*IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*
*e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 16, Issue 3 Ver. VIII (March. 2017), PP 55-58*
*www.iosrjournals.org*

# Urinary Tract Infections in Children - A Slick Entity

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***Abstract:*** *Although urinary tract infections(UTI) are a common entity among all age groups, it warrants prompt attention in paediatric population. The infections are often fraught with underlying genitourinary abnormalities in children and hence systematic evaluation is necessary to decrease morbidity. Our study enrolled children with documented UTI . 93 children were taken up with ages from 15 days to 12 years and were further evaluated. Ultrasonogram detected abnormalities in twenty four .Voiding cystourethrogram revealed pathologies in 23 children. Intravenous pyelography was done in two occasions. Children with vesicoureteric reflux underwent DMSA to assess the extent of parenchymal damage. In children with Pelvic Ureteric Junction(PUJ) obstruction, DTPA had a major impact on the definitive treatment. The genitourinary abnormalities associated with urinary tract infection in the study included primary vesicoureteric reflux, posterior urethral valve, hydronephrosis due to PUJ obstruction, pyonephrosis due to PUJ calculus, vesical calculus, vulval synaechiae and patent urachus. Treatment was tailored according to the individual problem. Twenty nine percent of the UTIs are associated with genitourinary anomalies and hence it is worth evaluating children with UTI. Sonographic and nuclear studies play a major role in decreasing morbibity in the long run in children.*

***Keywords:*** *DMSA,DTPA, Posterior urethral valve,Urinary tract infections ,Vesicoureteric reflux,*

## I. Introduction

Urinary tract infection (UTI) is common at the extremes of age - in children and elderly. Symptoms of urinary tract infection are vague and generalized[1]. Recognition and evaluation of urinary tract infections and genitourinary anomalies associated with the infection and subsequent management prevents long term complications of progressive parenchymal and functional loss.UTI is the most common cause of parenchymal loss. 5% to 10% of children with UTI have obstructive urinary tract infection and an additional 21% to 57% have vesicoureteric reflux(VUR)[2]. Children with voiding dysfunction, neurogenic bladder and bowel dysfunction may predispose to urinary tract infection[3,4]. Hence evaluation of the index infection warrants to detect urinary tract anomalies and helps in preventing renal damage and morbidity of recurrent infections.

## II. Aim Of The Study

**2.1**To detect the abnormalities of the urinary tract associated with urinary tract infections in children.
**2.2**To evaluate the yield of the various diagnostic modalities.

## III. Materials And Methods

The period of study was from February 2015 to February 2017 in the Department of Paediatric Surgery, Coimbatore Medical College Hospital. Children with culture positive UTI were included in the study and further evaluated with ultrasonogram (USG) of the renal tract. Abnormalities if any detected by ultrasonogram were further evaluated with voiding cystourethrogram (VCUG) under antibiotic cover. Renal scintigraphy, urodynamic study and other relevant investigations were performed based on the individual merits of the condition.

## IV. Results

During the study period ninety three children with documented urinary tract infection(culture positive ) were prospectively evaluated. The data collected for analysis and the results are as follows. There were seventy three males and twenty female children. The male to female ratio was 3.4 : 1 The age distribution of the children was between 15 days and 12 years. There were seven children in the age group of 0 -1 year , forty one children in the age group of 1 -5 years, forty five children were greater than 5 years. Our children presented with combination of symptoms. The symptoms specific to urinary tract included dysuria, increased frequency, dribbling, pyuria, bed wetting, retention and poor stream. The nonspecific symptoms were abdominal pain, fever, vomiting, loss of appetite, constipation, diarrhea, umbilical discharge and abdominal distension. Fever was the most frequent symptom followed by abdominal pain. The clinical findings in our children were phimosis in fourteen, palpable bladder in seven, flank fullness in five, palpable kidney in six. In the complicated UTI group( children with anatomic abnormalities of the urinary tract) ,four children had phimosis – two children

