysplasia, <b>VUR</b> , branchio-oto-renal syndrome ( <a href="#">19</a> )
	<i>SIX5</i>	Transcription factor, autosomal dominant	Renal hypodysplasia, <b>VUR</b> , branchio-oto-renal syndrome ( <a href="#">20</a> )

Copy number variants (29)	1q21	Deletion or duplication of region	Renal hypoplasia/dysplasia/cysts, PUV, UPJO, <b>VUR</b>
	4p16.1-16.3	Deletion or duplication of region	Renal hypoplasia/dysplasia/cysts
	16p11.2	Deletion or duplication of region	Renal hypoplasia/dysplasia/cysts, PUV, UPJO, duplex collecting system, <b>VUR</b>
	16p13.11	Deletion or duplication of region	Renal hypoplasia/dysplasia/cysts, UPJO, duplex collecting system
	17q12	Deletion or duplication of region, contains HNF1 $\beta$	Renal hypoplasia/dysplasia/cysts, PUV, UPJO, duplex collecting system
	22q11.2	Deletion or duplication of region	DiGeorge syndrome, renal hypoplasia/dysplasia/cysts, UPJO, PUV, dual collecting system, <b>VUR</b>

**Environmental Factors****CAKUT Phenotypes****Maternal diet**

Folic acid use (47)

Duplex collecting system, VUR, PUV

Low folate (46)

UPJO, renal agenesis, renal cysts

Vitamin A deficiency (43,44)

VUR renal hypoplasia, renal dysplasia

**Maternal conditions**

Maternal obesity (48)

Duplex collecting system, VUR

Maternal diabetes (40)

Wide range of CAKUT phenotypes including kidney abnormalities and outflow tract

Maternal malnutrition (38)

Low nephron number, low birth weight

**Maternal substance use**

Maternal cocaine (45)

Horseshoe kidney, renal hypoplasia, renal dysplasia, duplex collecting system, VUR

Maternal alcohol (41)

Fetal alcohol syndrome, renal hypoplasia, kidney insufficiency

Angiotensin-converting enzyme inhibitors and angiotensin receptor blockers (47)

Acute kidney injury, renal hypoplasia

*In vitro* fertilization (48)

UPJO, duplex collecting system, PUV, VUR

## Vesicoureteral reflux and the extracellular matrix connection

Fatima Tokhmafshan<sup>1</sup>, Patrick D. Brophy<sup>2</sup>, Rasheed A. Gbadegesin<sup>3,4</sup>, and Indra R. Gupta<sup>1,5</sup>

### Extracellular matrix syndromes with VUR as a urinary tract phenotype

Syndrome	Inheritance	Gene	Characteristic features	Renal and urinary tract phenotypes
Cutis laxa	Autosomal dominant, Autosomal recessive	<i>ELN</i> , <i>FBLN4</i> , <i>FBLN5</i> , <i>ATP6V0A2</i> , <i>ATP7A</i> , <i>EFEMP2</i>	Lax and inelastic skin, vascular anomalies, gastrointestinal diverticula, abdominal hernia, genital prolapse	VUR, bladder diverticula
Ehlers–Danlos	Autosomal dominant, Autosomal recessive	<i>ADAMTS2</i> , <i>COL-I-A1</i> , <i>COL-I-A2</i> , <i>COL-III-A1</i> , <i>COL-V-A1</i> , <i>COL-V-A2</i> , <i>PLOD1</i> , <i>TNXB</i>	Hyperextensible skin, joint hypermobility, poor wound healing, easy bruising and scarring, molluscoid pseudotumors, subcutaneous spheroids, muscle hypotonia	VUR, bladder diverticula
Marfan	Autosomal dominant	<i>FBN1</i>	Increased height, disproportionately long limbs and digits, anterior chest deformity, joint laxity, vertebral column deformity, highly arched palate	VUR, bladder diverticula
Williams	Autosomal dominant	<i>ELN</i>	Cardiovascular defects, mental retardation, joint, skin, and facial abnormalities	VUR, bladder diverticula, Renal artery stenosis, agenesis, ectopia

## Vesicoureteral Reflux

Hiral Banker, Narothama R. Aeddula.

**Renal scarring** in VUR occurs by two main mechanisms:

- 1) Infected urine refluxing to the kidney creating inflammatory reactions, often resulting in fibrosis then cortical scarring. It is more prevalent with VUR grade III-V. Around 50% of patients of acute pyelonephritis develop renal scarring.
- 2) Sterile urine causes urinary back pressure on the renal pelvis and renal tubules. It is known as the "water hammer effect". Severe intrarenal reflux often results in the destruction of the tubules, parenchymal atrophy, and scarring.

# Diagnosis



## Grading system for VUR on VCUG, according to the International Reflux Study Committee



<b>Grade I</b>	Reflux does not reach the renal pelvis; varying degrees of ureteral dilatation
<b>Grade II</b>	Reflux reaches the renal pelvis; no dilatation of the collecting system; normal fornices
<b>Grade III</b>	Mild or moderate dilatation of the ureter, with or without kinking; moderate dilatation of the collecting system; normal or minimally deformed fornices
<b>Grade IV</b>	Moderate dilatation of the ureter with or without kinking; moderate dilatation of the collecting system; blunt fornices, but impressions of the papillae still visible
<b>Grade V</b>	Gross dilatation and kinking of the ureter, marked dilatation of the collecting system; papillary impressions no longer visible; intraparenchymal reflux



**Review Article****Pediatric voiding cystourethrography: An essential examination for urologists but a terrible experience for children**

Kazuyoshi Johnin, Kenichi Kobayashi, Teruhiko Tsuru, Tetsuya Yoshida, Susumu Kageyama and Akihiro Kawauchi

