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Clinical and Pathological Profile of Urinary Tract Infection in Children and Adolescents; A Hospital Based Study

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Abstract **Original Research Article**

Background*:** Urinary tract infections (UTIs) encompass a wide array of infections, accounting for a vast number of community as well as hospital-acquired infections. ***Aim of the Study: The aim was to analyse the clinical presentation of UTI in children and Adolescents between 6 year to 18 years of age and to analyse the causative microorganism and their drug susceptibility in urinary tract infection in children and Adolescents of the above age group. ***Methods*:** This retrospective was conducted at the Department of Pediatrics in Bangladesh Shishu Hospital, Dhaka, Bangladesh. A total of 51 patients were enrolled and analyzed in this study based on culture-positive urine isolates. The study duration was September 2021 to August 2022. The ethical committee of the institution approved the study protocol. Antimicrobial susceptibility was done for positive urine culture by the Kirby-Bauer disk diffusion method. Statistical analysis was done using Statistical package for social sciences (SPSS) software version 16. ***Result:*** This is a retrospective study; 98 children were enrolled and analyzed. The majority of the study population was aged 6-10 years (62.75%), 11(21.57%) patients were from the age group 11-15 years, and 8(15.69%) patients were from the age group 16-18 years. ***Conclusion*:** The most common clinical presentations of UTI in admitted patients are fever, dysuria and abdominal pain. Gram-negative bacilli were found to be responsible for UTI, and the most frequently isolated bacteria were E-coli.

Keywords: Children, Urinary tract infection, Antibiotic susceptibility, Escherichia coli.

INTRODUCTION

Urinary tract infection (UTI) is one of the children's most common bacterial infections [1]. It is estimated that at least 1% of boys and 3% of girls develop urinary tract infections during the first ten years of life [1]. UTI is mainly due to the ascending infection from the urethra. The diagnosis of UTI in young children is essential as it may be the marker of urinary tract abnormalities. Early diagnosis is vital to preserving the renal function of the growing kidney [2]. UTI is one of the most critical risk factors in the development of renal insufficiency or end-stage renal disease [3]. 8-10% of girls and 2-3% of boys will have symptomatic UTI before the age of seven, being more frequent in males in the first three months of life and producing a progressive increase with a predominance of girls from the first year of life [4]. In the first 4-6 months of age, it is more frequent in the male sex, with a boy/girl relationship with a 4/1 ratio. After three years, UTIs are much more frequent in girls, so 5% of school girls suffer from it, with a girl/boy ratio more excellent than 10/1 [5]. UTIs are one of the most common bacterial infections; approximately 5-14% of pediatric emergencies are due to this cause [6, 7]. Finally, we can say that its incidence is related to age and sex. Existing epidemiological studies are very heterogeneous, with variations between one and the other regarding the definition of UTI, the populations studied, and the methodology used to collect the urine samples. On the other hand, children with UTIs, especially the smallest ones, present nonspecific symptomatology, which sometimes makes the UTI undetected [8]. This study aimed to analyze the clinical presentation of UTI in children between 6 year to 18 years of age and to analyse the causative microorganism and their drug susceptibility in urinary tract infection in children and Adolescents between 6 year to 18 years of age.

METHODOLOGY & MATERIALS

This retrospective was conducted at the Department of Pediatrics in Bangladesh Shishu Hospital, Dhaka, Bangladesh. A total of 51 patients were enrolled and analyzed in this study based on culture-positive urine isolates. The study duration was one year September 2021 to August 2022. The ethical committee of the institution approved the study protocol. Patient details, including age, sex, clinical presentation, previous history of UTI, and any congenital anomaly, were collected from inpatient and outpatient records and entered in the predesigned proforma. The urine culture and sensitivity report was analyzed using WHONET software. A urine sample collected by clean catch midstream technique/ catheter sample was included. A urine sample showing significant growth of more than or equal to 105 CFU/ml of a single micro-organism in the presence of symptoms was considered significant and processed for further identification and susceptibility testing [15]. Data were collected from their outpatient or inpatient records, including Micturating cystourethrogram (MCU) and Dimercapto succinic acid (DMSA) scan reports. In the presence of any potential growth, an antibiotic susceptibility test was done by the Kirby-Bauer disk diffusion method and interpreted according to Clinical and Laboratory Standards Institute Guidelines (CLSI) 2019 and 2020 [16]. Antibiotics tested were cephalosporins, amikacin, gentamicin, co-trimoxazole, nitrofurantoin, piperacillin-tazobactam, fluoroquinolones and carbapenems for gram-negative organisms and gentamicin, nitrofurantoin, norfloxacin, linezolid and vancomycin for gram-positive organisms. Suspected ESBL isolates were tested and confirmed using the combination disk method (Cephalosporin and Cephalosporin clavulanate disks). No informed consent was required as it was a non-interventional retrospective study per national guidelines, and no additional sampling was done.

