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Original Research Article

Prevalence of urinary tract infection and sensitivity pattern in febrile children less than 5 years of age

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ABSTRACT

Background: Fever has long been considered as an important clinical finding in children with urinary tract infections (UTIs), it is often ignored in children in whom the symptoms are fuzzy. UTI in children is alarming because of the acute and chronic complications not seen routinely in adults. The study emphasizes that UTI should be strongly suspected in febrile children to prevent future complications. This study was undertaken to determine the prevalence of UTI and sensitivity pattern in febrile children and to assess the validity of microscopic urine analysis against urine culture in the diagnosis of UTI.
Methods: A descriptive study was undertaken in the department of pediatrics, NMCTH, Birgunj. Data related to age, sex, nutritional status, socioeconomic status were noted. Physical examinations with relevant investigations were carried out in all those patients.
Results: Out of 1074 children 147 showed significant pyuria (13.7%) and 44 showed significant bacterial growth making an overall prevalence of 4.1%. Urine cultures were done in all the cases and showed positive culture in 29.93%. Among culture positive cases gram negative organisms were commonly isolated. *E. coli* (70.45%) commonly isolated in the culture was found highly sensitive to cefotaxime and sulphamethoxazole /trimethoprim (32.14%) and was highly resistance to cefepime, cefuroxime, cefixime.
Conclusions: Overall prevalence of UTI in our study was low (4.1%). The >5 pus cells/hpf in centrifuged sample should be considered as significant pyuria and further evaluation should be done promptly to initiate treatment and to prevent long term sequalae.

Keywords: Children, Febrile, UTI, Prevalence, Pyuria

INTRODUCTION

Children with fever account for a large proportion in outpatient department and emergency Medicine. Unlike occult bacteremia or severe bacterial illness (in infants and children) the emergency department has little attention to the identification of UTIs in children with fever, although recent data suggests that these patients have a high UTI rate and a high incidence rate. Most of the time, children experience with antibiotics emperically does not adequately assess UTI. However, fever is often the only symptom in children with UTI.[1]

UTI in children is the third most common infection after respiratory and gastrointestinal tract infections accounting for 4 to 10% of hospitalized children with fever.[2]

UTIs accounted for 10% of all febrile children, 13.6% of febrile infants and 7% of febrile newborns.[3]

Fever, severe bacteriuria and pyuria in children without a recorded source of infections must be considered as symptoms of pyelonephritis, an invasive infection of the renal parenchyma requiring prompt treatment.[4]

Recent studies using renal parenchymal nucleophilic scanning to determine the presence of UTI have shown that more than 75% of children under 5 years of age with febrile UTI have pyelonephritis.[5]

Most UTIs that causes scarring or impaired kidney growth occur in children younger than 4 years of age especially in the first year of life, who have severe reflux or obstruction and those with delayed treatment of UTIs.[6]

Focal renal scarring in children with pyelonephritis has a 23% risk for hypertension and10% risk for end-stage renal disease.[7]

Approximately 13% to 15% of end-stage renal disease is considered to be associated with UTI in childhood which is often unrecognized and therefore, under treated.[8]

It is essential to identify UTIs in febrile children and institute prompt treatment to reduce the potential for lifelong morbidity. Progressive renal damage caused by unrecognized pyelonephritis in childhood may lead to hypertension and chronic renal failure in later life.

The present study is undertaken to estimate the prevalence of UTI in febrile children less than 5 years of age and to assess the validity of routine microscopic Urine analysis against urine culture in the diagnosis of UTI.

Aims and objectives

Aim and objectives were to determine the prevalence of UTI in febrile children, less than 5 years of age, to assess the validity of microscopic urine analysis against urine culture in the diagnosis of UTI, to assess the antibiotic sensitivity pattern and to identify nutritional status and socioeconomic factors associated with UTI.

