

Study For Prevalence of Urinary Tract Infection (UTI) in Febrile Children and to Assess the Validity of Microscopic Urine Analysis in the Diagnosis of UTI

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ABSTRACT

Introduction: This study was undertaken to find out the prevalence of urinary tract infection in febrile children and to assess the validity of microscopic urine analysis in the diagnosis of urinary tract infection. Since UTI is commonly missed in children the study emphasises on strongly suspecting it in febrile children to prevent future complications. Study aimed to determine the prevalence of urinary tract infection in febrile children, less than 5 years of age and to assess the validity of microscopic urine analysis in the diagnosis of urinary tract infection.

Material and methods: A prospective study was undertaken in the department of Pediatrics, RMCH, Bareilly. Urine was collected from enrolled febrile patients and sent for routine microscopic examination as well as for culture and sensitivity.

Results: 240 febrile patients were enrolled in this study out of which 12 case showed positive urine culture giving a prevalence of UTI as 5%. Chi-square analysis was done for significant pyuria (>5 pus cells/ HPF) and a sensitivity of 100% was calculated with accuracy rate of 97.5%.

Conclusion: UTI is common in children presenting with febrile illness and should be suspected strongly. Urine culture is the gold standard for diagnosing UTI. Microscopic urine analysis is a strong tool and is helpful in diagnosing UTI.

Keywords: Urinary Tract Infection, Microscopic Urine Analysis

INTRODUCTION

Urinary tract infection (UTI), with a reported prevalence between 4.1% and 7.5%¹⁻⁴ is the commonest bacterial illness among febrile infants and young children. Ranked next to respiratory and gastrointestinal infections, it is the third most common infection in pediatric age group and accounts for 4 to 10% of febrile children admitted to hospital.⁵ Fever has long been considered a finding of clinical importance in children with UTI because it has been accepted as a marker of renal parenchymal involvement (Pyelonephritis).⁶ Urinary complaints are rare in infants and small children. It is only after 5 years of age, the typical triad of abdominal pain, vomiting and fever with chills, rigors or suprapubic pain are common presenting complaints of UTI.

Urinary tract infection is often overlooked especially in infants and young children in whom the symptoms are vague and don't focus the attention on urinary system. Undetected UTI in children is more alarming because of the acute and chronic complications of it in children which is not seen routinely in adults. The majority of these infections in the first 2 years of life are "occult" and most infections remain undiagnosed if tests are not routinely performed to detect them. Otherwise unexplained renal scarring has been cited as one of the most common cause of end-stage renal disease (ESRD) and is an established risk factor

for subsequent hypertension. The incidence of vesico ureteral reflux (VUR) is also higher in this age group than in older children and the severity of VUR is greater, with the most severe form limited to infants. The high incidence of undiagnosed and untreated UTI in young children is a cause of concern.

UTI was first described by Roger in 1839 and since then considerable clinical experience and research have been done on this entity. It has been established by various workers, both in India and other countries that UTI is one of the commonest infection in children. Infants and young children are of particular concern because UTI in this age group may cause few recognizable signs or symptoms other than fever and has a higher potential for renal damage than in older children.⁷⁻⁹

High incidence of suspicion is needed for diagnosing UTI as it may bring to attention a child with an obstructive anomaly or severe VUR. Second, because these children with UTI may have a febrile illness and no localizing findings, there may be a delay in diagnosis and treatment of the UTI. Third, first attack of UTI in infancy and early childhood is usually not a single attack but beginning of a continuous process with the risk of recurrences. The risk of renal damage increases as the number of recurrences increase. Proper diagnosis and prompt treatment of UTI in children is therefore vital.

The aim and objectives of the present study were to determine the prevalence of urinary tract infection in febrile children, less than 5 years of age and to assess the validity of microscopic urine analysis in the diagnosis of urinary tract infection.

MATERIAL AND METHODS

This prospective study was conducted in the department of Pediatrics, RMCH, Bareilly over a period of 12 months from 01/10/2014 to 30/09/2015. The study was a hospital based cross sectional study.

Selection of patients

Febrile children less than 5 years attending the outpatient department or admitted in department of Paediatrics, RMCH, Bareilly over a period of 12 months from 01/10/2014 to

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30/09/2015 were included in this study.