- **Inclusion Criteria**

Children between the age group of 9 years to 18 with UTI who satisfied inclusion criteria during the study period and who visited both the outpatient and inpatient department were included in the study.

- **Exclusion Criteria**

Repeated samples from the same patient who has already been included and those with evidence of perineal contamination were excluded from the study.

Statistical analysis was done using Statistical package for social sciences (SPSS) Software version 16. Fischer's chi-square test was used for comparing numerical parameters. A probability value (p-value) less than 0.05 was regarded as statistically significant.

RESULT

This is a retrospective study; 98 children were enrolled and analyzed. The majority of the study population was aged 6-10 years (62.75%), 11(21.57%) patients were from the age group 11-15 years, and 8(15.69%) patients were from the age group 16-18 years (Table 1). Figure 1 shows the sex distribution of the study population, 54% of patients were female, and 46% were male. All of the patient's had a fever, 23(45.10%) patients had dysuria, 8(15.69%) patients had abdominal pain, 3(5.88%) patients had vomiting and 2(3.92%) patients had increased frequency (Table 2). Table 3 is shown the percentage distribution of bacteria causing UTI in the study population; most of the patients had been infected by E. coli (23.47%), 4(4.08%) patients were infected by klebsiella pneumonia, both Pseudomonas areuginosa and Enterococcus faecalis had a percentage of 3.06%, both Morganella morganii and Proteus mirabilis percentage of 2.04%, each Acinetobacter baumannii, Enterobacter cloacae, and Enterobacter are genes has a percentage of 1.02% (Table 3).

Table 1: Age distribution of the study population (N=51)

Age range (Year)	Frequency	Percentage
(6-10)	32	62.75
(11-15)	11	21.57
(16-18)	8	15.69
Total	**51**	**100**

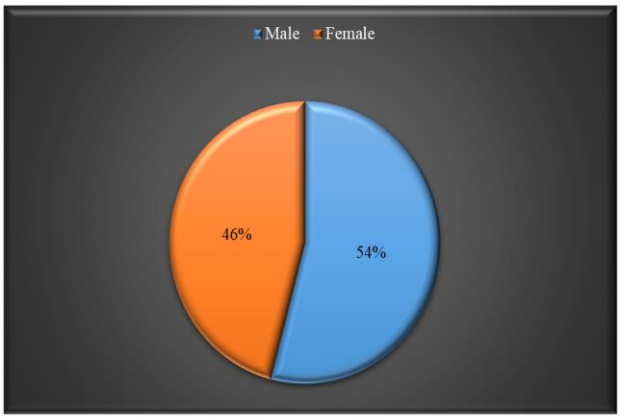

Figure 1: Sex distribution of the study population (N=98)

Table 2: Symptoms distribution of the study population

Symptoms	Frequency	Percentage
Fever	51	100.00
Dysuria	23	45.10
Increased frequency	2	3.92
Abdominal pain	8	15.69
Vomiting	3	5.88

Table 3: Percentage distribution of bacteria causing UTI in the study population

Bacteria	Frequency	Percentage
E. Coli	23	23.47
Klebsiella pneumoniae	4	4.08
Pseudomonas areuginosa	3	3.06
Enterococcus faecalis	3	3.06
Morganella morganii	2	2.04
Proteus mirabilis	2	2.04
Acinetobacter baumannii	1	1.02
Enterobacter cloacae	1	1.02
Enterobacter areogenes	1	1.02

