



## THE VALUE OF ULTRASONOGRAPHY FOR DIAGNOSING VESICoureTERAL REFLUX IN SYMPTOMATIC FIRST URINARY TRACT INFECTION IN CHILDREN OF A TERTIARY CARE HOSPITAL.

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**ABSTRACT** **Introduction:** Vesicoureteral reflux (VUR) is a common underlying abnormality for Urinary tract infection (UTI) in children. Detection of this VUR has been achieved by voiding cystourethrography (VCUG). For evaluation of VUR, renal ultrasonography is shown to be feasible but is not widely accepted. On this background our aim was to assess the value of routine ultrasonography in detecting VUR in children with symptomatic first UTI.

**Materials and Method:** Prospective observational study was conducted on 102 patients with diagnosed first documented symptomatic UTI. All children were evaluated with renal ultrasonogram and VCUG.

**Results:** Sensitivity and specificity value of ultrasonography in suggesting vesicoureteral reflux were 72.72% and 92.77% respectively. The most accurate results of sensitivity were obtained with high grades reflux (88.89%).

**Conclusions:** Ultrasonography is reliable in the exclusion or verification of high grade reflux and it has a low sensitivity in low grade vesicoureteral reflux.

**KEYWORDS :** UTI, Ultrasonography; Voiding cystourethrography; Vesicoureteric reflux.

### INTRODUCTION:

Urinary tract infection (UTI) is one of the most common bacterial infections in children, among them 8% were girls and 2% were boys<sup>[1]</sup>. UTI in young children indicates abnormalities of the urinary tract among the abnormalities vesicoureteral reflux is one of the important abnormality. The prevalence for vesicoureteral reflux (VUR) in young children (< 4 years) is 25%<sup>[3,4]</sup>. The gold standard investigation for diagnosis of VUR is the Voiding cystourethrography (VCUG)<sup>[5]</sup>. But there are so many disadvantages of the VCUG. These are traumatic examination for the child, exposure of the child's gonads to a high radiation dose. So investigations like VCUG involving ionizing radiation need to be justified and optimized if they are to be performed. However, the accurate diagnosis of this procedure depends upon the presence of the reflux because the VUR is seen alternatively<sup>[6]</sup>. The accurate diagnosis of VCUG for diagnosing the reflux is very high and for the reflux with a high grade (grade III and IV) is high as nearly as 100%<sup>[7]</sup>. But ultrasonography (US) has no ionizing radiation. US is an easy to reach and easy to perform technique<sup>[8,9]</sup>, though few studies stated that US is not as accurate as VCUG in diagnosing VUR<sup>[10,11]</sup>. On our study was conducted to assess the role of USG in diagnosing VUR.

### OBJECTIVE:

The aim of our study was to evaluate the role of USG in diagnosing VUR in patients with first symptomatic UTI.

### MATERIALS and METHODS:

An observational cross-sectional study was conducted in the department of pediatrics, G.S.V.M Medical College, Kanpur, India for two years and six months between January 2008 and July 2010. We have collected data on 150 children who were diagnosed with a clinically proven first episode of UTI at the pediatric department of our hospital. Then all children were undergone history taking, clinical examination and proper investigations. Among all 150 symptomatic children only 102 children were included in our study according to inclusion and exclusion criteria. Inclusion criteria were; age between 6 months to 5 years, documented symptomatic culture proven first UTI cases and exclusion criteria were; previous history of UTI, h/o antibiotic intake within 7 days, any obvious neurological abnormalities and impairment. UTI was diagnosed by; the presence of any growth on suprapubic specimen or  $\geq 50 \times 10^5$  CFU/ml of catheterized sample, or more than  $10^5$  CFU/ml organisms of a single species<sup>[12]</sup>. All 102 children were evaluated with an USG and Voiding cystourethrography (VCUG). VCUG was generally performed at least 1 month after the first UTI under fluoroscopic guidance with the child awake as described previously<sup>[13]</sup>. VUR was graded by means of the International Reflux Study Committee classification<sup>[14]</sup>. The study

protocol was reviewed and approved by the Ethics committee of G.S.V.M Medical College, Kanpur, India. All statistical analysis was done using SPSS version-20.

### RESULT:

The study was performed in patients with urine culture proven documented first UTI at the pediatric department of our Children hospital, G.S.V.M Medical College, Kanpur from 2008 to 2009. A total of 102 patients were selected with the above criteria and were evaluated by clinical, microbiological and radiological examination. Among the 102 children with first UTI, 62 (60.78%) were girls and 40 (39.21%) were boys. VCUG was performed in all children. In this study 204 cases of kidney-ureter-unit (102 patients) were examined. On VCUG thirty one children (30.39%) had evidence of VUR of this 18 patients had unilateral (18 kidney-ureter-unit) and 13 patients had bilateral (26 kidney-ureter-unit) reflux. Among 44 kidney-ureter-unit of VUR, 35 (79.55%) kidney-ureter-unit had grade I, II, or III (low-grade) (Table 1) and 9 kidney-ureter-unit had grade IV, V (high grade). VCUG showed reflux in 44 kidney-ureter-unit. Of these, 32 kidney-ureter-unit were diagnosed by renal ultrasonography. In ultrasonography 6 kidney-units shown reflux but VCUG was reported normal (Table 2). The sensitivity of the renal ultrasonography versus VCUG in diagnosing the VUR was 72.72% (Table-3), and the specificity of sonography versus VCUG was 92.77%. The positive and negative predictive values were 84.21% and 92.77%, respectively. The sensitivity of sonography versus VCUG in diagnosing the VUR for grades IV and grade V (high grade) was 88.89%.

