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Original Research Article

Antibiotic Sensitivity Pattern and Demographic Characteristics of Urinary Tract Infection among Hospitalized Children

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Abstract

Introduction: Urinary tract infection (UTI) is the third most common infection during childhood and considered as an important risk factor for the development long-term complications. It was aimed to look into the demographic characteristics, clinical presentations, and antimicrobial resistance among children hospitalized for UTI. ***Methods:*** This cross-sectional observational study was conducted at the Inpatients Department of Uttara Adhunik Medical College and Hospital, Dhaka, Bangladesh. The study duration was 2 years, from July 2017 to June 2019, during which period, a total of 90 children with urinary tract infection visiting the study place were included in the study, following the inclusion and exclusion criteria. ***Result:*** The age of the participants ranged from over 1 months to 5 years., with majority (55.56%) being between the age of 2-5 years. The male to female ratio was 1:1.73. Fever was the commonest presenting symptom in participants, with 87.78% prevalence, followed by vomiting in 80% of the participants. The commonest organism cultured in this study was E. coli (80%), followed by Klebsiella spp. (20%). Isolated pathogens were highly sensitive to Amikacin (100.0%), Meropenem (100.0%), Imipenem (97.0%) and Nitrofurantoin (90.9% - 100.0%), moderately sensitivity to third generation Cephalosporine and highly resistant to Ampicillin (75.0 - 78.8%), Amoxiclav (72.7% - 87.5%) and Cephalexin (81.1% - 87.5%). ***Conclusion:*** The proportion of urinary tract infection in females was higher than males. Most patients presented with more than one symptom but most commonly presented with fever. E. coli was the most common isolated bacteria in hospitalized children with a principal diagnosis of UTI. Most of the isolated pathogens were highly resistant to ampicillin, cotrimoxazole, and highly sensitivity to amikacin, nitrofurantoin and meropenem.

Keywords: Infection, Urinary Tract, Antibiotic, Sensitivity, Resistance.

INTRODUCTION

Urinary tract infection (UTI) is the third most common serious bacterial infection in childhood and has been identified as an important risk factor for the development of progressive renal impairment and long-term consequences [1]. The occurrence of UTI in children varies according to their age and gender. The male to female ratio ranges from 2.8 to 5.4:1 throughout the first year of life. UTIs in male children are most common during the first year of life, and they are substantially more common in uncircumcised boys. However, after 1 - 2 years, there is a clear female predominance, with a male to female ratio of 1:10 [2]. When a youngster is assessed for fever, this is a crucial differential. A high-grade fever defined as a temperature of 39°C or higher, is linked to an increased risk of UTI. UTI is thought to be caused by an ascending infection through the urethra [3]. Colonic bacteria, particularly Enterobacteriaceae, are the most commonly isolated species from children with simple UTI. Staphylococcus aureus infection was assumed to be uncommon in children who did not have indwelling catheters or other sources of infection. However, new Nigerian research has identified it as a common cause of UTI in otherwise healthy youngsters [4]. In females, Escherichia colt app. accounts for 75-90 percent of all

UTIs, followed by Klebsiella app. and Proteus app. species, but previous reports show that Proteus app. is as common as E. coli in male UTIs aged > 1 year, and Staphylococcus saprophyticus and Enterococcus app. are causative pathogens in both sexes [2]. The identification of UTI in young children is critical because it might be a marker for urinary tract anomalies, and it may be related with bacteremia in newborns. Early detection is crucial for preserving renal function of the developing kidney as well as delaying the commencement of antibacterial therapy, which is associated with a greater risk of renal scarring, hypertension, and progression to end-stage kidney disease [3]. The mainstay of treatment, antibiotic therapy, is dependent on a number of factors, including the predominant pathogens in the patient's age group, antibacterial sensitivity patterns in the practice area, the patient's clinical status, the opportunity for close follow-up, and, of course, the cost of treatment [5]. Before exposing the causal bacteria and antimicrobial sensitivity and resistance report, the majority of these youngsters get empirical antibiotic therapy [6]. It has recently been demonstrated that extremely high resistance to Trimethoprim, Ampicillin, and Cephalosporins, rendering them unsuitable for empirical use, intermediate sensitivity to 3rd generation cephalosporin, and highly sensitive to Ciprofloxacin (84.4%), Amikacin (83.8%), and Nitrofurantoin (82.8%) [7]. The increasing resistance of bacterial infections is a worldwide concern that varies by location and even country. Such studies demonstrated the need for ongoing surveillance and investigation of additional oral medicines for the treatment of UTI in the community [2].