with voiding dysfunction, one child with posterior urethral valve ( PUV) and one child with VUR. The causative organisms in our children included E.coli, Proteus, Klebsiella, Pseudomonas and Staphylococci. E. coli grew in 65, Proteus in 13, Klebsiella in 10, Staphylococci in 3, Pseudomonas in 1 and mixed growth in 1 culture. E.coli was the commonest pathogen and accounted for 69.8% of the infections. Ultrasonogram detected abnormalities in twenty four out of ninety three children (25.8%) .The findings of ultrasonogram were cystitis in nine, vesicoureteric reflux in three, posterior urethral valve with hydronephrosis in two, hydronephrosis due to pelviureteric junction obstruction in four, obstructive megaureter with hydronephrosis in one child, Pelvi ureteric junction (PUJ) calculus with pyonephrosis in two, vesical calculus in one child, contracted kidney due to chronic pyelonephritis in one and unilateral renal agenesis in one.Ninety one children underwent VCUG and diagnosis was arrived in twenty three children (24.73%) . VCUG was done by single shot method after filling the bladder to its capacity. Two exposures were taken - anteroposterior and oblique views.

The results of VCUG were posterior urethral valve with reflux in eight children, primary vesicoureteric reflux in nine children, large capacity smooth contoured bladder in four and irregular asymmetrical bladder in two children with suspected bladder diverticulum in one child.Intravenous pyelography was done in two occasions. Once to evaluate a solitary kidney and another for assessing a case of moderate hydronephrosis due to pelviureteric junction obstruction. In both cases it was consistent with the ultrasonogram findings. Those children with vesicoureteric reflux, dimercaptosuccinic acid(DMSA) was done to assess the parenchymal damage. Among the eight children who underwent DMSA study, four children had PUV with VUR and four children had primary VUR. Among the four PUV children, acute pyelonephritis was diagnosed in one, bilateral scarring in one, unilateral scarring in one and in one child the kidneys were normal. In primary VUR group, bilateral scarring was detected in two children, unilateral scarred contracted kidney with 3% function in one child who ultimately underwent nephrectomy and bilateral normal kidneys in one child.

In four children with sonographic evidence of PUJ obstruction, diethylenetriaminepentaacetic acid (DTPA) scan was done. One child with obstructive megaureter with hydroureteronephrosis had normally functioning kidneys. One child with recurrent PUJ calculus with pyonephrosis had adequately functioning kidneys. One child with pelviureteric junction obstruction with hydronephrosis was found to have adequate function with features of obstruction and one child had a solitary kidney on DTPA. Cystoscopy was done for diagnostic and therapeutic purposes. Diagnostic cystoscopy was done in four children. They included two cases of suspected neurogenic bladder, one case of suspected bladder diverticulum and one case of ectopic ureter. In one child suspected with neurogenic bladder, there were trabeculations . There was ectopic ureterocele in one child and two studies were normal. Diagnostic and therapeutic cystoscopy was done in eight cases of posterior urethral valve and primary fulguration was done.The genitourinary abnormalities associated with urinary tract infection in the study included primary vesicoureteric reflux, posterior urethral valve, hydronephrosis due to pelviureteric junction obstruction, pyonephrosis due to pelviureteric junction calculus, vesical calculus, vulval synaechiae and patent urachus.

All the patients were treated with appropriate antibiotics and rest of the treatment plan was tailored according to the individual problem. So the treatment included observation with antibiotic prophylaxis in two children, circumcision in fourteen children, cystoscopic fulguration in eight children, pyeloplasty in three children, ureteric reimplantation in eleven , nephrostomy in two children, laparoscopic nephrectomy in one child, pyelolithotomy in two, vesicolithotomy in one, laxatives for four children, vulval synechiae release in one child and urachal cyst excision in one child.

## V. Discussion

UTI often serves as a marker for anatomical abnormality of the genitourinary tract. It is important to identify these abnormalities early because if untreated, they may lead to recurrent infections and loss of renal parenchyma.