	VUCUG	RNC	USG	VUS	I-MRVCUG	D-MRVCUG
Diagnosis of VUR	Direct	Direct	Indirect	Direct	Indirect	Direct
VUR grading	5	3	N.A.	3	3	5
Catheterization	Yes	Yes	No	Yes	No	Yes
Radiation exposure	Yes	Yes	No	No	No	No
Clear description of whole urinary tract including urethra	Yes	Limited	Limited	Limited	Yes	Yes
Surgeon preference	Yes	Limited	Limited	Limited	Limited	Limited
Operator dependent	Yes	No	Yes	Yes	No	No
Availability	High	High	High	Limited	Limited	Limited
Cost	Low	High	Low	High	High	High

RNC = radionuclide cystography

VUS = voiding urosonography

D-MRVCUG = direct MRVCUG

USG = ultrasonography

I-MRVCUG = indirect MRVCUG

## **Advantages of VCUG**

- Direct diagnosis of VUR
- Grading of VUR
- Gives detailed information about the bladder and the urethra
- Highly available
- Low cost
- Preferred by surgeons

## **Disadvantages**

- Needs insertion of urethral catheter
- High exposure to ionizing radiation
- Increase the risk of ascending UTI

## Review Article

# **Pediatric voiding cystourethrography: An essential examination for urologists but a terrible experience for children**

Kazuyoshi Johnin, Kenichi Kobayashi, Teruhiko Tsuru, Tetsuya Yoshida, Susumu Kageyama and Akihiro Kawauchi

## **Conclusion**

Performance of VCUG should be reserved for those occasions when the results would affect VUR management to determine the requirement for surgical intervention.

CLINICAL REPORT Guidance for the Clinician in Rendering Pediatric Care

American Academy  
of Pediatrics



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# Establishing a Standard Protocol for the Voiding Cystourethrography

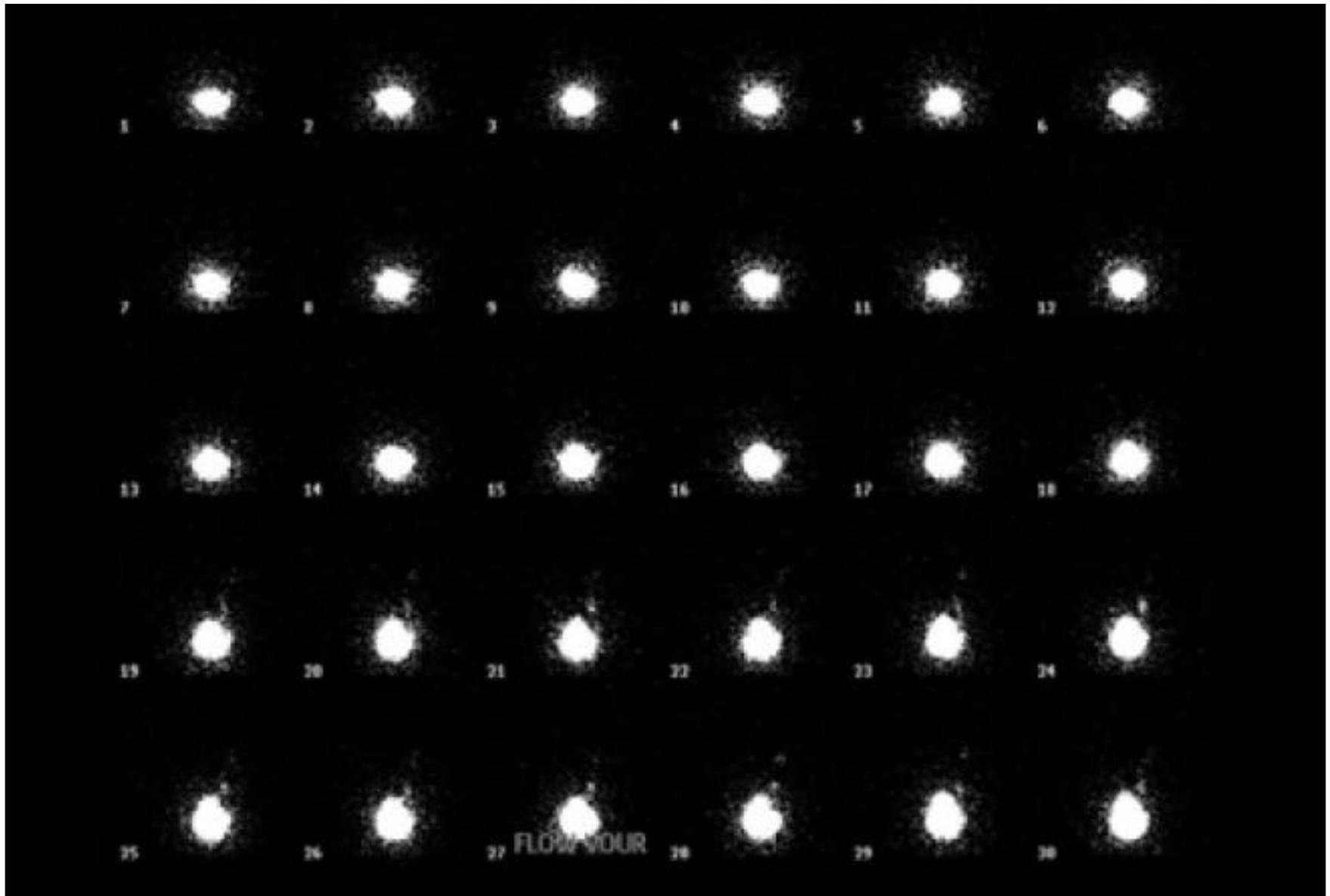
Dominic Frimberger, MD, Maria-Gisela Mercado-Deane, MD, FAAP, SECTION ON UROLOGY, SECTION ON RADIOLOGY

|PEDIATRICS Volume 138, number 5, November 2016:e20162590

# **Radionuclide techniques for the detection of vesicoureteral reflux and their clinical significance**

**Christodoulos Likartsis, Nikoleta Printza, Athanasios Notopoulos**

Hellenic Journal of Nuclear Medicine • May-August 2020





DMSA renal isotope scan for detection of renal scarring

# Medical treatment options

watchful waiting

intermittent or continuous antibiotic prophylaxis

bladder rehabilitation in those with LUTD



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VUR](#)