METHODS

The present study was conducted in the department of pediatrics National Medical College and Teaching Hospital, Birgunj during the period of 01/09/2020 to 01/09/2021 (i.e., 12 months). It is a hospital based, descriptive, cross-sectional and prospective study.

Selection of patients

Febrile children less than 5 years attending the outpatient department or admitted in the hospital over a period of 12 months were included in the study.

Inclusion criteria

Inclusion criteria were febrile children between 1 month to 5 years and fever {rectal s38.3°C or axillary temperature s37.8°C} included in the study.

Exclusion criteria

Children below 1 month and above 5 years, any child who has received antibiotics 48 hours prior were not included in the study, children with known congenital genitourinary anomalies and parents/guardians not willing to enroll the child in the study were excluded from the study.

The 1074 children were included in the study, data related to age; sex, nutritional status and socioeconomic status were noted. A complete history related to the onset, duration of fever and associated symptoms such as nausea, vomiting, diarrhea, urinary disturbances, other system involvement was obtained.

A thorough physical examination with relevant investigations was carried out in all patients. Routine blood counts, urine analysis and urine culture sensitivity were done.

Statistical analysis

Excel sheet version 2011 for windows was used for data collection. The data was analyzed using statistical package for social sciences (SPSS) software version 21 for windows. The descriptive statistics like frequency distribution, mean, median, percentage, were examined to determine the association by multivariate logistic regression analysis. Findings are expressed in the form of tables, bar diagram and charts where feasible.

Ethical consideration

For this study ethical approval was taken from institutional review committee (IRC) of national medical college (NMCTH, Birgunj). Informed and written consent was taken from the mother or guardian before including them in the study. Confidentiality was maintained. Every participant (child guardians) was provided with the right to withdraw his or her child from the study at any time.

Collection of urine sample

From all 1074 cases a sample of urine was collected. In children under 2 years of age urine was collected by suprapubic aspiration and in others midstream sample was collected.

Method of collection of mid-stream sample

In children above 2 years of age the genitalia were cleaned with soap and water and person collecting sample washed hands before touching the sterile bottle. Child was allowed to pass urine and midstream sample was collected in sterile bottle and was sent for culture.

Method of collection of suprapubic aspiration sample

Assistant was asked to hold the child supine with legs extended, the skin was wiped with povidone-iodine (betadine) swab, insertion point was identified, midline, lower abdominal crease (2 cm above pubic symphysis). The symphysis pubis was palpated and local anesthetic (lidocaine) was injected 2 cm above the superior edge of the symphysis. A 22-gauze needle attached to 10 ml syringe was inserted perpendicular to the skin, aspirating gently as the needle was advanced and if urine was obtained, needle was removed and squirted urine into sterile urine jar.

Urine analysis

The fresh urine samples obtained from the above techniques were subjected for urinalysis and culture and sensitivity. The urine specimens were centrifuged in a standard manner, 10ml of urine was span at the rate of 2500 rpm for 20-30mintes, supernatant decanted off and sediment resuspended in the remaining 0.2 ml. The urine was 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

The clean catch mid-stream urine was inoculated into blood and mac conkey agar plates with a 0.01 ml calibrated loop. All plates were incubated at 35-37°C for 24 hrs under aerobic condition to obtain accurate colony count. On culture of mid-stream sample 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 specimen in a mid-stream of urine.

Culture sensitivity

Antimicrobial susceptibility of isolates was tested by disk diffusion method by using Mueller-Hinton medium using antibiotic discs with a minimum inhibitory concentration (MIC). Antimicrobial agents tested were amoxicillin, ampicillin, amoxicillin+ clauvanic acid, trimethoprim + sulphamethoxazole, ciprofloxacin, ofloxacin, norfloxacin. Nitrofurantoin, gentamicin, amikacin, cephalexin, cefurorixme, ceftriaxone, cefotaxime, cefepime. These antibiotics were chosen as they are the antibiotics of choice in the treatment of UTI.

