



**IS VOIDING CYSTOURETHROGRAM NECESSARY IN A FEBRILE INFANT  
WITH NORMAL RENAL ULTRASOUND?**

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**Abstract**

***Aims:***

To determine the sensitivity, specificity, and predictive values of renal ultrasound findings for vesicouretral reflux (VUR) in febrile infant with urinary tract infection.

***Patients and Methods:***

Retrospective review of the ultrasound and voiding cystourethrogram (VCUG) results of 42 infants under 3 months of age admitted with their first episode of urinary tract infection (UTI) over 18 months period. Ultrasound findings were considered suggestive of VUR if 'dilatation of the pelvi-calyces', 'dilatation of ureters' or "dilatation of the collecting system of one or both kidney" was reported.

***Results:***

A total of 49 patients were eligible for inclusion (medium age 28 days, 30 (71%) were male). Forty-two patients met all inclusion criteria. Prevalence of VUR on VCUCs was 62 % (26/42). Sensitivity of ultrasound for detection of VUR was 62 %, specificity 62 %, positive predictive value = 73, Negative predictive value = 50 %.

**Conclusion:**

Renal ultrasound findings are not sensitive and not specific for VUR in infant under 3 months of age with first UTI. So, VCUG is necessary in these infant even if renal ultrasound is normal.

**Key words:** urinary tract infection, vesicouretral reflux, fever, ureter

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**Introduction**

The urinary tract is a relatively common site of infection in infants and young children. Urinary tract infections (UTI) are important because they cause acute morbidity and may result in long term medical problems, including hypertension and reduced renal function (1). The prevalence of UTI in girls younger than 1 year of age is 6.5 %, in boys it is 3.3 % (2). Because urinary tract infection in infant cannot be identified clinically, Renal ultrasound of such patients may be warranted (3). The purpose of the Renal ultrasound is to detect anatomical abnormalities of the urinary tract systems as well as VUR. Because Renal U/S is safe, non-invasive and inexpensive, physicians may be reassured by normal ultrasound and not appreciative of performing VCUG which is the gold standard test for the diagnosis of visecouretral reflux. The objective of this study was to determine whether the presence of a dilated collecting system of the Kidney and urinary tract, as reported by Radiologist, predicted the presence of VUR on VCUG.

**Patients and Methods**

All patient admitted to Al-Jahra Hospital from 1st January 2002 to 30th September 2003, with a discharge diagnosis of urinary tract infection (UTI) were identified by retrospective review of the medical records for urinary tract infection. All the charts of all infant under 3 months of age admitted with UTI defined as presence of a pure bacterial growth > 100000 colony forming units/ml (4) were reviewed. Infant with spinal cord abnormalities were excluded. At Al-Jahra Hospital, the current protocol for urinary tract infection in the department of pediatric requires that all infants under 3 months of age admitted with culture proven UTI be investigated with Ultrasound (u/s) and voiding cystourethrogram (VCUG). The renal ultrasound is done at time of admission. In this study, a renal U/S was considered suggestive of VUR, if "a dilatation of the pelvi-calyces", " Dilation of the ureter " or "dilatation of the collecting system of one or both kidneys" was reported. All VCUG were performed at Al-Jahra Hospital before or soon after discharge. All patients were on prophylactics antibiotics, pending their VCUG test results. All ultrasound and voiding cystourethrogram(VCUG) studies were reviewed by a group of five staff radiologists.

Descriptive statistics for the entire group included age, sex and prevalence of VUR. The statistical indices used to evaluate the properties of the diagnostic test were sensitivity, specificity and predictive values (positive and negative) when gold standard test exists (in this case, VCUG), sensitivity was defined as the proportion of those with the disorder (VUR) in whom the test (renal U/S) is a definitive, specificity in the proportion of those

without the disorder in whom the test is negative. The positive predictive value in this context is the probability of VUR in infant with dilatation noted on the ultrasound scan; the negative predictive value is the probability of no reflux in infant with no dilatation noted in ultrasound. For all indices, 95% confidence interval when calculated around the point estimates.

## **Results**

A total of 49 charts of patients less than 3 months of age with a discharge of UTI were identified. Three were excluded because of presence of spinal cord anomalies. Four patients who were booked for VCUG on out-patient, did not return for their appointment, leaving 42 subjects with UTI who had a VCUG performed. The median age of the 42 infants was 28 days; 30 (71%) were male. The median number of days between start of treatment for UTI and ultrasonography was 4 days. Twenty six patients were found to have VUR on VCUG, giving prevalence of 62 %. Of these 26 patients, one had grade I reflux, 3 had grade II reflux, 11 had grade III reflux , eight had grade IV reflux, and 3 had grade V reflux. Ultrasound result, suggested the presence of VUR in 16 of the 26 patients, and in 6 of 16 patients without VUR on VCUG. Table-I shows the distribution of the 26 patients with VUR on VCUG. The sensitivity of ultrasound for detection of VUR was 62 %; specificity was 62 %. The positive predictive value of ultrasound for VUR was 73 % and the negative predictive value was 50%.

## **Discussion**

This study shows that ultrasound findings are not predictive of VUR on VCUG. Furthermore, some children with higher grade VUR by VCUG were not detected by renal ultrasound including 8 infants with grade III and two with grade IV reflux. Our review of literatures showed few similar studies examined the reliability of ultrasonography in identification of reflux Nephropathy in children. Stokland and colleagues (5)-looked at older children (near age 2 years) who were referred for renal ultrasound and VCUG for first episode of UTI. Sherwood and colleagues (6) also found that ultrasound was not sensitive for VUR.

The median age of the children in our study was 28 days reflecting the group in pediatric population at risk of invasive bacterial infections . Hoberman and colleagues (7) investigated the prevalence of UTI among 945 febrile infant , with and without an apparent source of fever. They found fifty (3.3%) of the 945 febrile infant, had positive culture.

Our study showed that boys are more susceptible to urinary tract infection than girls. This finding is similar to other studies (8), which showed that boys are more susceptible before the age of 3 months.

Our study, being retrospective in design, had some limitations. The number of our subjects was small compared to other studies, which showed similar results. All ultrasound and VCUG studies were reviewed by a group of five staff Radiologists.

However, inter-rater reliability was not assessed. Because Radiologist reading the VCUG results, were not blinded to the ultrasound results, bias can not be excluded.

## **Conclusion**

Renal Ultrasound findings are neither sensitive nor specific for VUR. Therefore, physician should not use renal ultrasound findings to influence the decision on whether or not to proceed with a VCUG in the investigation even in infant under three months of age.

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