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## Management and Screening of Primary Vesicoureteral Reflux in Children (2010, amended 2017)

*Published 2010, amended 2017*

They include a comment that “the data were not sufficient to permit development of strict ‘standards of care’ in many instances”.

## Guidelines

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## Paediatric Urology

EAU Guidelines. Edn. presented at the EAU Annual Congress Milan 2021. ISBN 978-94-92671-13-4.

Controversy persists over the optimal management of VUR, particularly the choice of diagnostic procedures, treatment (medical, endoscopic or surgical), and the timing of treatment.

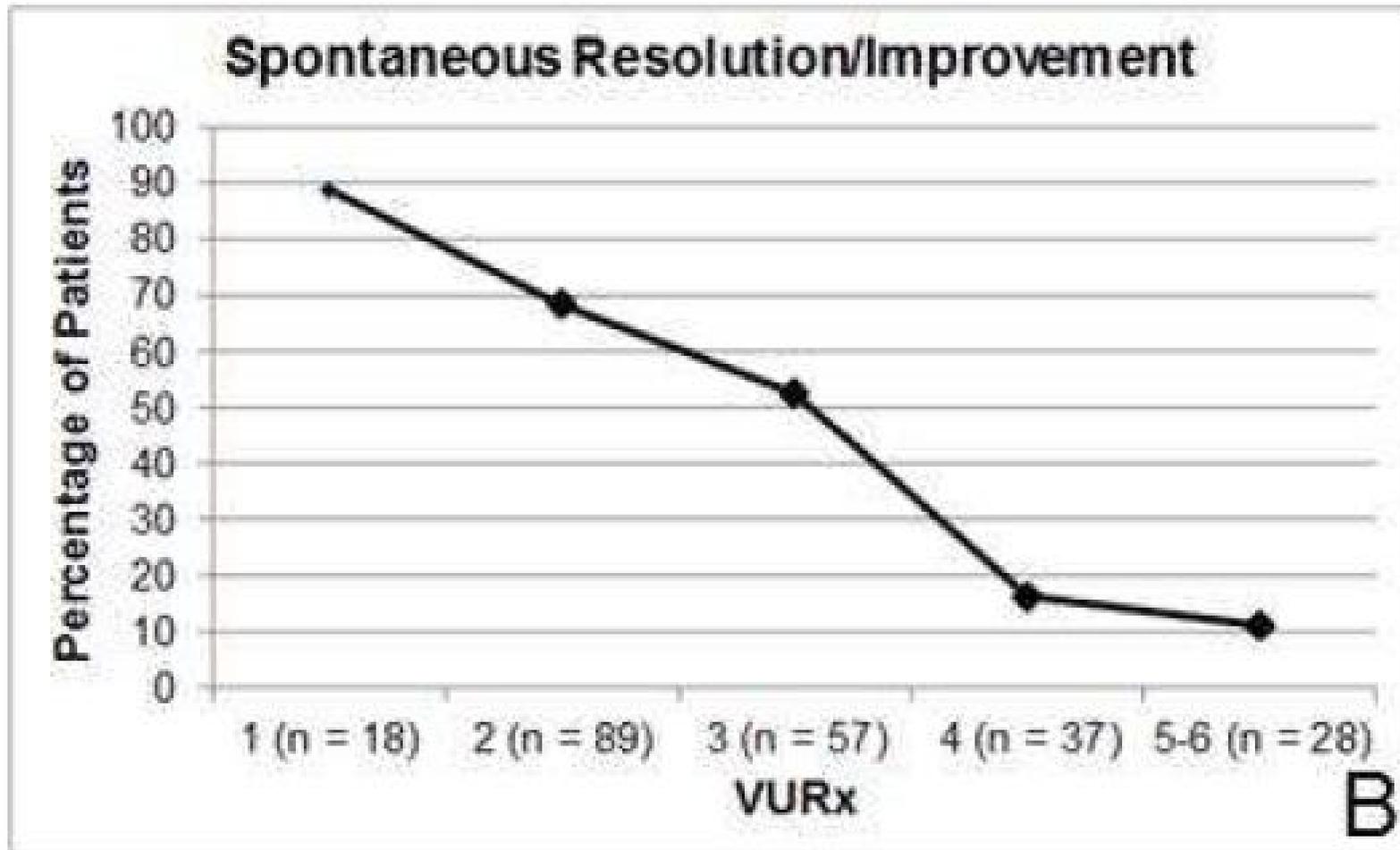
> J Pediatr Urol. 2014 Dec;10(6):1249-54. doi: 10.1016/j.jpuro.2014.06.019. Epub 2014 Jul 24.