RESULTS

In the present study of 1074 cases 462 (43%) were males, 612 (56.9%) were females, 315 cases were <1 year (29.32%). Maximum cases of UTI were in the age <2 years (68.7%). Minimum age in the study group was 2 months and maximum age in the study group was 60 months.

Table 1: Age and sex distribution of 1074 cases.

Age (Years)	Sex		Total
	Male	Female	
<1	120 (25.97)	195 (31.86)	315 (29.33)
1-2	221 (47.84)	202 (33)	423 (39.39)
> 2	121 (26.19)	215 (35.13)	336 (31.28)
Total	462	612	1074

Table 2: Age and sex distribution of subjects with urine showing >5 pus cells/hpf.

Age (Years)	Sex (%)		Total (%)
	Male	Female	
<1	21 (25.60)	30 (46.15)	51 (34.69)
1-2	27 (32.93)	13 (20.00)	40 (27.21)
2-3	11 (13.41)	4 (6.15)	15 (10.20)
3-4	18 (21.95)	10 (15.38)	28 (19.04)
4-5	5 (6.10)	8 (12.30)	13 (8.84)
Total	82	65	147

In the present study 147 children (13.7%) showed pyuria in centrifuged urine sample of which 82 (55.78%) were males and 65 (44.21%) were females. Majority were <2 years, 61.9%.

Table 3: Distribution of pus cells in urine.

No. of pus cells in urine	Sex (%)		Total (%)
	Male	Female	
>5	58 (70.73)	45 (69.23)	103 (70.07)
>10	11 (13.41)	15 (23.07)	26 (17.69)
Numerous	13 (15.85)	5 (7.70)	18 (12.24)
Total	82 (100)	65 (100)	147 (100)

In our study among 1074 children 147 (13.7%) showed significant pus cells in urine, 70.07% of children with pyuria showed more than 5 pus cells/HPF and 17.69% showed more than 10 pus cells/HPF. 12.24% showed numerous of pus cells.

In our study growth $>10^5$ CFU/ml of single organism was considered significant growth. The 95.06% of febrile

children showed no significant growth on urine culture. Among positive culture 70.45% showed *E. coli*, 11.4% showed *Klebsiella*, 9.1% showed *S. aureus*, 4.55% showed pseudomonas and Citrobacter.

E. coli (70.45%) commonly isolated in the culture was found highly sensitive to cefotaxime and sulphamethoxazole /trimethoprim (32.14%) and was highly resistance to cefepime, cefuroxime, cefixime.

Table 4: Distribution of urine culture.

Urine culture report	Sex (%)		Total (%)
	Male	Female	
No growth	445 (96.32)	585 (95.6)	1030 (95.90)
E. coli	12 (2.6)	19 (3.10)	31 (2.89)
Klebsiella	1 (0.22)	4 (0.65)	5 (0.47)
Staph. aureus	2 (0.43)	2 (0.33)	4 (0.37)
Pseudomonas	2 (0.43)	-	2 (0.19)
Citrobacter	-	2 (0.33)	2 (0.19)
Total	462 (100)	612 (100)	1074 (100)