Bangladesh is a highly populated developing country with a literacy rate of approximately 74.66 percent among those aged 15 and above, significant progress in health-related Millennium Development Goals (MDGs), and noticeable GDP growth [8-10]. Unfortunately, antibiotics are prescribed at random, even by pharmacists, without proper oversight. As a result, the current study aims to analyze demographic features, clinical factors related with the likelihood of UTI, and organism sensitivity to different types of antibiotics.

OBJECTIVE

General Objective

- To observe the demographic characteristics of children with UTI.
- To observe the sensitivity and resistance pattern of different UTI causing organisms to different antibiotics.

METHODS

This cross-sectional observational study was conducted at the Inpatients Department of Uttara Adhunik Medical College and Hospital, Dhaka, Bangladesh. The study duration was 2 years, from July 2017 to June 2019, during which period, a total of 90 children with urinary tract infection visiting the study place were included in the study, following the inclusion and exclusion criteria. Purposive sequential sampling was used to include the culture positive UTI children in the study. Following pretesting, a structured data collection form encompassing all variables of interest was constructed and finalized. Face-to-face interviews, detailed clinical examinations of patients, and analysis of necessary investigation records were used to acquire data from parents. Prior to data collection, informed consent was obtained from the parents, and ethical clearance was received from the research hospital's ethical review committee.The collected data was analyzed using the SPSS software version 20.

Inclusion Criteria

- Children over 1 month of age.
- Children ≤5 years of age.
- Diagnosed cases of Urinary Tract Infection.
- Patients whose parents had given consent to participate in the study.

Exclusion Criteria

- Critically ill children with other systemic illness.
- UTI patients with other chronic illness.
- Patients who had received antibiotic prior to admission.
- Exclude those affected with other chronic diseases etc.

RESULTS

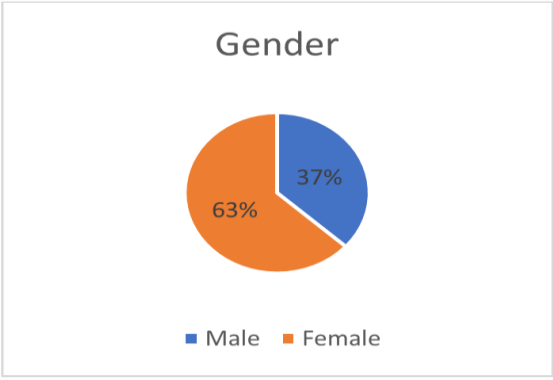

Figure 1: Gender Distribution of the participants (n=90)

Among the participants of the present study, female prevalence was higher, with 63.33% female and 36.67% male presence.

Table 1: Age Distribution of the participants (n=90)

Age	Frequency	Percentage
<1 years	11	12.22%
1-2 years	28	31.11%
2-5 years	50	55.56%

The age of the participants ranged from over 1 month to 5 years. 12.22% of the participants had been within the age range of 1 month to 12 months, while majority (55.56%) had been between the age of 2-5 years. The remaining 31.11% had been between the ages of 1-2 years.