## Vesicoureteral reflux index (VURx): a novel tool to predict primary reflux improvement and resolution in children less than 2 years of age

Andrew J Kirsch <sup>1</sup>, Angela M Arlen <sup>2</sup>, Traci Leong <sup>3</sup>, Laura S Merriman <sup>4</sup>, Lindsey A Herrel <sup>4</sup>, Hal C Scherz <sup>4</sup>, Edwin A Smith <sup>4</sup>, Arun K Srinivasan <sup>4</sup>

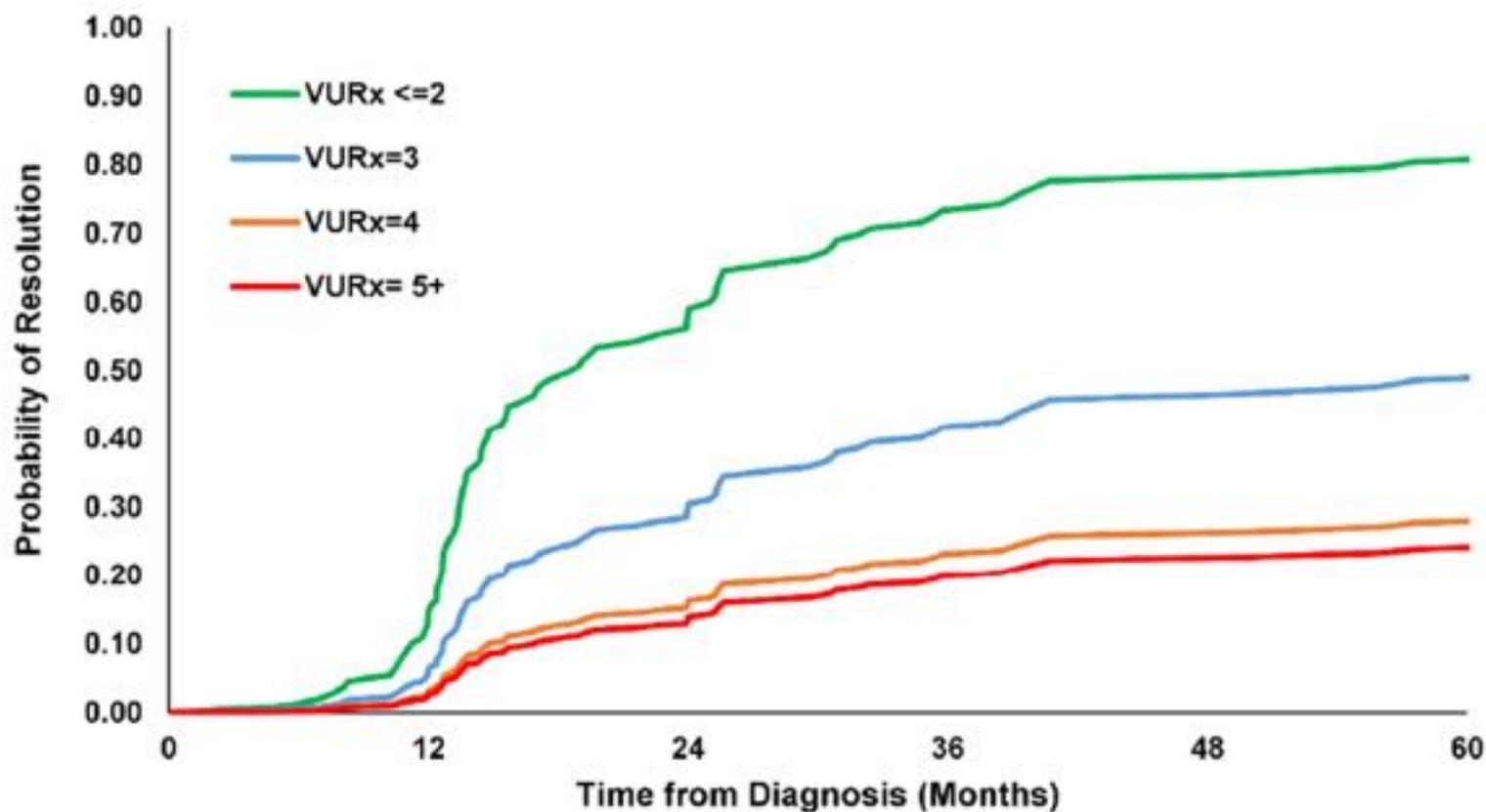
	1	2	3
Gender	female		
VUR timing	Voiding only	late	Early-mid
Ureteral anomalies	periureteral diverticulum or complete duplication		
High grade reflux	present		

Timing was assigned according to contrast volume infused and estimated bladder capacity according to age using the formula  $[\text{age}+2] \times 30$  mL. Late-filling VUR was defined as reflux onset at  $>75\%$  estimated bladder capacity.



## Vesicoureteral Reflux Index: Predicting Primary Vesicoureteral Reflux Resolution in Children Diagnosed after Age 24 Months

Michael Garcia-Roig<sup>1</sup>, Derrick E Ridley<sup>1</sup>, Courtney McCracken<sup>2</sup>, Angela M Arlen<sup>3</sup>, Christopher S Cooper<sup>3</sup>, Andrew J Kirsch<sup>4</sup>

