

ASSESSMENT OF THE URINARY TRACT INFECTION PREVALENCE IN FEBRILE SUBJECTS OF AGE LESS THAN 5 YEARS: A PROSPECTIVE CLINICAL STUDY

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ABSTRACT

Background: One of the most common reasons to visit OPD in subjects of age less than 5 years is fever. Very little attention is given to UTIs (urinary tract infections) as the cause of fever compared to other infections getting more attention. Without evaluating UTIs adequately, antibiotics are commonly given to children empirically. To minimize lifelong morbidity and provide prompt treatment, identification of UTI in children with fever is vital.

Aims:The present study was conducted to assess the UTI prevalence in subjects of age under 5 years and to assess the validity of urine culture and urine analysis for diagnosing urinary tract infection.

Method:The present prospective clinical study assessed 120 subjects within the age range of 2 months to 5 years admitted for fever. For all the subjects, demographics and predisposing factors were noted. Clean midstream urine was collected in subjects of age >2 years, whereas, bag collection in age <2 years for the collection of urine samples. In culture-positive subjects, an ultrasonogram was done, and urine culture and analysis were done in all the subjects.

Results:Proteus was seen in no female and 20% (n=1) culture-positive males, pseudomonas was seen in culture growth of 28.57% (n=2) females and no males, Klebsiella was isolated in 28.57% (n=2) females and 40% (n=2) culture-positive males of the present study, and E. coli was seen in 42.85% (n=3) females and 40% (n=2) males in the present study. Concerning the antibiotic sensitivity in 12 culture-positive subjects, sensitivity to Cefoperazone, Amikacin, Cefotaxin, Nitrofurantoin, and Gentamycin was seen in 8.33% (n=1), 16.66% (n=2), 33.33% (n=4), 8.33% (n=1), and 33.33% (n=4) study subjects respectively. The ultrasound showed hepatomegaly in 2 males, bilateral hydronephrosis with obstruction of PUJ was seen in 1 female, bilateral hydronephrosis with bladder wall thickening was also seen in 1 female and

no male in the culture-positive subjects of the present study, and cystitis was seen in 2 females and 1 male culture positive subjects of the present study

Conclusion: The present study concludes that subjects with pyuria showing >5 pus cells/HPF in the urine sample should be considered as the cases of significant pyuria and should be assessed further for early initiation of the UTI management using antibiotic therapy to reduce the long-term complications, sequelae, and morbidity.

Keywords: Febrile illness, Prevalence, Pyuria, Significant growth, Urinary tract infection

INTRODUCTION

One of the most common reasons to visit the emergency medicine department or OPD of Pediatrics department in subjects of age less than 5 years is fever. Children having febrile illness or fever are a major part of the Pediatrics Outpatient Department with the most common chief complaint by subjects or their parents. Very little attention is given to UTIs (urinary tract infection) as the cause of fever compared to other infections getting more attention despite recent literature data suggesting that urinary tract infections contribute to the significant morbidity in the child subjects.¹

Commonly, pediatric subjects receive empirical antibiotic therapy without appropriate assessment of the UTIs (urinary tract infections). In child subjects with UTI, fever is the most common presenting symptom. Fever with significant Pyuria and bacteriuria in pediatric subjects with no identified infection source must be assumed to be an invasive renal parenchyma infection, pyelonephritis, that need immediate management and treatment. Recent literature data that assessed renal parenchyma using nuclear scans for determination of UTIs have concluded that nearly 80% of child subjects under 5 years having fever/febrile UTI have a diagnosis of pyelonephritis. In nearly 30-65% of child subjects with UTI, renal scarring is usually done in Pyelonephritis, even when no urinary tract abnormality is present.²