Obstructive malformations such as ureteropelvic junction obstruction, posterior urethral valve, ureterocele, ectopic ureter, urethral diverticulum can increase the risk of UTI. Renal abnormalities such as papillary necrosis, nonfunctioning kidney, unilateral medullary sponge kidney, double renal moiety also predispose to urinary tract infection.

Children with vesicoureteric reflux may have significant post void residual urine which predisposes to urinary tract infection and subsequent scarring of the renal parenchyma. Functional abnormalities such as voiding dysfunction, bladder instability, infrequent voiding, Hinmann syndrome, neurogenic bladder are associated with increased incidence of urinary tract infection.

The overall incidence of neonatal bacteriuria is about 1 – 1.4%[5,6,7,8]. More boys than girls get UTI during the first year of life[1,2] . Uncircumcised boys have as high as 10 times the risk of UTI[3] than circumcised boys. By 1 year of age 2.7% of boys and 0.7% of girls have had bacteriuria[4]. The incidence falls below 1% in school age boys and in girls it raises to 1 – 3%[5]. Febrile UTIs were more prevalent than nonfebrile UTIs during first 10 months of life[11].

Documented UTI is evaluated with imaging modalities to localise the acute infection ,detect the renal damage, identify the genitourinary anomaly that increases the risk of future renal damage and evaluate the changes in the urinary tract over time. All children requiring hospitalization should be screened with sonogram before discharge[9].

The guidelines for renal and bladder USG[9] are all boys with their first UTI, girls younger than 5 yrs with their first UTI and older girls with pyelonephritis or recurrent UTIs. It detects the presence of hydronephrosis, renal parenchymal thickness, perinephric collection, ureteral dilatation, duplication, polyps, calculi, bladder wall thickness,cystitis, diverticulum and ureterocele .

Studies on voiding cystourethrogram demonstrated 5-10% of patients have obstructive lesions and 20 – 50% have VUR associated with UTI[10]. VCUG delineates bladder and urethral abnormalities and VUR. VCUG is recommended in all boys with first UTI and girls younger than 5 yrs with first UTI and girls above 5yrs with recurrent UTI[10].

Nuclear renography accurately detects areas of acute renal inflammation and chronic scarring. DMSA is the common agent when cortical definition is needed[11].

Fourteen children had phimosis in the studied population of ninety three children and all of them underwent circumcision. According to studies, children with phimosis are having three to seven times increased risk of developing urinary tract infection. Though four children had phimosis - two children with voiding dysfunction, one child with PUV, and one child with VUR in the complicated group, we could not assess the relevancy or efficacy of circumcision due to short follow up.

The purpose of evaluating urinary tract infection is to detect anatomical as well as functional abnormalities like VUR. Ultrasonogram is sensitive in identifying the abnormalities in majority of the conditions (25.8%) . In our study ultrasonogram detected abnormalities in 24 among the 93 children. We used regular ultrasonography equipment for our study. Ultrasonogram is sensitive in detecting subtle changes in mucosa and muscle thickness and debris in the collecting system in cases of pyonephrosis. The ultrasonogram may prompt us to do VCUG as it happened in six cases of our study when the ultrasonogram detected hydroureteronephrosis but was not able to document VUR. Subsequently VCUG detected VUR in those cases.

The sensitivity of ultrasonogram in detecting VUR in our study is 33%. Meticulous examination by ultrasound allows detection of 87% in VUR[12] . Ultrasound detected hydronephrosis in all cases. Ultrasonogram detected only two cases of posterior urethral valve out of 6 cases amounting to 33%. At our institution, we used ultra sonogram equipment with 5 Mhz probe for this study and that may be the reason for the low detection rate.