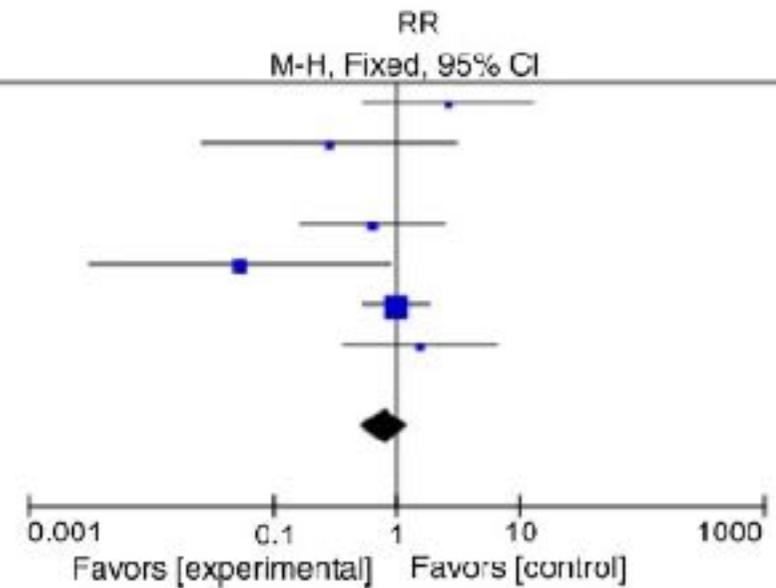


# Antibiotic Prophylaxis for Urinary Tract Infection–Related Renal Scarring: A Systematic Review

Ian K. Hewitt, MB, BS,<sup>a</sup> Marco Pennesi, MD,<sup>b</sup> William Morello, MD,<sup>c</sup> Luca Ronfani, MD,<sup>d</sup> Giovanni Montini, MD<sup>e</sup>

Study or Subgroup	Prophylaxis		No Prophylaxis		Weight, %	RR	M-H, Fixed, 95% CI
	Events	Total	Events	Total			
Garin et al, 2006 <sup>7</sup>	5	55	2	58	4.8	2.64 (0.53–13.03)	
Montini et al, 2008 <sup>8</sup>	1	82	2	46	6.4	0.28 (0.03–3.01)	
Pennesi et al, 2008 <sup>9</sup>	0	50	0	50		Not estimable	
Craig et al, 2009 <sup>10</sup>	3	35	5	37	12.0	0.63 (0.16–2.46)	
Brandström et al, 2011 <sup>11</sup>	0	68	9	68	23.5	0.05 (0.00–0.89)	
Hoberman, et al 2014 <sup>3</sup>	18	220	19	227	46.4	0.98 (0.53–1.81)	
Hari et al, 2015 <sup>12</sup>	4	37	3	43	6.9	1.55 (0.37–6.48)	
<b>Total (95% CI)</b>		<b>547</b>		<b>529</b>	<b>100.0</b>	<b>0.79 (0.51–1.24)</b>	

Total events: 31 (Prophylaxis) / 40 (No Prophylaxis)  
 Heterogeneity:  $\chi^2 = 7.84$ ,  $df = 5$  ( $P = .17$ );  $I^2 = 36\%$   
 Test for overall effect:  $Z = 1.02$  ( $P = .31$ )



In children with or without VUR and normal kidneys, the absence of any statistical benefit in the reduction of kidney scarring do not justify the possible side effects of long-term antibiotic exposure.

REVIEW

## The pathogenesis and management of renal scarring in children with vesicoureteric reflux and pyelonephritis

Vasikar Murugapoopathy<sup>1</sup> · Christine McCusker<sup>1</sup> · Indra R. Gupta<sup>2</sup> 

Received: 6 November 2018 / Revised: 11 December 2018 / Accepted: 20 December 2018

© IPNA 2019

In summary, recurrent pyelonephritis with and without VUR continues to result in renal scar formation. Antibiotic treatment eliminates bacteria, but with the risk of promoting antibiotic resistance and the possibility that a renal scar will still arise from the inflammation induced by infection.

Antibiotic prophylaxis is usually in the form of a single daily dose of co-trimoxazole (1–2 mg/kg of trimethoprim) or nitrofurantoin (1–2 mg/kg). Infants less than 3–6 mo may be administered cephalexin (10 mg/kg/d)

## Review Article

Investig Clin Urol 2017;58 Suppl 1:S54-58.  
<https://doi.org/10.4111/icu.2017.58.S1.S54>  
pISSN 2466-0493 • eISSN 2466-054X