Inclusion criteria

1. Febrile children between 6 month to 5 years.
2. Fever.

Exclusion criteria

1. Children below 6 month and above 5 years.
2. Any child who had received antibiotics 48 hours prior to the presentation was not included in this study.
3. Children with known congenital genitourinary anomalies.
4. Parents/Guardians not willing to enroll the child in the study.

Methods of study

This study was a hospital based Cross sectional study carried out at department of Pediatrics, RMCH, Bareilly over a period of 12 months from 01/09/2014 to 30/09/2015. Febrile children less than 5 years who attended outpatient department or got admitted in RMCH, Bareilly and fulfilled the inclusion criteria were enrolled in the study. A predesigned and pretested proforma was used to collect information. Informed consent was obtained from parents or guardians for enrolment of their children in the study. Guardians/ Children were interviewed using structured questionnaire for urinary tract infection. Data related to age, sex, nutritional status, socioeconomic status, predisposing risk factors like urethral instrumentation and bowel habits was noted.

Collection of urine sample

From all the cases a sample of urine was to be collected. In children below 2 years of age, urine sample was collected under aseptic precautions by transurethral bladder catheterisation or suprapubic aspiration. Urine was collected; around 10 ml into sterile bottle and sent for urine analysis, culture and sensitivity. In children above 2 years of age, a clean-catch mid-stream specimen was collected to minimize contamination by periurethral flora. Contamination was minimized by washing the genitalia with soap and water prior to collection. Child was then allowed to pass urine; midstream sample was collected in sterile bottle and was sent for urine analysis, culture and sensitivity.

Urine analysis

The fresh urine samples obtained from the above techniques was subjected for urinalysis. The urine specimens were centrifuged in a standard manner. The urine was then examined under microscope for hematuria and leukocyturia. In the present study more than 5 pus cells/HPF in a centrifuged urine sample was taken as significant pyuria.

Urine culture

Urine received in sterile containers was inoculated into blood and Mac-Conkey agar plates with a 0.01ml calibrated loop. All plates were incubated at 35-37°C for 24 hours under aerobic condition to obtain accurate colony count. On culture of urine, a colony count of more than $>10^5$ /ml organisms of a single species was considered significant. Samples showing insignificant growth, mixed growth of two or more pathogens or growth of non-pathogens were not considered as culture positive. The following definitions were employed in the present study.

Significant pyuria

Presence of more than 5 pus cells /HPF in a centrifuged urine sample.

Positive urine culture

A positive urine culture was defined as growth of $>10^5$ colonies of a single urinary tract pathogen/ml of urine specimen.

Imaging

All children diagnosed to have UTI underwent USG Abdomen, MCU scans as indicated by UTI management guidelines.

USG: All the UTI culture positive cases were subjected to USG Abdomen.

MCU Scans: All cases of UTI which turned out to be culture positive underwent micturating cysto-urethro-gram as indicated by UTI management guidelines.

STATISTICAL ANALYSIS

The data was analyzed by SPSS version 22 software along with below mentioned appropriate statistical tests at 5% level of significance. p value is calculated using *Chi-Square Test* given by the formula

$$\chi^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

Where O_i is Observed frequency and E_i is Expected frequency
Significance was interpreted as:

$0.05 < p < 0.10$ Suggestive of significance

$0.01 < p \leq 0.05$ Moderately significant

$p \leq 0.01$ strongly significant.

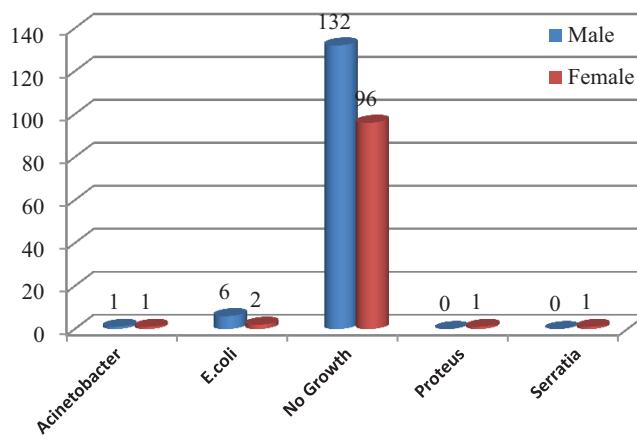
RESULTS

244 patients were enrolled in this study out of which 4 patients who met exclusion criteria were excluded. Of the 240 patients enrolled in this study and who met the inclusion criteria, 139 (57.9%) were male and 101 (42.1%) were female.