Voiding cystourethrogram was done in ninety one children with the exception of two children who were diagnosed as vulval synechiae and vesical calculus with clinical examination and ultrasonogram alone. The aim of VCUG is to detect vesicoureteric reflux, posterior urethral valve and other bladder and urethral abnormalities. Though it was done by single shot method, the procedure diagnosed nine cases of vesicoureteric reflux including 6 cases of vesicoureteric reflux which were not diagnosed by ultrasonogram. The other findings included large capacity smooth contoured bladder in four and irregular asymmetrical bladder in two children.

In our study VCUG detected VUR and PUV which are the common urogenital anomalies to be corrected surgically and having more risk for pyelonephritis and its complications (18.27%). The detection of these anomalies by USG is poor. Whereas USG is useful in detecting anomalies like hydronephrosis, obstructive megaureter, bladder calculus, contracted kidney following pyelonephritis (15.25%). Hence it is more reasonable to approach a documented urinary tract infection with VCUG along with USG to have a significant high yield (25.8%) to pick up surgically correctable anomalies and prevent parenchymal loss.

Vesicoureteric reflux is seen in 50% of cases with posterior urethral valve[13]. In our study eight cases of PUV were detected. Two of them were less than one year of age and six of them were between 1 and 5 years. All of them presented with VUR.

The most frequent diagnosis in our study was cystitis followed by vesicoureteric reflux and posterior urethral valve. Jodal et al 1994[14] study also states that cystitis is most common in 2-5yrs age group. On evaluation of documented urinary tract infections in 93 children, 27 cases of complicated urinary tract infection were diagnosed. They included vesicoureteric reflux - 9 Posterior urethral valve - 8, PUJ obstruction with hydronephrosis - 4 VUJ obstruction - 1, PUJ calculus - 2, Vesical calculus - 1, Non Neurogenic Neurogenic bladder – 2. In this study 29% of the urinary tract infection in children was complicated with anatomical or functional abnormalities of the urinary system.

In children with complicated urinary tract infection , vesicoureteric reflux is the commonest anomaly and accounts for about 63% of the diagnosis. According to studies the estimated incidence of vesicoureteric reflux in UTI is about 40% and it is the most common genitourinary anomaly associated with urinary tract infections. In Hadi sorkhi et al[15] study, 35 -40% of the urinary tract infections were associated with vesicoureteric reflux. Another study by Jonathan H_Ross et al[16] states that 30-50% of the urinary tract infections

are associated with vesicoureteric reflux and James larcombe et al 1999[17] described vesicoureteric reflux in urinary tract infection as 8- 40%and our study also confirms the same.

Hydronephrosis due to pelviureteric junction obstruction accounts for about 14.81% of the complicated UTI in our study. In Chandrasekaran et al[18] study, the association of hydronephrosis in UTI is upto 69% . Our study deviates from the above study in this regard.

Due to various factors we could not evaluate all the indicated children with nuclear renogram. Among the twelve evaluated children majority of them (75%) had abnormalities.It identified defects in nine children and excluded defects in three children and thus it helped to manage efficiently in three occasions; especially when a child developed recurrent pyonephrosis despite pyelolithotomy. To rule out a non functioning kidney, DTPA was done and it showed normally functioning kidneys thus avoiding nephrectomy. In another child with moderate hydronephrosis, DTPA showed normally functioning kidneys without obstruction and the child is on observation. One child had only 3% function with a scarred and contracted kidney on DMSA and hence underwent nephrectomy.

## VI. Conclusion

Twenty nine percent of the UTIs are associated with genitourinary anomalies and hence it is worth evaluating children with UTI. Vesicoureteic reflux is the commonest anomaly associated with UTI with E.Coli being the commonest organism.Voiding cystourethrogram is an effective tool for the diagnosis of VUR and PUV. It is more reasonable to approach a documented urinary tract infection with VCUG along with USG to have a significant high yield in picking up surgically correctable anomalies and prevent parenchymal loss.. Nuclear studies (DMSA and DTPA) play a major role in deciding treatment in selected cases.

## Future Perspectives

Since our study is conducted on a select and small population it needs further research to be extrapolated on a standardisation.

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