# ESPR UROGENITAL TASK FORCE VCUG Recommendations Revision 2022

# VCUG INDICATIONs

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# VCUG

- Voiding cystourethrography (VCUG) is a fluoroscopic study of the urinary tract.
- The purpose of the examination is to assess the bladder, urethra, other opacified structures, voiding phase and presence or absence of vesicoureteral reflux (VUR)

American College of Radiology. ACR–SPR practice parameter for the performance of fluoroscopic and sonographic voiding cystourethrography in children. 2016

## VCUG RECOMMENDATIONS REVISION: WE START FROM ESPR 2008 VCUG RECOMMENDATION <sup>1</sup>



# VCUG Revisited Indications Compared with CEVUS

2008

Pahair Radiol (2008) 38:108-148 DOI 10.1007/a00047-007-0595-7

REVIEW

Imaging recommendations in paediatric uroradiology: minutes of the ESPR workgroup session on urinary tract infection, fetal hydronephrosis, urinary tract ultrasonography and voiding cystourethrography, Barcelona, Spain, June 2007

Michael Ritcabona - Fred E. Avni -Johan G. Blickman - Jean-Nicolas Dacher -Kassa Darge - M. Luisa Lobo - Ulrich Willi

Urinary tract Malformation, Pelvicaliceal Dilatation > II° or "extenden criteria"

Pediatr Radiol (2014) 44:1478-1494 DOI 10.1007/s00247-014-3135-5

#### ESPR

ESPR uroradiology task force imaging recommendations in paediatric uroradiology, part VII: standardised terminology, impact of existing recommendations, and update on contrast-enhanced ultrasound of the paediatric urogenital tract

**2014**<sup>2</sup>

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# VCUG / CEVUS Revisited Indications

- 1. Urinary Tract Infection (UTI)
- 2. Pelvicaliceal Dilatation (PCD)
- 3. Lower Urinary Tract and Genital Malformation
- 4. Familial Vesicoureteral Reflux
- 5. Vesicoureteral Reflux Follow up and Postoperative
- 6. Dysfunctional Voiding (Neurogenic/Non Neurogenic)
- 7. Trauma (in selected case retrograde urethrogram is required)

## EPIDEMIOLOGY and CLINICAL IMPACT

- UTI represents the most common bacterial infection in children.<sup>3</sup>
- Prevalence of Vesicoureteric Reflux in children with febrile UTI is 30-50%. <sup>4</sup>
- The prevalence of renal scarring after febrile UTI is 10-40% of children with VUR, resulting from either congenital dysplasia and/or acquired post-infectious damage.
- Reflux nephropathy (RN) may be the most common cause of childhood hypertension, accounted for 7% to 17% of End Stage Renal
   Disease cases. <sup>4,7</sup>

A major goal of treating a child with VUR is to prevent recurring UTIs and renal parenchymal injury.<sup>4,16</sup>

## CLASSIFICATION

According to symptoms

- Asymptomatic Bacteriuria;
- Symptomatic UTI;

#### According to site

- Lower Urinary Tract Infection: **Cystitis**;
- Upper Urinary Tract Infection: **Pyelonephitis**;

#### According to age:

#### According to episode:

#### • First febrile UTI;

#### • Recurrent UTI:

*Unresolved:* the initial therapy is anedequate for elimination of bacterial growth in the urinary tract; *Persistent:* infection is caused by a ri-emergence of bacteria from a site within the urinary tract that cannot be eradicated (ex. stone), and the same pathogen is identified in persistent infection;

*Re-infection:* each episode can be caused by a variety of new organisms;

• **Breakthough UTI**: infection occurring in patients receiving antimicrobial prophilaxys.

#### According to complicating factors:

- Uncomplicated UTI: infection occurs in a patient with a morphologically and functionally normal upper and lower urinary tract, normal renal function and competent immune system;
- **Complicated UTI:** in newborns, abdominal and/or bladder mass; kidney and urinary tract anomalies; urosepsis; organism other than E. coli; atypical clinical course, including absence of clinical response to antibiotic within 48 h; decreased urine stream and raised creatinine. <sup>5, 6, 7</sup>

In infants there is increased incidence of sepsis and congenital renal abnormalities associated with febrile UTIs and incressed rate of hospitalization. Instead, the incidence of febrile UTI in older children is infrequent and often associated with behavioral abnormalities or dysfunctional elimination syndrome.<sup>7</sup>