95% of febrile patients (n=228) showed no significant growth on urine culture. 5% (n=12) of the febrile patients had positive cultures (66.7% showed *E.coli*, 16.7% showed Acinetobacter and 8.3% showed *Serratia* and *Proteus* each) (graph-1).

Prevalence of UTI in febrile children less than 5 years of age was found to be 5%. It was found to be 4.9% in 0-12 months, 6.3% in 13-24 months, 8% in 25-36 months, 6.5% in 37-48 months and 2.5% in 49-60 months (graph-2).

Out of 240 children, 22 (9.16%) children showed significant pyuria (>5 pus cells/HPF) in centrifuged urine sample of which 12 (54.5%) were males and 10 (45.5%) were females. Majority were <2 years (n= 11; 50%). 22(9.16%) children showed significant pyuria (>5 pus cells/HPF) in centrifuged urine



Graph-1: Distribution of pathogens in urine culture

sample. 18 (81.8%) of children showed 5-10 pus cells/HPF and 4 (18.2%) showed >10 pus cells/HPF (table-1).

Chi-square analysis was done taking urine culture as gold standard for diagnosis of UTI (table-2). Analysis was done for significant pyuria (>5 pus cells/HPF) and the following were calculated with the standard formulas:

Sensitivity=100%

Specificity=97.3%

Positive predictive value=66.6%

Negative predictive value=97.3%

Percentage of false positive=2.6%

Percentage of false negative=0%

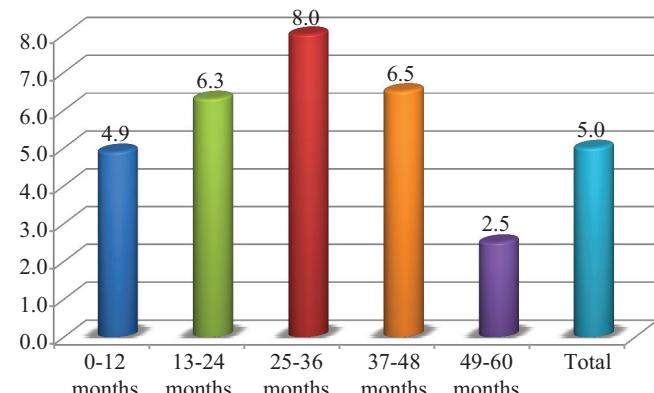
Accuracy rates=97.5%

DISCUSSION

This study was a hospital based Cross sectional study carried out in the Department of Pediatrics, Rohilkhand Medical College and Hospital, Bareilly over a period of 12 months to determine the prevalence of urinary tract infection in febrile children aged between 6 month to 5 years. This study was also done with the objective to assess the validity of routine microscopic urine analysis and culture in the diagnosis of urinary tract infection. In the present study prevalence of UTI in febrile children <5 years was 5.0% which is similar to Quigley R⁷ study where prevalence of 7% was noted, Nethersole PY et al¹⁷ showed prevalence of 4.1% to 7.5%, Ferrara P et al⁹ 2.1% to 8.7% and Kaushal RK¹⁸ et al 8.4% which is almost similar to the present study. In contrast to the present study, two different studies (Bauchner et al¹¹ and Schlager TA¹²) reported similar low prevalence of 1.7%, whereas Rabasa AI and Gofama MM¹⁹ reported high prevalence of 13.7%.

In this study, among 12 culture positive cases, 8(66.6%) grew *E.coli*, 2(16.6%) grew *Acinetobacter* and 1 (8.3%) each of *Serratia*, *Proteus* sp. As reported by Byran CS et al²⁰ *E.coli* was the most common urinary pathogen accounting for 66.6% of community acquired UTI. According to Bagga A et al²¹ about 90% of first symptomatic UTI and 70% of recurrent infections are due to *E.coli*. Waisman Y et al²² stated in their studies that of the 35 cultures, 27 were positive for *E.coli* (76%), 2 for *Klebsiella* (6%), 2 for *Enterococcus* (6%), 2 for *Pseudomonas* (6%), 1 for group B *streptococcus* (3%), and 1 for *Staphylococcus coagulase* negative (3%). According to Chris H et al the most commonly isolated urinary pathogens are enteric, gram-negative bacteria especially *E.coli*. Others include *Enterobacter*, *Klebsiella*, and *Proteus* sp. Zamir G et al²³ studied children with UTI and found the main causative agents were *Escherichia coli* 229 (85%), *Klebsiella* sp. 13 (5.1%), *Proteus* sp. 12 (4.7%), *Pseudomonas aeruginosa*, *Enterococcus faecalis* and *Morganella morgana* (1%) each. Saadeh SA and Mattoo TK²⁴ reported *E.coli* (60–92%) as the most common pathogen and other organisms were *Klebsiella*, *Proteus*, *Enterococcus* and *Enterobacter* sp.