Table 2: Distribution of participants by monthly income levels (n=90)

Monthly Income	Frequency	Percentage
<10,000	11	12.22%
10,000-25,000	48	53.33%
>25,000	31	34.44%

The monthly family income of the families was between 10,000 to 25,000 BDT for majority (53.33%) of the participants, while 34.44% had earned more than 25,000 per month, and 12.22% earned less than 10,000 per month.

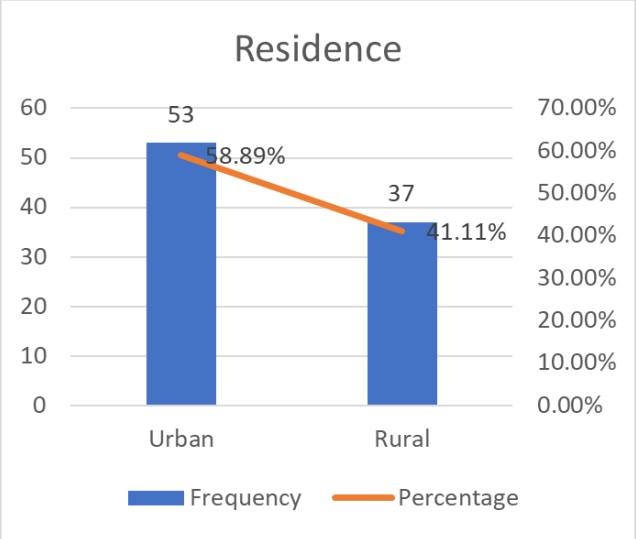

Figure 2: Distribution of participants by place of residence (n=90)

Over half the study participants (58.89%) had been from urban areas, while 41.11% had been from rural areas.

Table 3: Distribution of the male participants by circumcision status (n=33)

Age	Circumcision Status				P-Value
	Not Done		Done		
	Frequency	Percentage	Frequency	Percentage	
<12 months	2	6.06%	0	0.00%	<0.05
12-24 months	13	39.39%	0	0.00%	
>24 months	7	21.21%	11	33.33%	
Total	22	66.67%	11	33.33%	

Among the 33 participants, 66.67% had not had their circumcision done, while the remaining 33.33% had their circumcision. It was observed that prevalence of UTI was significantly higher among males who did not have their circumcision done.

Table 4: Distribution of presenting symptoms among the participants (n=90)

Symptoms	Frequency	Percentage
Fever	79	87.78%
Dysuria	22	24.44%
Crying during urination	15	16.67%
Anorexia	31	34.44%
Flank Pain	29	32.22%
Frequent Micturition	15	16.67%
Vomiting	72	80.00%
Malodourous Urine	24	26.67%

Symptoms	Frequency	Percentage
Poor appetite	31	34.44%
Diarrhea	20	22.22%
Swelling Leg	2	2.22%
Convulsion	18	20.00%
Supra Public Discomfort	22	24.44%

Fever and vomiting were the most common symptoms observed among the present study participants, in 87.78% and 80% respectively. The remaining symptoms did not have such high prevalence, but anorexia and poor appetite were observed in 34.44% of participants each, 32.22% had flank pain, 22.22% had diarrhea, 24.44% had dysuria and another 24.44% had supra public discomfort, while 20% had convulsion. Some other symptoms were also observed in smaller frequencies.

Table 3: Distribution of participants by laboratory findings (n=90)

laboratory Findings	Frequency	Percentage
WBC		
<11,000	46	51.11%
≥11,000	44	48.89%
Neutrophil Count		
<60	35	38.89%
≥60	55	61.11%
Hemoglobin %		
<10	44	48.89%
≥10	46	51.11%
ESR mm/hr		
<20	18	20.00%
≥20	72	80.00%
CRP		
<6	4	4.44%
≥6	86	95.56%

Laboratory findings of the participants revealed that white blood count was above normal range for 48.89% of the participants, while neutrophil count was 60 or higher for 61.11% of the participants. 48.89% of the participants had hemoglobin <10%, 80% had ESR of 20 or above mm/hr, and 95.56% had CRP levels of 6 or higher.