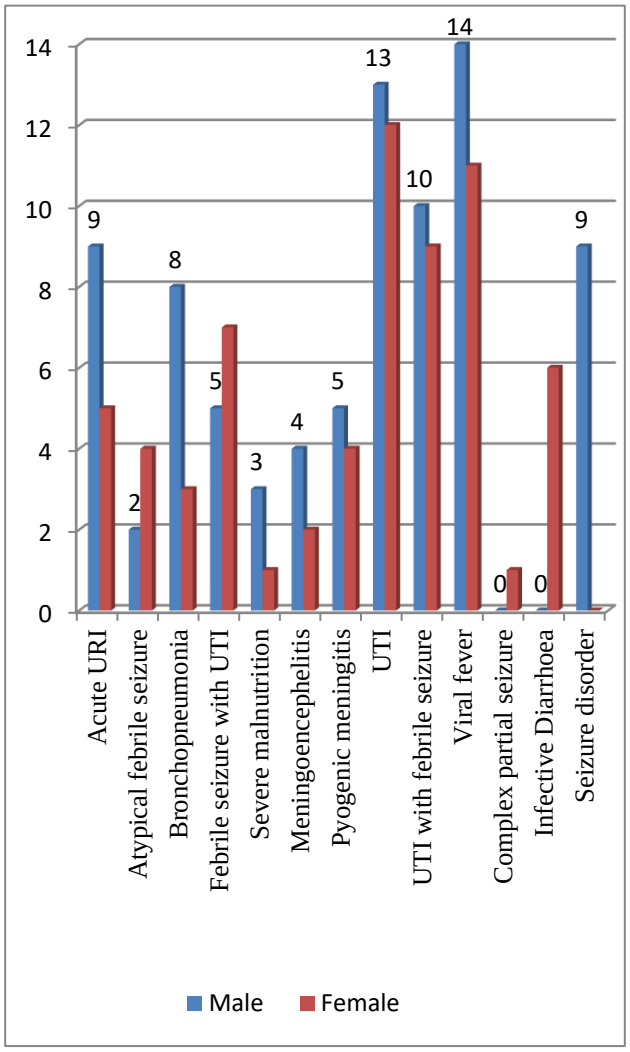

Figure 1: Final diagnosis in all pyuric children.

According to modified Kuppuswamy scale of socio-economic status, majority of children with significant pyuria (147) belong to class III (55.10%), (29.93%) belonged to class II and (14.97%) belonged to class IV.

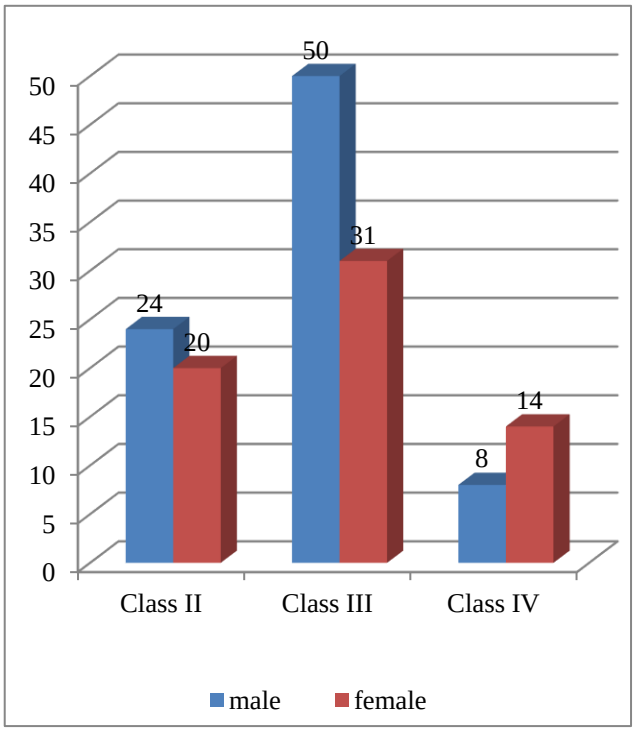

Figure 2: Distribution of socio-economic status.