INVESTIGATIVE AND CLINICAL UROLOGY  
**ICUROLOGY**



# Management of vesicoureteral reflux in neurogenic bladder

Charlotte Q. Wu, Israel Franco

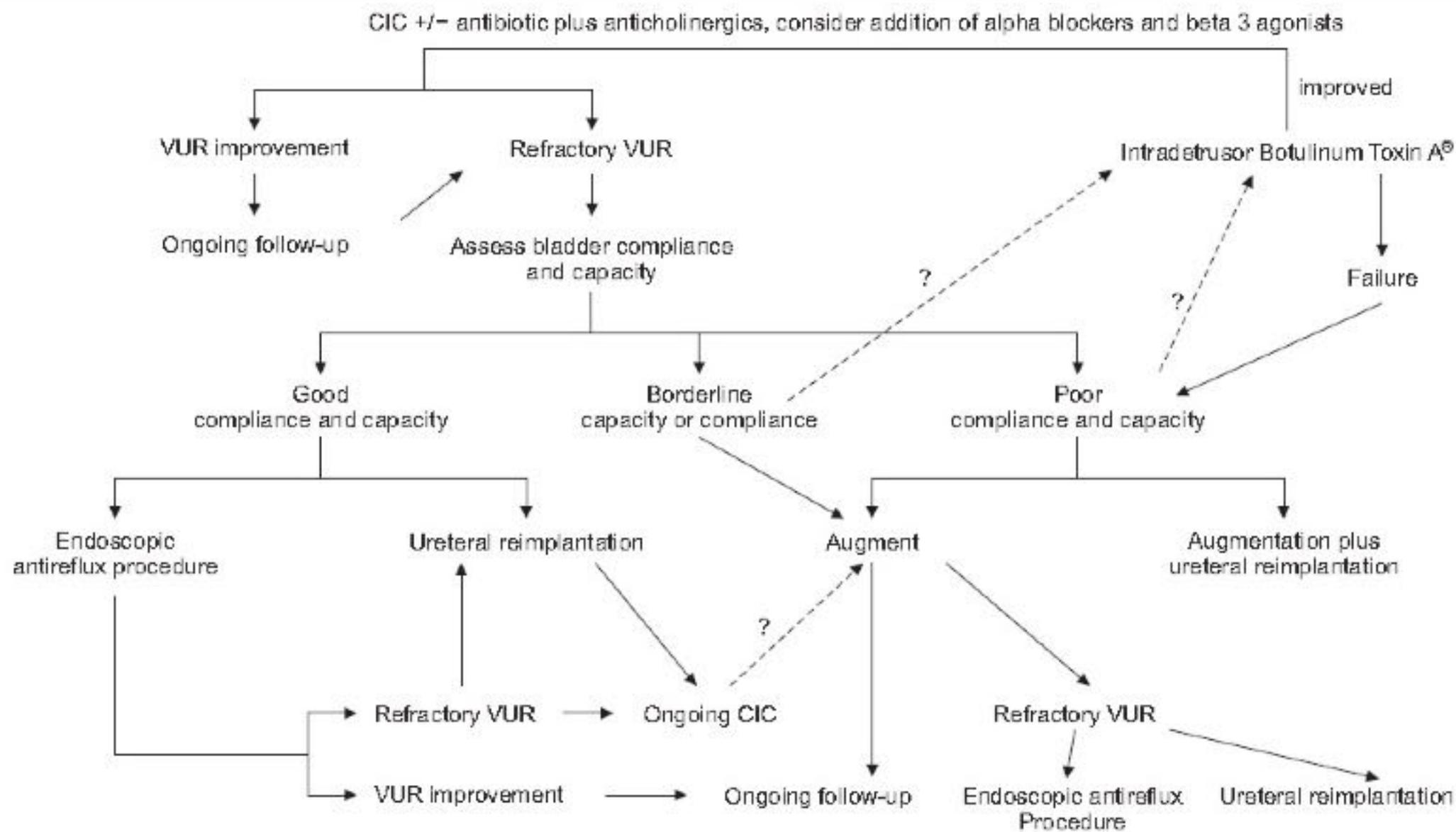


Fig. 1. Algorithm for management of vesicoureteral reflux (VUR) in neurogenic bladder. CIC, clean intermittent catheterization.

Review Article

# Envisioning treating genetically-defined urinary tract malformations with viral vector-mediated gene therapy

Filipa M. Lopes <sup>a</sup>, Adrian S. Woolf <sup>a,b,\*</sup>, Neil A. Roberts <sup>a,\*\*</sup>

# **Surgical treatment options**

Circumcision

Endoscopic Injection (EI)

Open ureteral reimplantation (OUR)

Robot-Assisted Laparoscopic Ureteral Reimplantation (RALUR)

- Circumcision during early infancy may be considered as part of the conservative approach because it is effective in reducing the risk of infection in normal children



# **Evolving surgical management of pediatric vesicoureteral reflux: is open ureteral reimplantation still the 'Gold Standard'?**

---

Andrew J. Kirsch<sup>1</sup>, Angela M. Arlen<sup>2</sup>

EI

- 1<sup>st</sup> line; 95% avoid open surgery
- Lower morbidity, ambulatory
- High parental satisfaction

OUR

- More options (intra vs. extravesical)
- Higher morbidity
- Open surgery IS minimally invasive in some situations (younger patients home quickly with concealed scar)

RALUR

- Older patients with complex anatomy (failed Dx/HA or OUR)
- Home in 1-2 days

Epub 2017 Sep 12.

# Contemporary Management of Vesicoureteral Reflux

Perviz Hajiyev<sup>1</sup>, Berk Burgu<sup>2</sup>**Table 2 – Open surgical ureteral reimplantation techniques [29,33].**

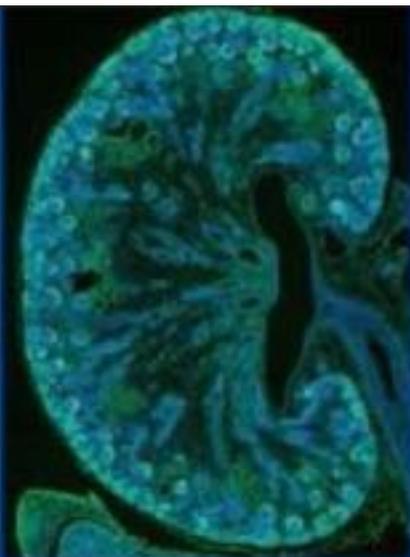
Surgery technique	Approach	Advantages	Disadvantages
Cohen	Intravesical neocystotomy	Longer tunnel length and reduced risk for ureteral kinking/obstruction	Further endoscopic procedures more difficult
Lich–Gregoir	Extravesical neocystotomy	Less invasive	Increased risk of urinary retention in bilateral repairs
Politano–Leadbetter	Intravesical–extravesical	Longer tunnel length	Ureteral kinking/obstruction
Glenn–Anderson	Intravesical trigonal advancement	Reduced risk for ureteral kinking/obstruction	Not suitable for dilated ureters

# How to proceed?

- during postnatal follow-up of antenatally diagnosed hydronephrosis
- during screening of siblings and offspring of VUR patients.
- after urinary tract infection (UTI)

# How to proceed?

- during postnatal follow-up of antenatally diagnosed hydronephrosis
- during screening of siblings and offspring VUR patients.
- after urinary tract infection (UTI)



