URINARY TRACT INFECTION IN CHILDREN UNDERGOING DIAGNOSTIC VOIDING CYSTOURETHROGRAPHY

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ABSTRACT

Objective — *To determine the frequency of urinary tract infection (UTI) in children undergoing voiding cystourethrogram (VCUG) and to find out congenital urinary tract anomalies (CUTA) that may predispose to such an outcome.*

Study design — *Descriptive case series.*

Place & Duration of study — *The Department of Pediatric Nephrology, National Institute of Child Health (NICH) Karachi, from September 2007 to March 2008.*

Methodology — *A total of 100 children of one month to 12 years underwent voiding cystourethrogram following standard technique. For post-VCUG-UTI, urinalysis and culture and sensitivity (CS) were done in all cases. The demographic data, indications, post-VCUG- UTI, type of pathogens and radiological diagnosis were recorded. Descriptive statistics were used for analysis.*

Results — *Out of 100 patients there were 70 males and 30 females. Mean age was 3.05 ± 2.9 years (range one month - 12 years). Post- VCUG-UTI was found in 12 patients. Most common pathogen was E. coli (n= 5/12, 42%) followed by Pseudomonas aeruginosa (n= 4/12, 33%) and Klebsiella (n=3/12, 25%). CUTAs diagnosed on VCUG were found in 59 cases. Posterior urethral valves (PUV n-26) and primary vesicoureteral reflux (VUR n-22) were the two most common CUTAs and probably the risk factors for UTI in addition to catheterization.*

Conclusions — *This study showed a high frequency of post-VCUG-UTI in children. Both VCUG and CUTAs may be considered as risk factors for UTI.*

Key words — *Urinary tract infection, Voiding cystourethrogram, Vesicoureteral reflux.*

INTRODUCTION:

Urinary tract infection is one of the most common childhood bacterial infections.[1] It is estimated that at least 8% of girls and 2% of boys have UTI in childhood.[1,2] E coli is the most common causative pathogen followed by Klebsiella, Proteus, Pseudomonas, Enterobactor and others.[1-3] The current goals of management of UTI are to document its frequency, to identify children at risk of recurrence, to prevent renal scarring and its long term complications such as hypertension and chronic kidney disease (CKD).[3-5] Thus it is the early diagnosis and treatment of not only UTI but also detection of underlying urinary tract abnormalities.

Studies have shown that 25-55 % of children with febrile UTI may show radiological abnormalities of urinary tract; and primary VUR has been found in 30-40% of first febrile UTI.[2,4,5] The relationship between UTI, VUR and and renal scarring is complex and still not understood well. However, children with VUR are at high risk of UTI and for pyelonephritic renal scarring.[6-9] Currently

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ultrasound (US), VCUG and dimercaptosuccinic acid (DMSA) scan are the gold standard radioimaging tools for detection of underlying CUTAs in children with UTI and antenatally detected pelvic dilation. [7-11]

Voiding cystourethrogram is a commonly performed diagnostic procedure during childhood in the work up of UTI and postnatal evaluation of infants with prenatally detected hydronephrosis, to diagnose VUR, PUV and other abnormalities of urinary tract.[2,4,5,8,9] However, VCUG is an invasive and stressful procedure for children and their parents, since it requires urethral catheterization.[12] The reported complications of VCUG are mechanical and psychological trauma, acute UTI, improper placement of catheter, bladder perforation, catheter knotting and contrast reactions.[13-16] There are studies carried out in Pakistan on various aspects of UTI, VUR and congenital urinary tract anomalies in pediatric population but currently data on the complications like UTI following VCUG is lacking in local literature.[17-20]

This study was planned to estimate the magnitude of the post-VCUG complications in children undergoing diagnostic work up at tertiary care public sector hospital so that future recommendations can be made for its prevention. The objectives of this study were to determine the frequency of UTI in children undergoing VCUG and to find out CUTAs that may predispose to such an outcome.

METHODOLOGY:

This descriptive study was carried out on children who underwent diagnostic VCUG from September 2007 to March 2008, in the department of Pediatric Nephrology of NICH, Karachi. Patients of one month to 12 years of age were included. All had normal pre VCUG urine examination. Those with documented UTI in 10 days prior to VCUG were excluded. Informed consent was taken from parents. All patients were catheterized under standard aseptic technique by single pediatric resident on x-ray table using age appropriate sized feeding tube. A contrast was injected, standard view x-ray films were taken of the bladder when full and during and after micturition following the standard guidelines.[12] The catheter was removed immediately after the procedure. The images were interpreted by a radiologist. Post-VCUG patients were followed clinically for fever and urinary symptoms for 10 days and urinalysis and CS were done in all cases from day 5-10. In infants sterile urine collection bags were used whereas, mid stream urine specimen was taken in older children. Post-VCUG UTI was defined as > 10^5 colony forming units (CFU) of a single pathogen per ml of urine sample.[1] The demographic data including age, sex, indications, type of CUTAs on VCUG, number of post-VCUG UTI, type of pathogen and their CS pattern were recorded on a proforma**.** Data was computed on SPSS version 13 and descriptive statistics were applied for analysis. Frequency and percentages were used for categorical variables like age groups, gender, diagnosis on VCUG and type of pathogens. Mean and standard deviation (SD) were used for numerical variables like age.

RESULTS:

Out of 100 children, 70 were males and 30 females with male to female ratio of 2.33:1. Mean age (± S.D) of the study population was 3.05 ± 2.9 years, with a range of one month to 12 years and median age 2 years. Most common age group was 1-2 years (n 31) followed by 3-5 years (n 27). Twenty six patients were less than one year of age.