The majority of UTIs that lead to the diminishing of the kidney growth or kidney scarring is seen in children under 4 years, and is most common in infant subjects under the age of 1 year, especially in children where treatment of UTI is delayed and in subjects with gross obstruction or reflux. Child subjects of less than 2 years of age having recurrent UTIs have a high risk of renal scarring, and nearly 1/3rd of these subject is asymptomatic. It is vital to assess urinary tract infections in children and provide immediate and appropriate treatment to decrease the risk and chances of morbidity in these subjects.³

Renal damage in children which is progressive and is from an unknown source of pyelonephritis in children may lead to renal failure and hypertension when these subjects reach adult life. Previous literature data has shown that pyelonephritis makes the focus of renal scarring in children which poses nearly 15% increased risk for pregnancy toxemia, 10% increased renal failure risk, and 25% risk for hypertension when these subjects reach adult life.⁴ The present study was conducted to assess the UTI prevalence in subjects of age under 5 years and to assess the validity of urine culture and urine analysis for diagnosing urinary tract infection.

MATERIALS AND METHODS

The present prospective clinical study was conducted to assess the UTI prevalence in subjects of age under 5 years and to assess the validity of urine culture and urine analysis for diagnosing the urinary tract infection. The study was conducted at Department of Paediatrics, Dr. Vasantraopawar medical college and research centre, Nashik, Maharashtra after obtaining clearance from the concerned Ethical committee. The study population was comprised of the subjects visiting the Outpatient Department of Pediatrics of the Institute.

The study included a total of 120 child subjects from both genders. The inclusion criteria for the study were child subjects under 5 years of age (2 months to 5 years), who had a chief complaint of fever with an axillary temperature of $\geq 37.8^{\circ}\text{C}$, attending the Department of Pediatrics of the Institute. The exclusion criteria for the study were subjects who had antibiotics within the past 48 hours of the study, subjects of age less than 2 months or more than 5 years, not willing to consent, and subjects with established congenital anomalies of the genitourinary part.

After the final inclusion of 120 study subjects, detailed history including demographics was noted for all the subjects including voiding difficulties, and predisposing factors including urethra instrumentation. Complete febrile history was recorded concerning duration and onset of fever along with associated symptoms such as other system involvement, urinary disturbances, diarrhea, vomiting, and nausea. This was followed by a thorough physical examination and relevant investigations in all the subjects. Urine analysis including urine sensitivity and culture was done along with blood investigations in all the subjects. In culture-positive children, an ultrasonogram was done. Micturating cystourethrogram (MCU) was done in 4 study subjects.

For all 120 subjects, a urine sample was collected. Clean midstream urine was collected in children of age more than 2 years, whereas, in subjects under 2 years, bag method collecting nearly 10ml of urine was used for urine collection. The collected urine sample was then sent for sensitivity and culture to the laboratory.

For urine analysis, culture, and sensitivity, the samples were subjected to centrifugation in a chamber for 30 minutes at 2500rpm, and the remaining sediment was resuspended in the chamber after decantation of the supernatant fluid. Microscopic urine examination was then done to assess Leukocyturia and Haematuria. In the present study, the presence of >5 puss cells/HPF in the sample after centrifugation of urine was considered as significant for Pyuria, and in these subjects, sensitivity and culture were done.

The clear mid-stream urine inoculation was done on Mac-Conkey agar plates with a 0.01 ml calibrated loop which was then incubated for 24 hours at 35- 37°C under aerobic conditions to get an accurate count of the colonies. On mid-stream urine sample culture, a $>105/\text{ml}$ colony count of single species organisms was considered to be significant. Samples that were shown non-pathogens growth, mixed growth of 2 or more pathogens and insignificant growth were considered as culture negative. A positive culture of urine was defined as more than 105 colony growth of a single pathogen of urinary tract/ml of specimen in a clear mid-stream urine.