Denis F. Geary  
Franz Schaefer



# Comprehensive Pediatric Nephrology

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CHAPTER  
**36**

## Vesicoureteral Reflux

Ranjiv Mathews and Tej K. Mattoo

**2008**

**TABLE 37-3 Causes of Prenatal Hydronephrosis Associated with Impaired Antegrade Urine Flow**

Ureteropelvic junction obstruction  
 Extrinsic  
 Intrinsic

Infundibular and infundibulopelvic stenosis

Ureterovesical junction obstruction

Posterior and anterior urethral valves

Ectopic ureteral insertion\*

Urethral atresia

Ureteral stricture<sup>105, 106</sup>

Retrocaval and retroiliac ureter

Ureterocele\*†

Vesicoureteral reflux‡

Prune belly syndrome

Extrinsic compression of urinary tract (pelvic masses, retrocaval ureter, hydrometrocolpos)

Functional pathologies (neurogenic dysfunction, megacystic microcolon intestinal hypoperistalsis syndrome<sup>107</sup>)

Complex anatomical abnormalities (cloaca, cloacal exstrophy)

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- Ultrasound of the kidney and bladder is the first standard evaluation tool and should be delayed until the first week after birth because of early oliguria in the neonate. It is essential to evaluate the bladder, as well as the kidneys.
- The absence of hydronephrosis on postnatal US excludes the presence of significant obstruction; however, it does not exclude VUR. Thus, follow up with US scans every 15-30 days, if two successive scans are normal, VUR is absent or of low-grade.
- Indications of VCUG include: the presence of cortical thinning and irregularity, as well as increased echogenicity on US, the presence of other UT anomalies or development of UTI.

# How to proceed?

- during postnatal follow-up of antenatally diagnosed hydronephrosis
- during screening of siblings and offspring VUR patients.
- after urinary tract infection (UTI)

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### 3.14.2.3. *Recommendations for paediatric screening of VUR*

<b>Recommendations</b>	<b>Strength rating</b>
Inform parents of children with vesicoureteric reflux (VUR) that siblings and offspring have a high prevalence of VUR.	Strong
Use renal ultrasound (US) for screening of sibling(s).	Strong
Use voiding cystourethrography if there is evidence of renal scarring on US or a history of urinary tract infection.	Weak
Do not screen older toilet-trained children since there is no added value in screening for VUR.	Weak

- Although early screening and therefore early diagnosis and treatment appears to be more effective than late screening in preventing further renal damage, screening in all siblings and offspring cannot be recommended based on the available evidence.

# How to proceed?

- during postnatal follow-up of antenatally diagnosed hydronephrosis
- during screening of siblings and offspring VUR patients.
- after urinary tract infection (UTI)

**EDUCATIONAL REVIEW**

# Primary vesicoureteral reflux; what have we learnt from the recently published randomized, controlled trials?

Eduardo H. Garin<sup>1</sup> 

Received: 21 June 2018 / Revised: 1 August 2018 / Accepted: 3 August 2018

1. It is not necessary to request a VCUG in every child with first febrile UTI unless abnormal RUS or other specific clinical circumstances are present.
2. It is not necessary to start routine antibiotic prophylaxis after a first febrile UTI in a VUR patient.
3. The use of long-term urinary antibiotic prophylaxis does have its drawbacks as increasing bacterial resistance and low adherence with prescribed medication. The duration of follow-up during prophylaxis in reflux patients has not been defined.