A total of twelve patients developed post-VCUG-UTI (males 5, females 7). E. coli was the most common organism, found in 5 (42%) cases. Other important pathogens were Pseudomonas (n 4, 33%) and Klebsiella (n 3, 25%). Voiding cystourethrogram was abnormal in 59 cases. All children with abnormal VCUG were younger than 5 years and 50% of them were below two years of age (table I). The most common CUTA detected on VCUG was PUV, found in 26 patients (44.06%) followed by vesicoureteral reflux in 22 (37.28%). Other anomalies were rectovaginal fistula in 6 (10.16%) and bladder diverticulae in 5 (8.47%) cases.

Table I: Age Distribution of Patients with Post VCUG UTI (n=12)

Age (Years)	Number	Percentage
< 1	2	16.7
1 -2	4	33.3
3 – 5	6	50.0

DISCUSSION:

Voiding cystourethrography remains essential radioimaging technique for diagnostic evaluation of children with UTI.[3-5] With the widespread use of prenatal US, VCUG is performed as part of the postnatal radiological evaluation of infants with prenatally detected hydronephrosis.[9, 10] The procedure is relatively simple but considered as a risk due to urinary catheterization and risk of radiation.

Studies have shown that complications are associated with VCUG in children.[13-16] The routine use of VCUG as primary radioimaging technique after diagnosis of UTI has been questioned due to risk of radiation, technical complications, risk of introduction of infection and radiologically negative results.[4,7,11] This is more likely when there is no pyelonephritis and UTI involves lower urinary tract. In such situation DMSA renal scan has been recommended as initial test to localize infection and if it is positive then one should proceed for VCUG.[8,9, 11]

UTI is an indicator of underlying pathological condition like primary VUR and instrumentation like catheterization for VCUG may be a risk for infection.[2,4] Both primary underlying CUTAs and catheterization are considered as risk factors for development of UTI. In this study majority of patients (n 70) were males which is in contrast to local and regional studies where female preponderance has been reported.[2,11,17] The mean age of 3.05 ± 2.9 years in our study indicates delayed diagnosis in contrast to other studies in which children of young age < 2 years have been studied due to antenatal diagnosis of hydronephrosis.[5, 9, 11, 17] However, different studies have enrolled different age groups with specific objectives.

Few studies have investigated the frequency of UTI following VCUG. The present study has shown a high frequency of post -VCUG UTI (12%). This is comparable to a studies by Glynn B et al and Mc Alister et al with similar objectives in which frequency of post-VCUG was 6% and 16% respectively.[13,14] Rachmiel M et al studied the frequency of symptomatic UTI in patients who underwent VCUG while on prophylactic antibiotic and found a low frequency (1.7%) of post-VCUG UTI.[16] In another study by Vates et al, about the frequency of post-VCUG complications in 178 infants with prenatal diagnosis of hydronephrosis while on prophylactic antibiotic, and found that none of the patients developed UTI.[21] Similar observation has also been reported by Zerin et al.[22] Onay et al and Kim MS et al in their recent studies reported post VCUG infection rate of 18.33% and 22.58 % respectively.[23,24] In the later study patients developed UTI despite the fact that all were on prophylactic dose of antibiotic. Post–VCUG- UTI in our study was observed more in males as compared to females. This is again in contrast to general preponderance of UTI in females and reflects the populations studied since majority (70%) of patients in our study were boys.

Voiding cystourethrography revealed CUTAs in fifty nine (59%) cases. In a study by Rachmiel M et al, CUTAs were found in 41% on VCUG and VUR accounted for 45.8% of cases.[16] In our study PUV (44.06%) and VUR (37.28%) were the two major CUTAs detected. This is also comparable to 40.8% of VUR in a study by Rachmeil M et al. Surprisingly there was no single case of PUV reported in that study though 72 children of 7 days to 5 years with hydronephrosis were studied.[16] The frequency of PUV and VUR in studies on children with UTI from Pakistan are consistent with our figures.[3, 4, 18-2].

Regarding pathogens of UTI in our study, E. coli was the most common organism isolated. This is consistent with other studies.[2, 5, 9, 16] Growth of pseudomonas (33%) and Klebsiella (25%) in this study reflects the introduction of infection through catheterization. Similar observation has been shown in a study on 421 children from Israel.[16] Pseudomonas was also found as an important pathogen for UTI in their study and VUR has been considered as a major risk factor for UTI.[16] As patients with pseudomonas infections were found throughout the study period and also more in patients with high grade reflux and PUV, therefore possibility of contamination is highly unlikely. Thus, catheterization for VCUG may be a risk factor for UTI in addition to underlying congenital urinary tract abnormalities. CUTAs have also been found as major risk factors for UTI in a study done at the same institute by Channa A et al.[20]

Kim MS et al has shown an overall complication rate of 32.7% in children undergoing VCUG including, bladder rupture and UTI after VCUG.[24] More recently echo enhanced voiding urosonography has been recommended instead of VCUG in children with confirmed scars and a catheter-free US techniques for detection of VUR that may prove to be the solution of the problem.[25]

CONCLUSIONS:

This study showed a high frequency of post VCUG infections and CUTAs in children who underwent VCUG. Thus both VCUG and CUTA may be considered as risk factors for UTI. However in order to confirm the strength of association, further studies on a large scale are needed.

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