RESULTS

The present prospective clinical study was conducted to assess the UTI prevalence in subjects of age under 5 years and to assess the validity of urine culture and urine analysis for diagnosing the urinary tract infection. The study included a total of 120 child subjects from both genders within the age range of 2 months to 5 years. The demographic characteristics of the study subjects are listed in Table 1. Majority of study subjects were in the age range of 2-5 years with 40.83% (n=49) subjects followed by 34.16% (n=41) subjects of age <1 year, and least 25% (n=30) subjects in age 1-2 years. There were 47.5% (n=57) males and 52.5% (n=63) females in the study. For UTI prevalence and culture-positive subjects based on age, the majority of subjects were in 1-2 years of age with 13.33% (n=4) subjects followed by 12.19% (n=5) subjects from <1 year age. Based on gender, there were 11.11% (n=7) culture-positive females and 8.77% (n=5) males as shown in Table 1.

The study results showed that on urine culture growth, it was seen that *Proteus* was seen in no female and 20% (n=1) culture-positive male, *Pseudomonas* was seen in culture growth of 28.57% (n=2) females and no males, *Klebsiella* was isolated in 28.57% (n=2) females and 40% (n=2) culture-positive males of the present study, and *E. coli* was seen in 42.85% (n=3) females and 40% (n=2) males in the present study (Table 2). Concerning the antibiotic sensitivity in 12 culture-positive subjects, sensitivity to Cefoperazone, Amikacin, Cefotaxin, Nitrofurantoin, and Gentamycin was seen in 8.33% (n=1), 16.66% (n=2), 33.33% (n=4), 8.33% (n=1), and 33.33% (n=4) study subjects respectively as shown in Table 3.

The ultrasound was done in all 12 culture-positive study subjects, the ultrasound findings showed normal findings in 2 males and 2 females, right Pleural effusion with ascites in no subject, hepatomegaly in 2 males and no females, bladder calculi in no subject, Bilateral hydronephrosis with obstruction of PUJ was seen in 1 female and no male in the culture-positive subjects of the present study, bilateral hydronephrosis with bladder wall thickening was also seen in 1 female and no male in the culture-positive subjects of the present study, and cystitis was seen in 2 females and 1 male culture positive subjects of the present study as shown in Table 4.

DISCUSSION

The present prospective clinical study was conducted to assess the UTI prevalence in subjects of age under 5 years and to assess the validity of urine culture and urine analysis for diagnosing the urinary tract infection. The study included a total of 120 child subjects from both genders within the age range of 2 months to 5 years. Majority of study subjects were in the age range of 2-5 years with 40.83% (n=49) subjects followed by 34.16% (n=41) subjects of age <1 year, and least 25% (n=30) subjects in age 1-2 years. There were 47.5% (n=57) males and 52.5% (n=63) females in the study. For UTI prevalence and culture-positive subjects based on age, the majority of subjects were in 1-2 years of age with 13.33% (n=4) subjects followed by 12.19% (n=5) subjects from <1 year age. Based on gender, there were 11.11% (n=7) culture-positive females and 8.77% (n=5) males. The demographic and disease characteristics were comparable to the studies of Kaufman J et al⁵ in 2019 and Hoberman A et al⁶ in 2014 where authors depicted similar demographics and disease characteristics as in the present study.

The results of the present study also showed that on urine culture growth, it was seen that *Proteus* was seen in no female and 20% (n=1) culture-positive male, *Pseudomonas* was seen

in culture growth of 28.57% (n=2) females and no males, Klebsiella was isolated in 28.57% (n=2) females and 40% (n=2) culture-positive males of the present study, and E. coli was seen in 42.85% (n=3) females and 40% (n=2) males in the present study. Concerning the antibiotic sensitivity in 12 culture-positive subjects, sensitivity to Cefoperazone, Amikacin, Cefotaxin, Nitrofurantoin, and Gentamycin was seen in 8.33% (n=1), 16.66% (n=2), 33.33% (n=4), 8.33% (n=1), and 33.33% (n=4) study subjects respectively. These results were consistent with the findings of Hewitt IK et al⁷ in 2017 and Robinson JL et al⁸ in 2014 where similar antibiotic sensitivity and urine culture growth patterns were seen in the study subjects by the authors.