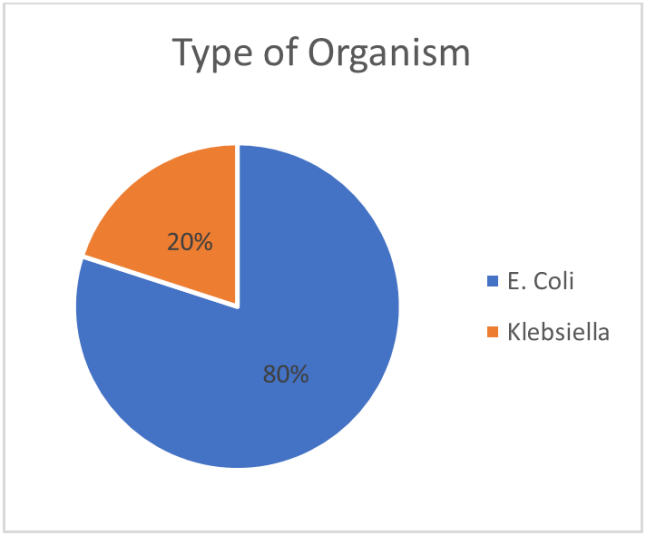

Figure 3: Distribution of participants by type of cultured organisms (n=90)

80% of the participant had E. coli infection, while the remaining 20% had klebsiella infection.

Table 4: Sensitivity and resistance rate of different cultured organisms by different antibiotics (n=90)

Antibiotic	E. Coli (n=72)		Klebsiella (n=18)	
	Resistant	Sensitive	Resistant	Sensitive
Ampicillin	78.8	21.2	75	25
Amoxiclav	72.7	27.3	87.5	12.5
Cotrimoxazole	78.8	21.2	87.5	12.5
Cephalexin	81.8	18.2	87.5	12.5
Gentamicin	24.2	75.8	37.5	62.5
Nalidixic Acid	36.4	63.6	12.5	87.5
Ceftazidime	33.3	66.7	25	75
Ceftizoxime	72.7	27.3	12.5	87.5
Ceftriaxone	24.2	75.8	12.5	87.5
Cefuroxime	27.3	72.7	0	100
Cefixime	57.6	42.4	25	75
Nitrofurantoin	9.1	90.9	0	100
Amikacin	0	100	0	100
Ciprofloxacin	51.5	48.5	75	25
Levofloxacin	57.6	42.4	100	0
Netilmicin	12.1	87.9	12.5	87.5
Meropenem	0	100	0	100
Imipenem	3	97	12.5	87.5

Against the different types of antibiotics, E. coli had high resistance (>60%) against ampicillin, amoxclay, cotrimoxazole, cephalexin, and ceftizoxime, while had high sensitivity (60%) against gentamicin, naldixic acid, ceftazidime, ceftriaxone, cefuroxime, nitrofurantoin, amikacin, netilmicin, meropenem and imipenem. Among these antibiotics, E. coli had 100% sensitivity against amikacin and meropenem, while klebsiella had 100% sensitivity to cefuroxime, nitrofurantoin, amikacin, and meropenem.