[3] Hoen, Lisette A et al. "Update of the EAU/ESPU guidelines on urinary tract infections in children." Journal of pediatric urology 2021

## Urinary Tract Infection (UTI)

NICE 2007/ Revised 2018 <sup>8</sup>	<6months 1 <sup>st</sup> febrile UTIs $\rightarrow$ US $\rightarrow$ if pathologic findings $\rightarrow$ VCUG 6months - 3years Atypical/Recurrent febrile UTIs $\rightarrow$ US $\rightarrow$ VCUG $\geq$ 3 years Atypical/Recurrent febrile UTIs $\rightarrow$ US
<b>AAP 2016:</b> <sup>9</sup>	1 <sup>st</sup> febrile UTIs $\rightarrow$ US $\rightarrow$ if pathologic findings $\rightarrow$ VCUG
	Recurrent febrile UTIs → VCUG
	Complex or Atypical febrile UTIs → VCUG
APP Clinical Practise Gu	aidelines are targeted to febrile infants from 2months to 2 years.

<b>ACR 2017:</b> <sup>7</sup>	1 <sup>st</sup> febrile UTIs in children <2months $\rightarrow$ VCUG in boys and Direct Radionucleide Cystography in girls.
	1 <sup>st</sup> febrile UTIs in Infants age >2months and <6years $\rightarrow$ US and option for VCUG
	1 <sup>st</sup> febrile UTIs in Infants <mark>.≥6years.</mark> → NO IMAGING
	Atypical UTIs $\rightarrow$ VCUG
ACR recognises ce-VUS	S as a accurate method to evaluate Vesicoureteral Reflux but it is not in their Appropriateness Criteria.

#### AAP Clinical Practise Guidelines and ACR Appropriateness Criteria were published before 2016 FDA approval of US contrast agent.

IT 2020: <sup>6</sup>	1 <sup>st</sup> febrile UTIs $\rightarrow$ US $\rightarrow$ if pathologic findings $\rightarrow$ VCUG as standard, Direct Radionucleide Cystography in girl and ce-VUS are alternative test.
	Second febrile UTIs → VCUG as standard, Direct Radionucleide Cystography in girl and ce-VUS are alternative test.
	Non <i>E.Coli</i> febrile UTIs → VCUG as standard, Direct Radionucleide Cystography in girl and ce-VUS are alternative test.

- <u>1<sup>st</sup> febrile UTIs</u>  $\rightarrow$  US  $\rightarrow$  if pathologic findings  $\rightarrow$  Detection of Vesicoureteric Reflux by imaging
- Febrile UTIs in Infants <12months  $\rightarrow$  Detection of Vesicoureteric Reflux by imaging

**EAU/ ESPU 2021:**<sup>3</sup>

- Recurrent febrile UTIs  $\rightarrow$  Detection of Vesicoureteric Reflux by imaging
- Non *E.Coli* febrile UTIs  $\rightarrow$  Detection of Vesicoureteric Reflux by imaging

VCUG remains the gold standard test for the Vesicoureteric Reflux detecting, but in EAU/ESPU '21 it is added also <u>ce-VUS</u> (urosonography) as a possible imaging.

# VCUG/CEVUS Indications

* UTI	<ul> <li>1<sup>st</sup> Febrile UTIs: - with alt. US;</li> <li>Recurrent Febrile UTIs.</li> </ul>	- Complicated - Infants<12m	

## Pelvicaliceal Dilatation (PCD)

✓ PCD is found in 1-2% of prenatally examinations<sup>11</sup>

✓ 80% have spontaneous resolution. <sup>12</sup>

 $\checkmark$  Vesicoureteral Reflux prevalence is 15-21% in screened populations with prenatal PCD. <sup>12</sup>

- ✓ Febrile Urinary Tract Infections in patients with antenatal PCD is up to 15–29% in PCD grades 3–4
- $\checkmark$  Renal scarring occurs in approximately 10%.
- ✓VCUG is also indicated as an immediate postnatal study for neonates with prenatal PCD and suspected bladder outlet obstruction. <sup>14, 15</sup>

## Pelvicaliceal Dilatation (PCD)

## ✤ ANTENATAL

#### ➢ SOCIETY FOR FETAL UROLOGY 2010: <sup>13</sup>

	2 trimester	3 trimester
Mild	4 to < 7mm	7 to < 9 mm
Moderate	$7 \le 10 \text{ mm}$	9 to ≤15mm
Severe	> 10 mm	> 15 mm

## ✤ POSTNATAL

#### SOCIETY FOR FETAL UROLOGY 2010: <sup>13</sup>

- SFU 0 Normal, no splitting.
- SFU 1 Urine in pelvis barely splits sinus.
- SFU 2 Urine fills intrarenal pelvis, few calyces visualised and dilatated.
- SFU 3 SFU2 and minor calyces uniformly dilatated and parenchyma preserved.
- SFU 4 SFU 3 and parenchyma thin.