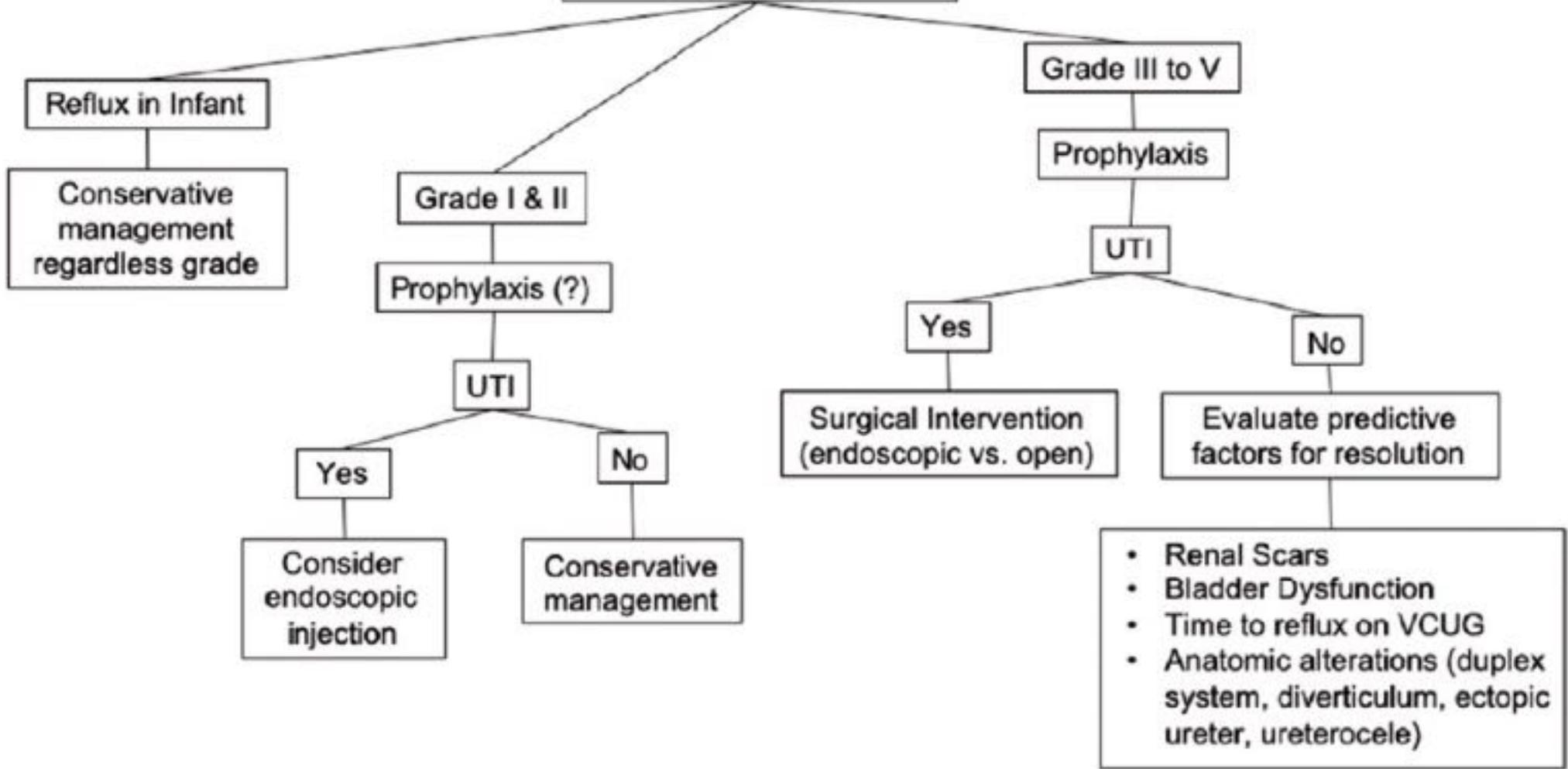


## Brazilian consensus on vesicoureteral reflux— recommendations for clinical practice

---

José Murillo B. Netto <sup>1, 2</sup>, Atila Victal Rondon <sup>3, 4</sup>, Marcos Giannetti Machado <sup>5</sup>, Miguel Zerati Filho <sup>6</sup>, Rodrigo Lessa Pena Nascimento <sup>7</sup>, Salvador Vilar Correa Lima <sup>8</sup>, Adriano de Almeida Calado <sup>9</sup>, Ubirajara Barroso Jr. <sup>10, 11</sup>

# Treatment of a Child with Vesicoureteral Reflux



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## Paediatric Urology

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### 3.14.4. *Summary of evidence and recommendations for the management of vesicoureteric reflux in childhood*

#### **Summary of evidence**

There is no evidence that correction of persistent low-grade reflux (grades I-III) without symptoms and normal kidneys offers a significant benefit.

The traditional approach of initial medical treatment after diagnosis and shifting to interventional treatment in case of breakthrough infections and new scar formation needs to be challenged, because the treatment should be tailored to different risk groups.

Surgical correction should be considered in patients with persistent high-grade reflux (grades IV/V). There is no consensus about the timing and type of surgical correction. The outcome of open surgical correction is better than endoscopic correction for higher grades of reflux, whereas satisfactory results can be achieved by endoscopic injection for lower grades.

The choice of management depends on the presence of renal scars, clinical course, grade of reflux, ipsilateral renal function, bilaterality, bladder function, associated anomalies of the urinary tract, age, compliance, and parental preference. Febrile UTI, high-grade reflux, bilaterality, and cortical abnormalities are considered to be risk factors for possible renal damage. The presence of LUTD is an additional risk factor for new scars.

Recommendations	Strength rating
Initially treat all patients diagnosed within the first year of life with continuous antibiotic prophylaxis, regardless of the grade of reflux or presence of renal scars.	Weak
Offer immediate, parenteral antibiotic treatment for febrile breakthrough infections.	Strong
Offer definitive surgical or endoscopic correction to patients with frequent breakthrough infections.	Weak
Offer open surgical correction to patients with persistent high-grade reflux and endoscopic correction for lower grades of reflux.	Strong
Initially manage all children presenting at age one to five years conservatively.	Strong
Offer surgical repair to children above the age of one presenting with high-grade reflux and abnormal renal parenchyma.	Weak
Offer close surveillance without antibiotic prophylaxis to children presenting with lower grades of reflux and without symptoms.	Strong
Ensure that a detailed investigation for the presence of lower urinary tract dysfunction (LUTD) is done in all and especially in children after toilet-training. If LUTD is found, the initial treatment should always be for LUTD.	Strong
Offer surgical correction, if parents prefer definitive therapy to conservative management.	Strong

<p>Select the most appropriate management option based on:</p> <ul style="list-style-type: none"><li>• the presence of renal scars;</li><li>• clinical course;</li><li>• the grade of reflux;</li><li>• ipsilateral renal function;</li><li>• bilaterality;</li><li>• bladder function;</li><li>• associated anomalies of the urinary tract;</li><li>• age and gender;</li><li>• compliance;</li><li>• parental preference.</li></ul> <p>Refer to Table 3 for risk factors and follow-up.</p>	Weak
<p>In high-risk patients who already have renal impairment, a more aggressive, multidisciplinary approach is needed.</p>	Strong

**Case Report**

**Distal Renal Tubular Acidosis Secondary to Vesico-ureteric reflux: a  
Case Report with Review of Literature**

Anjali Bharani<sup>1</sup>, Tanmay Bharami<sup>2</sup>, Rajesh Bharani<sup>3</sup>

Although CKD and arterial hypertension are considered the most important complications of VUR, urinary concentration and distal acidification defects are also important complications that may be seen in some children which should also be ruled out.

# Conclusions

- VUR is not uncommon in the practice of pediatric nephrology.
- Its management differs when primary than secondary to other CAKUT.
- VCUG is still the gold-standard imaging technique for VUR diagnosis despite some disadvantages.
- The ultimate goal of treatment is prevention of renal scarring with its complications.
- Treatment options include medical and surgical modalities.
- The choice of the appropriate treatment is still very controversial and need individualization based on clinical presentation and risk stratification.