DISCUSSION

There was a female majority among the 90 children brought to the hospital for UTI, with a male: female ratio of 1:1.73. This high proportion of female participants was consistent with the findings of other studies, in which the proportion of girls was 8 times higher than that of boys [11-15]. According to several additional researches, urinary tract infection is more common in females than in males, regardless of age [16, 17]. The other demographic findings of this study, such as monthly income, domicile, and age, were similar with prior studies [2, 18] A large percentage of the 33 male participants in our study had not been circumcised, while just roughly 33.33 percent had been circumcised. This leads to the conclusion that being uncircumcised is a risk factor for UTI, and circumcision reduces the risk of UTI in young children, which is supported by a number of other factors [19-21]. UTI is clinically defined by any or all of the following symptoms: abdomen or flank discomfort, fever, lethargy, nausea, vomiting, constipation, and, in rare cases, diarrhea. Nonspecific symptoms may include poor feeding, irritability, and weight loss [2]. In the current study, UTI was most usually associated with fever, followed by vomiting, anorexia, and other symptoms. Dysuria, weeping during urination, failure to thrive, diarrhea, and other symptoms were less common in the current study than in previous investigations [2]. Although enuresis is a common symptom of children UTI. However, in the current investigation, this was not identified in any of the study populations. This could be owing to the study's inclusion of 5-year-old youngsters. Because the majority of these children have physiological enuresis, no significant correlation with UTI was detected. The average WBC count was 12,190 * 6976 thousands/mm^3, with the range being 11000 to 30000/mm^3. More than half of the patients showed neutrophilic leukocytosis, and 95% had CRP levels greater than 6 mg/L. The organisms cultivated from urine in this investigation revealed that E. coli was the most commonly cultured organism, followed by Klebsiella spp. Klebsiella pneumonia is more common in children under the age of two, but E. Coli was mostly cultured in the urine of female children. Due to the high frequency of female participants among the current study participants, there was a high incidence of E. Coli. These findings were also consistent with earlier research that found a significant prevalence of E. Coli [13, 22]. The growth of resistant bacteria is a major issue in UTI treatment. Isolation of fluoroquinolone-resistant E. coli from UTI patients is recognized as a severe treatment concern in Japan [23]. In the current study, E. coli demonstrated 78.8 percent, cotrimoxazole resistance, and cephalexin resistance, respectively: In various investigations of Canada, Europe, Africa, Turkey, Spain, Taiwan, and Israel, the majority of identified pathogens were resistant to ampicillin and cotrimoxazole [22-25]. The current study results showed that amikacin, nitrofurantoin, and meropenem had the best activity against &. coli, followed by third-generation cephalosporins, which was consistent with

the findings of earlier studies [26, 27]. Klebsiella spp. had a varying antibiotic resistance and showed higher resistance to ampicillin (75%), cotrimoxazole (87.5%), and cephalexin (87.5%) and showed lowest resistance to amikacin (0%) nitrofurantoin (0%), and meropenem (0%). Yüksel *et al.*, reported a low rate of resistance of Klebsiella spp. against amikacin (50%) and ciprofoxacin (50%), and a higher level of resistance against ampicillin (82%) [27]. Sensitivity of Klebsiella spp. to cotrimoxazole in the present study was 12.5%, while other studies reported 65% - 75% sensitivity to this antibiotic, which might be due to uncontrolled administration of the drug [22-27]. When compared to Mortazavi and Shahin *et al.*, 2009. 's study, resistance to ampicillin had grown and resistance to gentamicin, nalidixic acid, ceftazidime, and cefixime had reduced, while resistance to other antibiotics had remained same [28]. Also, Klebsiella spp. demonstrated 100 percent antibacterial sensitivity to amikacin and nitrofurantoin, which was an improvement to the findings of Muratani *et al.*, [23].

Limitations of the Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community. There is a need for large longitudinal national studies to determine prevalence, demographic characteristics, possible etiology, and antibiotic resistance.

CONCLUSION

The proportion of urinary tract infection in females was higher than males. Most patients presented with more than one symptom but most commonly presented with fever. E. coli was the most common isolated bacteria in hospitalized children with a principal diagnosis of UTI. Most of the isolated pathogens were highly resistant to ampicillin, cotrimoxazole, and highly sensitivity to amikacin, nitrofurantoin and meropenem.

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Conflict of Interest: None declared.

Ethical Approval: The study was approved by the Institutional Ethics Committee.

RECOMMENDATION

Further large scale, multi-centered study would better to generalize the results of the current study.

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