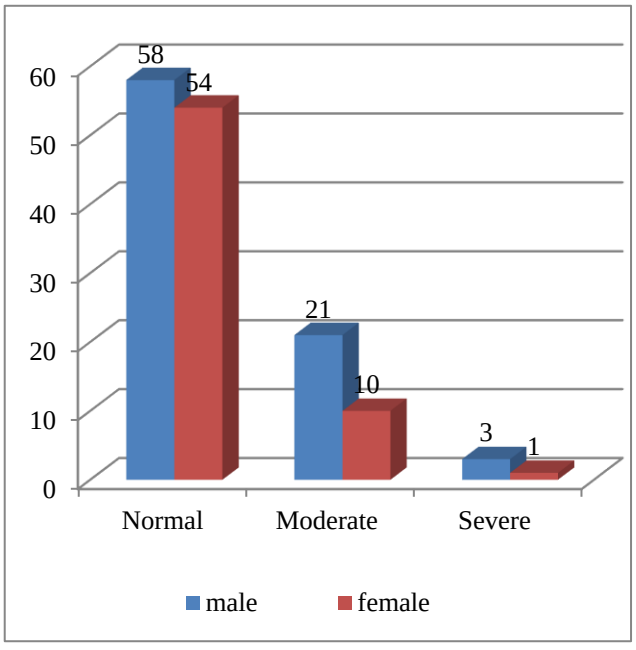

Figure 3: Distribution of subjects based on nutritional status (WHO classification) in pyuric children showing >5 pus cells/HPF.

Nutritional status of majority of children was normal i.e., 76.20%, 21.08% were in moderate nutrition, and 2.72% belong to severe under nutrition.

Table 5: Sensitivity of *Escherichia Coli, S. Aureus* and *Klebsiella* to all antibiotics.

Antibiotics	*E. coli* (%)		*Klebsiella* (%)		*S. Aureus* (%)	
	Sensitivity	Resistant	Sensitivity	Resistant	Sensitivity	Resistant
Sulphamethoxazole/ trimethoprim	32.14	67	30.15	69.85	25	75
Cephalosporins						
Cefotaxime	32.14	67	43.20	57.80	13.50	87.50
Ceftriaxone	14.30	85	19.30	80.70	0	100
Cefuroxime	0	100	24.40	75	0	100
Cefepime	0	100	30.31	69	0	100
Cephalexin	0	100	0	100	0	100
Cefixime	0	100	0	100	0	100
Fluroquinolones						
Norfloxacin	28.57	71	38.57	61.40	37.50	62.50
Ofloxacin	21.40	78	41.20	58	37.50	62.50
Ciprofloxacin	21.40	78	48.42	51	31.50	68
Aminoglycosides						
Amikacin	14.30	85	30.30	69.70	25	75
Gentamicin	0	100	32.43	67.57	18.75	81.25
Penicillin's						
Amoxicillin/Clavulanate	3.57	96.42	8.62	91.38	13.50	87.50
Amoxicillin	0	100	2	98	6.25	93.75
Ampicillin	0	100	6	94	0	100
Nitrofurantoin	3.57	96.42	8	92	13.50	87.50

DISCUSSION

UTIs are common, potentially serious infections of childhood. They cause acute morbidity as well as long term sequeale including hypertension and impaired renal function. Accurate diagnosis of UTI is important to facilitate appropriate management of acute illness, and to ensure appropriate evaluation and follow up. Equally important is accurately ruling out a UTI to avoid unnecessary cost and potentially harmful treatment and evaluation.

The present study was a descriptive study conducted in department of pediatrics at national medical college and teaching hospital over a period of 12 months between September 2019 to august 2020 to determine the magnitude of UTI in febrile children between 1 month to 5years and also to assess the validity of routine microscopic urine analysis against culture in the diagnosis of UTI.

A total of 1074 febrile children were included in the study, out of 1074 patients in study 462 were males and 612 were females with M:F ratio 1:1.3 and majority of them i.e., 68.7% were <2 years. In our study out of 1074 children 147 children showed significant pyuria (13.7%) and 44 showed significant bacterial growth making an overall prevalence of 4.1%. Among culture positive UTI'S 75% were <2 years of age with overall prevalence of 4.5% in children <2 years and 6.66% in children <l year.