Out of 240 febrile children who met the inclusion criteria, 22(9.1%) children showed significant pyuria (>5 pus cells/HPF). 12 (54.5%) of significant pyuria cases showed significant bacterial growth. 100% of children showing >10 pus cells were culture positive whereas only 44.4% of children showing >5 pus cells were culture positive. In the present study, Sensitivity and Specificity of urine analysis was 100% and 97.3%. PPV



Graph-2: Age and prevalence of UTI

PUS Cells	Sex		
	Male	Female	Total
5-10	9(75%)	9(90%)	18(81.8%)
>10	3(25%)	1(10%)	4(18.2%)
Total	12(100%)	10(100%)	22(100%)

X²=0.825, p=0.363 not significant.

Table-1: Distribution of pus cells in urine

Urine analysis	Urine culture		
	Positive	Negative	Total
Positive	12 (TP)	6 (FP)	18
Negative	0 (FN)	222 (TN)	222
Total	12	228	240

X²=155.7, p< 0.01 highly significant.

Table-2: Chi Square Analysis (urine analysis*urine culture)

and NPV was 66.6% and 97.3%. Percentage of false positive and false negative were 2.6% and 0% respectively. Accuracy rate was 72%. Bachur R and Harper MB²⁵ stated sensitivity and specificity of 82% and 92% respectively. Waisman Y et al²⁶ reported sensitivity and specificity of 88.6% and 88.4% respectively, almost similar to present study. Waisman Y reported PPV and NPV of 75.6% and 95% respectively which is similar to our study. In contrast to our study, Zorc JJ et al²⁷ reported sensitivity and specificity of urine analysis as 67% and 79%. ShawKN²⁸ et al stated sensitivity and specificity of 57-87% and 53-79% respectively.

SUMMARY

Urine culture is the gold standard test in diagnosing UTI. Urine culture positivity was more in urine analysis showing >10 pus cells/HPF as compared to >5 pus cells/HPF. In diagnosing UTI, pyuria >10 pus cells/HPF was more specific (100%) with higher positive predictive value than the conventional >5 pus cells/HPF. Many of the patients who had a different provisional diagnosis turned out to be UTI hence a high index of suspicion is needed to diagnose UTI and prevent complications.

REFERENCES

1. Hoberman A, Chao HP, Kellen DM, Hickey R, Davis HW, Ellis D et al. Prevalence of urinary tract infection in febrile infants. J Pediatr. 1993;123:17-23.
2. Hoberman A, Wald ER, Reynolds EA, Penchansky L, Charron M. Pyuria and bacteriuria in urine specimens obtained by catheter from young children with fever. J