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CONCLUSION

Within its limitations, the present study concludes that in subjects with pyuria showing >5pus cells/HPF in the urine sample should be considered as the cases of significant pyuria and should be assessed further for early initiation of the UTI management using antibiotic therapy to reduce the long-term complications, sequelae, and morbidity. The present study had a few limitations including small sample size, shorter monitoring period, and geographical area biases. Hence, more longitudinal studies with a larger sample size and longer monitoring period will help reach a definitive conclusion.

REFERENCES

1. NICE Resource impact report: Urinary tract infection in under 16s: diagnosis and management (CG54): National Institute for Health and Care Excellence; 2017.
2. Urinary tract infection in under 16s: diagnosis and management, clinical guideline CG54. United Kingdom National Institute for Health and Care Excellence; 2017.
3. Nandan S, Sharma S, Rangari P, Rangari A. Prevalence and associated factors of dengue infection among Bhilai population: a hospital based cross sectional study. IJMSDR, 2018; 2:6:258-264.
4. Cyriac J, Holden K, Tullus K. How to use... urine dipsticks. Arch Dis Child Educ Pract Ed 2017; **102**:148–54.
5. Kaufman J, Knight AJ, Bryant PA, et al. Liquid gold: the cost-effectiveness of urine sample collection methods for young precontinent children. Arch Dis Child 2019.
6. Hoberman A, Greenfield SP, Mattoo TK, et al. Antimicrobial prophylaxis for children with vesicoureteral reflux. N Engl J Med. 2014; **370**:2367–76.

7. Hewitt IK, Pennesi M, Morello W, et al. Antibiotic prophylaxis for urinary tract infection-related renal scarring: a systematic review. *Pediatrics*2017;**139**:e20163145.
8. Robinson JL, Finlay JC, Lang ME, et al. Urinary tract infections in infants and children: diagnosis and management. *Paediatr Child Health*2014;**19**:315–9.
9. Tullus K. Fifteen-minute consultation: why and how do children get urinary tract infections? *Arch Dis Child Educ Pract Ed*2019.
10. Primack W, Bukowski T, Sutherland R, et al. What urinary colony count indicates a urinary tract infection in children? *J Pediatr*2017;**191**:259–61.

TABLES

Characteristics	Variables	N=120	%
Mean age (years)		2.82±2.14	
Age range (years)	<1	41	34.16
2 months-5	1-2	30	25
	2-5	49	40.83
Gender	Males	57	47.5
	Females	63	52.5
UTI prevalence (age-based) (culture positive)	<1	5	12.19
	1-2	4	13.33
	2-5	3	6.12
UTI prevalence (gender-based) (culture positive)	Males	5	8.77
	Females	7	11.11

Table 1: Demographic and disease characteristics of the study subjects

Culture Growth	Females		Males		Total (n)
	%	n=7	%	n=5	
Proteus	0	0	20	1	1
Pseudomonas	28.57	2	0	0	2
Klebsiella	28.57	2	40	2	4
E. coli	42.85	3	40	2	5

Table 2: Culture growth in the urine of culture-positive UTI subjects

Sensitivity to antibiotics	n=12	%
Cefoperazone	1	8.33
Amikacin	2	16.66
Cefotaxin	4	33.33
Nitrofurantoin	1	8.33
Gentamycin	4	33.33

Table 3: Antibiotic sensitivity in organism grown on urine culture in study subjects

Ultrasound findings	Females	Males
Normal	2	3
Right Pleural effusion with ascites	0	0
Hepatomegaly	0	2
Calculi bladder	0	0
Bilateral hydronephrosis with obstruction of PUJ	1	0

Bilateral hydronephrosis with bladder wall thickening	1	0
Cystitis	2	1

Table 4: Ultrasound findings in the study subjects with UTI