#### ► EUROPEAN SOCIETY OF PEDIATRIC RADIOLOGY 2008 (ESPR): 1



## VCUG IN PCD RECOMMENDATIONs

- ➤ ACR 2020: <sup>17</sup>
- Follow-up in 1 to 6 months with an US is usually appropriate for neonates with an antenatal diagnosis of hydronephrosis and SFU grade 1 and 2 (PCD 1 e 2) on initial US;
- Antenatal diagnosis of hydronephrosis and <u>SFU grade 3 or 4 or AP Renal Pelvic Diameter</u> >15mm (PCD 3 e 4) hydronephrosis on initial neonatal US, or hydronephrosis associated with parenchymal abnormalities, hydroureter, or bladder wall thickening.

 $\rightarrow$  VCUG, or MAG3 renal scan is usually appropriate for a male child.

→VCUG, voiding urosonography, or MAG3 renal scan is usually appropriate for a female child.

Ped Nephrol 2018 Visuri et al. In patients with antenatally detected PCD, a visible ureter and reduced renal length in US are significant risk factors for high-grade VUR.<sup>12</sup>

When infants who were diagnosed with prenatal PCD become symptomatic with Febrile Urinary Tract Infection, further evaluation with VCUG should be considered.<sup>4</sup>

# VCUG/CEVUS Indications

* UTI	<ul> <li>1<sup>st</sup> Febrile UTIs: - with alt. US; - Complicated - Infants&lt;12m</li> <li>Recurrent Febrile UTIs.</li> </ul>
*PCD	<ul> <li>SFU Grade 3-4/ PCD 3-4.</li> <li>with other Renal, Ureteral and/or Bladder US abnormalities.</li> <li>Febrile UTI.</li> </ul>
Lower Urinary Tract and Genital Malformation	<ul> <li>Suspicion of Genitourinary malformation.</li> <li>Pre-surgery anatomy study.</li> </ul>
* Familial VUR	<ul><li>Sibling with altered US or febrile UTI.</li><li>Offspring with altered US or febrile UTI.</li></ul>
* Follow up VUR	<ul> <li>After endoscopic injection (especially if recurrent UTIs)</li> <li>Febrile UTIs post Ureterocystoneostomy.</li> <li>Asymptomatic patient with Vesicoureteral Reflux (possibly with ceVUS).</li> </ul>
Dysfuctional Voiding	<ul> <li>VCUG and Urodynamics are an alternative to Video Urodynamics</li> <li>In the case of Renal, Ureteral and/or Bladder US abnormalities.</li> <li>Febrile UTI.</li> </ul>
Trauma	<ul> <li>Bladder rupture (ceVUS).</li> <li>Urethra/Bladder trauma.</li> </ul>

## \*ceVUS alternative to VCUG

# CEVUS diagnostic ACCURACY (compared to VCUG)

# Sensitivity : 90.4 %. Specificity 92.8% Chua ME, Mendoza JS, Ming JM et al. World J Urol, 2018

# ➡ 10% more VUR diagnosed by ceVUS Papadopoulou F, Ntoulia A, Siomou E, Darge K. Pediatr Radiol, 2014

More sensitive in detecting intra renal reflux Kim D, Choi YH, Choi G et al.uUltrasonography, 2021

## VCUG and CEVUS COMPARISON

	CeVUS	VCUG
Invasiveness	-	-
Radiation exposure	+	-
Time of examination	-	+
Learning curve and operator dependence	-	+
Usefulness in complex anatomy or abdominal gas pattern	-	+
Bladder wall	+*	+*
Urethra	+	++
Detection of VUR in coexisting obstruction	+	-
Panoramic views	-	+
Accurate road map for surgery	-	+
Volume and viability of data	-	+

• Bladder wall thickness best assessed on CeVUS

Strength + Weakness -

• Bladder wall trabeculations and irregularities on VCUG

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