- Pediatr. 1994;124:513-9.
3. Fallanzadeh MH, Alamdarbe HM. Prevalence of urinary tract infection in preschool febrile children. *Iran J Med Sci.* 1999;24:35-39.
 4. Shaw KN, Gorelick M, McGowan KL, Yaksco HM, Schwartz JS. Prevalence of urinary tract infection in febrile young children in the emergency department pediatrics. 1998;102:E16.
 5. Alper BS, Cirry SH. Urinary tract infection in children. *Am Fam Physician.* 2005;72:2483-8.
 6. American academy of pediatrics, committee on quality improvement, subcommittee on urinary tract infection. The diagnosis, treatment and evaluation of the initial urinary tract infection in febrile infants and young children. *Pediatr.* 1999;103:843-52.
 7. Quigley R. Diagnosis of UTI in children. *Current Opinion in Pediatrics.* 2009;21:194-8.
 8. Lin DS, Huang SH, Lin CC, Tung YC, Huang TT, Chiu NC. Urinary tract infection in febrile infants younger than eight weeks of age. *Pediatr.* 2000;105:20.
 9. Ferrara P, Romaniello L, Vitelli O, Gatto A, Serva M, Cataldi L. Cranberry juice for the prevention of recurrent UTI: A randomized controlled trial in children. *Scandinavian Journal of Urology and Nephrology.* 2009;43:369-72.99.
 10. RK, Bansal S, Sharma VK, Sood A, Goyal A. Urinary tract infection among children presenting with fever. *Indian Pediatr.* 2003;40:269-270.
 11. Bauchner H, Philipp B, Dahefsky B, Klein JO. Prevalence of bacteriuria in febrile children. *Pediatr Infect Dis.* 1987; 6:239-42.
 12. Hoberman A, Chao HP, Keller DM, Hickey R, Davis HW, Ellis D. Prevalence of urinary tract infection in febrile infants. *J Pediatr.* 1993;123:17-23.
 13. Schlager TA. UTI in Children Younger Than 5 Years of Age Epidemiology, Diagnosis, Treatment, Outcomes and Prevention. *Paediatr Drugs.* 2001;3:**219**.
 14. Rabasa AI, Gofama MM. Urinary tract infection in febrile children in Maiduguri north eastern Nigeria. *Pediatr Nephrol.* 2009;12:124-7.
 15. Tramer SK, Warry P. Management of urinary tract infection in children. *Indian J Pediatr.* 1984;51:571-74.
 16. Kramer MS, Tange SM, Drummond KN, Mills EL. Urinary testing in young febrile children: A risk benefit analysis. *J Pediatr.* 1994;125:6-13.
 17. American academy of pediatrics, committee on quality improvement, subcommittee on urinary tract infection. The diagnosis, treatment and evaluation of the initial urinary tract infection in febrile infants and young children. *Pediatr.* 1999;103:843-52.
 18. Lin DS, Huang SH, Lin CC, Tung YC, Huang TT, Chiu NC. Urinary tract infection in febrile infants younger than eight weeks of age. *Pediatr.* 2000;105:20.
 19. Kaushal RK, Bansal S, Sharma VK, Sood A, Goyal A. Urinary tract infection among children presenting with fever. *Indian Pediatr.* 2003;40:269-270.
 20. Rabasa AI, Gofama MM. Urinary tract infection in febrile children in Maiduguri north eastern Nigeria. *Pediatr Nephrol.* 2009;12:124-7.
 21. Bryan CS, Reynolds KL. Community acquired bacteremic urinary tract infection: Epidemiology and Outcome. *J Urol.* 1984;132:490,934.
 22. Bagga A, Hari P. Vesicoureteric reflux and reflex nephropathy. *Indian Pediatr.* 1998;35:1197-1209.
 23. Waisman Y, Zerem E, Amir L, Mimouni M. The Validity of the Uriscreen Test for Early Detection of Urinary Tract Infection in Children. *Pediatrics.* 1999;104:41.
 24. Zamir G, Sakran W, Horowitz Y, Koren A, Miron D. Urinary tract infection: Is there a need for routine renal ultrasonography? *Arch Dis Child.* 2004;89:466-68.
 25. Saadeh SA and Mattoo TK. Managing UTI. *Pediatr Nephrol.* 2011;26:1967-76.
 26. Bachur R, Harper MB. Reliability of the Urinalysis for Predicting UTI in Young Febrile Children. *Arch Pediatr Adolesc Med.* 2001;155:60-5.
 27. Waisman Y, Zerem E, Amir L, Mimouni M. The Validity of the Uriscreen Test for Early Detection of Urinary Tract Infection in Children. *Pediatrics.* 1999;104:41.
 28. Zorc JJ, Levine DA, Platt SL, Dayan PS, Macias CG, Krief W et al. Clinical and Demographic Factors Associated With Urinary Tract Infection in Young Febrile Infants. *Pediatrics.* 2005;116:325-9.
 29. Shaw KN, McGowan KL, Gorelick MH, Schwartz JS. Screening for Urinary Tract Infection in infants in the Emergency Department. *Pediatrics.* 1998;101:1-5.
 30. Smellie JM, Poulton A, Prescond NP. Retrospective study of children with renal scarring associated with reflux and urinary infection. *BMJ.* 1994;308:1193-6.

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