### DISCUSSION:

VUR is a common abnormality of genitourinary system in children and that abnormality leads to ascending infection, renal growth impairment and parenchymal scarring and is also responsible for 30-50% of renal failure in children<sup>[15]</sup>. Previous studies have assessed the value of sonography in diagnosis of VUR and outcome of these investigation have been different<sup>[10,16,17]</sup>. It has been suggested that ultrasonography might be substituted for other methods of both upper and lower urinary tract as it has the advantage of being non-invasive and without radiation. In USG the dilatation of renal pelvis and/or ureter was considered as a sign to diagnose the VUR. Kopac *et al.* and Keney *et al.* stated that the dilatation of ureter or renal pelvis can be considered as a criterion to diagnose the VUR<sup>[18,19]</sup>.

The results of this study showed that VCUG diagnosed reflux in 44 kidney-ureter-unit among them 32 kidney-ureter-unit had evidence of VUR in sonography. Whereas USG diagnosed 6 kidney-ureter-unit had reflux but VCUG was reported normal. The sensitivity and the

specificity of the sonography versus VUCG in diagnosing the VUR were 72.72% and 92.77% respectively. The positive and negative predictive values of USG in VUR diagnosis were 84.21% and 92.77%, respectively. But the sensitivity of sonography for high grades reflux (grades IV and grade V) are even higher (88.89 %) in diagnosing the VUR. Several studies have reviewed the USG in contrast to VCUG. Sensitivity, specificity, Positive predictive value and negative predictive value of ultrasonography for prediction of VUR was 40%, 76%, 32% and 82% respectively in Mahant and Alshamsa studies<sup>[10,13]</sup>. Also, in study by Lee et al<sup>[20]</sup>, the prediction of VUR by ultrasonography were 41.7% and 86% in low and high grade VUR by ultrasonography. Zamir et al. showed that the specificity value of USG in diagnosing the reflux is high and their results are similar to our study<sup>[21]</sup>.

But Several recent studies have shown different findings regarding the usefulness of RUS as a screening tool for VUR. Like Alon and Ganapathy<sup>[22]</sup> evaluated 124 patients with UTI among them 8.1% of patient showed hydronephrosis and/or hydroureter in sonography however, by VCUG, 38% patients were found to have VUR. Another study<sup>[23]</sup> evaluated 453 children with RUS, VCUG, and dimercaptosuccinic acid renal scan (DMSA), among them 101 children who had a normal RUS and normal DMSA, 23% had VUR in VCUG. DiPietro et al<sup>[24]</sup> reported almost similar findings. Smellie and Rigden<sup>[25]</sup> evaluated 58 children with UTI by four methods of investigation. Thirty six patients (62%) have VUR by VCUG, but among them only 13% had abnormal RUS and this study showed that sensitivity, specificity, and false negative rate of RUS for predicting VUR were 42%, 91%, and 78%. Another study by Hoberman et al<sup>[26]</sup> found that the sensitivity of RUS for detecting VUR on VCUG was 10%, and PPV was 40%. But there is uncertainty about the most appropriate investigation for necessary management while protecting the child from radiation or invasive procedures.

In our study it was shown that sonography has a high specificity but a low sensitivity values to diagnose the reflux. Though the results have been different from various study, but most of these studied have stressed that sonography is a safe and reasonable procedure for VUR diagnosis<sup>[3,8,17]</sup>. The main advantage of USG in contrast to VCUG is that it does not employ ionizing radiation. It is also possible to repeat the sonography in patients<sup>[8]</sup>. When the bladder is full, cyclical filling of the bladder may increase the sensitivity for detection of VUR at the expense of increased radiation dose. For this reason the USG can be used as an alternative procedure to diagnose the VUR.

**CONCLUSIONS**

This study revealed that ultrasonography has a high specificity but a low sensitivity values to diagnose the reflux. But the sensitivity of ultrasonography for high grades reflux are even higher in diagnosing the VUR. Our results showed that sonography is reliable in the exclusion or verification of high grade vesicoureteral reflux. Ultrasonography is a reasonable and almost cheap technique without any ionizing radiation which can be performed in all children with first urinary tract infection.

**Table- 1: VCUG findings in symptomatic children hospitalized for a first urinary tract infection according to sex.**

	Grade of VUR	Male No (%)	Female No (%)	Both (n=102) No (%)
No VUR	0	27(26.47%)	44(43.13%)	71(69.60%)
VUR	I	4(1.94%) ku unit	6(2.94%) ku unit	10(4.88%) ku unit
	II	7(3.43%) ku unit	9(4.42%) ku unit	16(7.85%) ku unit
	III	3(1.47%) ku unit	6(2.94%) ku unit	9(4.41%) ku unit
	IV	2(0.98%) ku unit	4(1.96%) ku unit	6(2.94%) ku unit
	V	1(0.49%) ku unit	2(0.98%) ku unit	3(1.47%) ku unit
	Unilateral	9(8.82%)	9(8.82%)	18(17.65%)
	Bilateral	4(3.92%)	9(8.82%)	13(12.74%)
	Total	13(12.74%)	18(17.64%)	31(30.39%)

ku unit - kidney –ureter unit

**Table -2: Comparative results of VCUG and USG**

VCUG(KU units)	VUR+	VUR-	TOTAL
USG(KU units)			
VUR+	32	12	44
VUR-	6	154	160
TOTAL	38	166	204

Sensitivity	72.72%
Specificity	92.77%
Positive predictive value	84.21%
Negative predictive value	92.77%

ku unit - kidney –ureter unit

**Table -3: Ultrasound results by grade of VUR on voiding cystourethrogram**

VCUG Grade	Ultrasound		Total	Sensitivity
	Abnormal	Normal		
Low grade VUR	I	6	4	68.57%
	II	11	5	
	III	7	2	
High grade VUR	IV	5	1	88.89%
	V	3	0	
Total	32	12	44	

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