DISCUSSION

According to local epidemiological studies, knowledge of the sensitivity pattern of common uropathogens is necessary for selecting empirical antibiotic therapy. Studies recommend that the policies for UTI treatment in children should be evaluated every five years according to resistance rates [9]. The incidence of culture-positive UTI among symptomatic children in our present study is 18.44%, comparable to studies conducted in Nepal, Tanzania, Nigeria, and Gondar [10-12]. Similar observations were noted by Kaur *et al.,* in India and Parajuli *et al.,* in Kathmandu, Nepal [13, 14]. A higher incidence was reported in Italy, China, and Nepal [15, 16]. The age group of less than one year was the most affected in our study. This concurs with the study conducted in South Kerala and Bareilly in India [17, 18]. Our observations are similar to Sharma et al., GK *et al.,* and Singh *et al.,* [19-21]. The age group least affected was 11-15 years. Males outnumbered females in the first year of life. This is in full agreement with other studies like Dyaneshwari *et al.,* Ramagopal *et al.,* Pal *et al.,* Dash *et al.,* and Mehta *et al.,* [22-26]. The reason is that uncircumcised infant boys are more likely to have UTI, as microorganisms can develop under prepuce. In our study, the male: female ratio was 1.3:1 during infancy and 1:1 between 1-15 years of age. In children above one year to fifteen, female preponderance has been reported with a rate ranging from 6:1 to 1.33:1 depending on different sample sizes and differences in the studied age group [27]. In our study, there was not much female preponderance after one year of age, as only those cases presented to our hospital were considered, and other UTI cases in the community were not considered. Bay *et al.,* reported that the age group between 7-12 years was the most affected, with female preponderance [28]. Taneja *et al.,* and Qureshi *et al.,* reported 1-5 years as the most common age group affected with a male preponderance [29, 30]. Fever was the most common presenting symptom in our study population, which was seen in 52.82%. This is concurrent with several previous reports, which state that fever is the most common presenting feature, such as Ramgopal *et al.,* Shrestha *et al.,* Vaidya *et al.,* and Brkic *et al.,* [23, 31-33]. The second most common presenting complaint in our study was dysuria, as reported by Anis-ur-Rehman *et al.,* [34]. Constipation was reported as an important risk factor for recurrent UTI by Rushton *et al.,* which was reduced after improving bowel habits [35]. Gram-negative bacilli were the predominant causative group of childhood UTI, accounting for 91.38% of our study. E. coli was the predominant organism isolated in our study (66%). This is consistent with studies reported by other authors [24, 31, 32, 36-38]. E. coli, in general, was noted to account for 50-90% of UTIs in the pediatric age group, irrespective of sex, age, community, or country [31]. The second common pathogen grown in our sample was Klebsiella pneumonia, similar to studies by Badhan *et al.,* Vaidya *et al.,* and Pal *et al.,* [24, 32, 39]. A high resistance rate was found to antibiotics such as cephalosporins, and co-trimoxazole in E. coli and Klebsiella. This finding correlates with the study by Ohana *et al.,* Ramagopal *et al.,* Taneja *et al.,* and Sharma *et al.,* [19, 23, 38]. This may be attributed to the frequent use of these drugs in general peadiatric practice, low cost, and ease of administration. The higher resistance to these oral drugs is worrisome as they will indicate the need for intravenous administration. In our study, fluoroquinolones showed a sensitivity of 60% to E. coli and 78% to Klebsiella. E. coli isolates were highly sensitive against Nitrofurantoin as compared to Klebsiella (95% and 74%, respectively), similar to the study by Pal *et al.,* [24]. This may be due to Nitrofurantoin being a reserved drug for treating UTIs in the pediatric population. Amikacin showed a sensitivity of 95% to E. coli and 83% to Klebsiella, consistent with the study by Elpis *et al.,* and Payel *et al.,* [40, 41]. In this study, Piperacillin- Tazobactam sensitivity was 85% and 78% to E. coli and Klebsiella, Carbapenem sensitivity was 95% to E. coli and 83% to Klebsiella. This is worrisome as the rate of prescription of these drugs will increase, and resistance may build up over time (Table 3). Among the gram-positive organisms, Enterococcus faecalis was the only isolated pathogen, and it had 100 % sensitivity to linezolid, and vancomycin. In a study by Gupta *et al.,* and Shrestha *et al.,* among the gram-positive organisms, Enterococcus faecalis was the most isolated pathogen [31, 42]. Other authors have also reported gram-positive organisms like Coagulase- negative Staphylococcus, Staphylococcus aureus, and streptococci. However, these pathogens were not isolated from our samples. In their study, Lok *et al.,* and Muoneke *et al.,* reported Staphylococcus

aureus as the second most common uropathogenic isolated [38]. This variation could be due to congenital anomalies or changing geographical areas and ethnicity. 43.58% of gram-negative bacilli were ESBL positive, similar to studies by Akram *et al.*, (42%), Tangar *et al.*, (36.5%), Shrestha *et al.*, (40%) and Parajuli *et al.*, (38.9%) [31].

Limitations of the Study

Every hospital-based study has some limitations, and the results of the present study may not be representative of the whole of the country or the world at large. The number of patients included in the present study was less in comparison to other studies. Because the trial was short, it was difficult to remark on complications and mortality.

Conclusion and Recommendations

UTI is common in children and adolescent. Fever and dysuria was the most common presenting feature. E. coli is still our center's leading cause of pediatric UTI, followed by Klebsiella pneumoniae. However, there is an alarming increase in ESBL species. Unlike reports elsewhere, gram-positive micro-organisms were not found to have a major role in our centre. Co-trimoxazole, and Cephalosporins, once the mainstay of treatment, were no longer useful at our center. As the resistance to Cephalosporins increases, the use of Cephalexin as a drug for uroprophylaxis warrants revision. Nitrofurantoin can be the drug of choice when the oral route is preferred. Amikacin, Piperacillin [1], Tazobactam, and Carbapenems can be used as intravenous preparation. The pertaining issue of antimicrobial resistance among isolates calls for stronger antibiotic stewardship. Regular surveillance should be done to determine the prevalent organisms and their antibiotic susceptibility to choose empiric antibiotic therapy for UTIs in children and Adolescents.

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