In our study prevalence of febrile UTI in infants is almost similar to that of Dharaka et al, and Hoberman et al who reported a prevalence of 5.4% and 5.3% respevtively.[9,10]

Compared with Gupta et al and Kaushal et al the total prevalence of UTI in febrile children in this study was lower i.e., 4.1% and 6.66% respectively, who reported the prevalance of (25.9%, 8.4%) in children <5 years and (12.3%, 9.4%) in infant respectively.[11,12] Overall prevalence of febrile UTI in infants in our study (6.66%) was higher than that reported by Prasad et al and Bauchner et al who reported prevalence of 4.95% and 1.7%.[14]

In our study prevalence of UTI was 4.5 % in the under-2 age group which was almost similar to the results of Roberts et al who coated prevalence of 4.1%. Srivasths et al reported a prevalence of 2.48% in children <2 years which was the lowest level reported in developing countries.[15,16]

Among culture positive cases gram negative bacteria detection rate was the highest which were 70.45% *E. coli* and 11.4% *Kleibsella* 9.1% *S. aures* and 4.55% *Pseudomonas* and *Citrobacter* each which correlates with other research results. Bryan et al reported *E. coli* as the common urinary pathogen in 85% of cases.[17] According to Aravind Bagga et al 90% of first symptomatic UTI and 70% recurrence infections were due to *E. coli*.[18] Saadeh and Mattoo et al also reported *E. coli* (60-92%) as the most common bacterium isolated in their study.[19] A similar studies by Saheb et al and Rai et al (93.3%) says that the predominant organism isolated in their study was *E. coli*.[20,21]

Urine cultures were done in all the cases and the positive rate of culture was 29.93%. Out of which 34% had numerous pus cells in urine microscopy, 50% had >10 pus cells/HPF and 16% had >5 pus cells/HPF. Hence the presence of pyuria of >5 leukocytes/HPF in a centrifuged sample is a significant indicator of UTI.

We are also able to establish antibiotic susceptibility pattern of various pathogens isolated. *E. coli* was most sensitive to cefotaxime and sulphamethoxazole//trimethoprim (32.14%), commonly used fluroquionolones norfloxacin showed sensitivity of (28.57%), ofloxacin and ciprofloxacin (21.40%), sensitivity of amikacin was lowest (14.30%). Sensitivity of *E. coli* to cefotaxime in our study was similar to study by Badhan et al.[22] In contrast study done by Patel et al and Ponvelil et al *E. coli* was found most sensitive to imipenem and nitrofurantoin.[23,24] In our study *E. coli* was highly resistance to cefepime, cefurorixme, cefixime, gentamycin, ampicillin and amoxicillin. In contrast other study shows high resistance to fluroquinolones.[22, 25]

Other organism similar to other studies, such as *Kleibsella* are highly sensitivity to fluroquinolones and cephalosporines.[26] In contrast a study by Mozaffari et al confirmed that 61.2% of *K. pneumoniae* isolated has drug resistance, of which 20.4% were 100% resistance to all cephalosporin.[27] *S. Aureus* shows high sensitivity to fluroquinolones, which was similar to other study by Onanuga et.al.[28] These figures remind us that we have serious problem in that bacterial resistant to antibiotics.

CONCLUSIONS

Clinicians should be aware of the possibility that febrile children may have UTI and should consider obtaining a urine culture specimen as part of their diagnostic evaluation.

The presence of another potential source of fever such as upper respiratory tract infection or otitis media is not reliable in excluding UTI. Several studies in developed countries have shown a low prevalence (1.7-4.1%) of UTI in febrile children.

Present study reveals similar overall prevalence of UTI (4.1%) in febrile children <1 month to 5 years and 4.5% in children <2 years and 6.66% in children <1 year of age. Prevalence of culture positivity was 51% in those who showed >10 pus cells/HPF in centrifuged sample of urine compared to 4% in those who showed >5 pus cells/HPF. Most common uropathogen isolated was *E coli* and was highly resistant to all antibiotics used in the treatment of UTI.

Hence, we conclude that pyuria of >5 pus cells /HPF in centrifuged sample should be considered as significant pyuria and further evaluation should be done promptly to initiate treatment and to prevent morbidity and long term sequalae.

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