Demography, Symptom and Antibiotic Sensitivity Pattern of Urinary Tract Infection in Hospitalized Children: A Cross-Sectional Observation in Bangladesh

Nayeema Sadia[1]*, Md Sarwar Ferdaus[2], Shams Ibne Maksud[3] and Sarwar Mahboob[4]

[1]Assistant Professor, Department of Paediatrics, Uttara Adhunik Medical College, Dhaka, Bangladesh
[2]Professor, Department of Paediatrics, Uttara Adhunik Medical College, Dhaka, Bangladesh
[3]Assistant Professor, Department of Paediatrics, Nightingale Medical College and Hospital, Bangladesh
[4]Cox's Bazar, Sadar Hospital, Cox's Bazar, Bangladesh

*Corresponding Author: Nayeema Sadia, Assistant Professor, Department of Paediatrics, Uttara Adhunik Medical College, Dhaka, Bangladesh.

Abstract

Background: 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: The cross-sectional observation was conducted from August 2012 to February 2013 in a tertiary care hospital in Dhaka city. A total 41 Children of up to 5 years of age with UTI were included in the study after taking written informed consent. Then thorough history was taken to evaluate demographic characteristics and detail physical examination and investigations was done to see clinical parameters.

Results: The mean age of patients was 33.17 ± 19.53 months. The male to female ratio was 1:1.73. Fever was the commonest presenting symptom in (87.8%) children, and other common symptoms included vomiting (80.5%), anorexia (34.1%), poor feeding (34.1%), flank pain (31.7%), malodour urine (26.8%), dysuria (24.4%), suprapubic discomfort (24.4%), convulsion (19.5%). More than fifty percent of patients had neutrophilic leukocytosis. Ultrasonographic findings were abnormal in 31% patient. The commonest organism cultured in this study was *E. coli* 33 (80.5%) followed by *Klebsiella* spp. 8 (19.5%). Isolated pathogens were and 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%), Amoxyclav (72.7% - 87.5%) and Cephalexin (81.1% - 87.5%).

Conclusion: UTI is more common in girls and fever is the most common presentation, *E. coli* spp is the prime cause and highly sensitive to Nitrofurantoin, Meropenem and Amikacin. Further large scale, mulicentered study would help better to generalize the results.

Keywords: *UTI; Antibiotic Resistance; Antibiotic Sensitivity; Bangladesh; Children*

Background

Urinary tract infection (UTI) is the third most common serious bacterial infection during infancy and childhood as well as it has been considered an important risk factor for the development of progressive renal disease and long-term complications [1]. The prevalence

Demography, Symptom and Antibiotic Sensitivity Pattern of Urinary Tract Infection in Hospitalized Children: A Cross-Sectional Observation in Bangladesh

458

of UTI varies with the age as well as the gender of the children. During the first year of life, the male to female ratio range is 2.8 - 5.4:1. UTI in male child mostly occur during the first year of life, much more commonly in uncircumcised boys. But, beyond 1 - 2 years, there is a striking female preponderance with a 1:10 male to female ratio [2]. It is an important differential when a child is evaluated for fever. High grade fever such as temperature 39°C or more is associated with an increased risk of UTI. It is hypothesized that UTI is caused by an ascending infection via the urethra [3]. Colonic bacteria, especially *Enterobacteriaceae*, are the commonest organisms isolated from children with uncomplicated UTI. Infection with *Staphylococcus aureus* was thought to be rare in children without indwelling catheters or other sources of infection. However, recent Nigerian studies had observed it as a common cause of UTI in otherwise well children [4]. *Escherichia coli* spp corresponds with 75% - 90% of all UTIs, followed by *Klebsiella* spp and *Proteus* spp species in females, but previous reports have showed that *Proteus* spp is as common as *E. coli* in UTIs of males aged > 1 year, *Staphylococcus saprophyticus* and *Enterococcus* spp are causative pathogens in both sexes [2]. The diagnosis of UTI in young children is important as it can be a marker for urinary tract abnormalities and in the newborn; may be associated with bacteremia. Early diagnosis is critical to preserve renal function of the growing kidney as well as delay in initiation of the antibacterial therapy is associated with an increased risk of renal scarring, hypertension, and progression to end-stage kidney disease [3]. Antibiotic therapy which is the mainstay of treatment is dependent on a number of factors such as the predominant pathogens in the patient's age group, antibacterial sensitivity patterns in the practice area, the clinical status of the patient, the opportunity for close follow-up and of course, cost of treatment [5]. Most of these children receive empirical antibiotic therapy before revealing the causative pathogen and antimicrobial sensitivity and resistance report [6]. Recently, it has been demonstrated that extremely high resistance to Trimethoprim, Ampicillin, and Cephalosporins, rendering them unsuitable for empirical use and intermediate sensitivity to 3rd generation cephalosporin and highly sensitive to Ciprofloxacin (84.4%), Amikacin (83.8%) and Nitrofurantoin (82.8%) [7]. Increasing resistance of bacterial pathogens is of worldwide concern that is varied in different regions and even countries. Such reports showed that continued surveillance and investigation of other oral agents for treatment of UTI in the community is required [2]. Bangladesh is densely populated poor developing country with a literacy rate of about 61.0% among the age of 15 years and above; with significant achievement in health related Millennium Development Goals (MDGs) with noticeable Gross Domestic Product (GDP) growth [8-10]. Unfortunately antibiotics are being prescribed very randomly even by the pharmacy men without adequate supervision. So, the present study is aimed to evaluate demographic characteristics, clinical factors that are associated with the likelihood of UTI and to see the sensitivity of organism.

Methods

The cross-sectional observation was conducted from August 2012 to February 2013 in the inpatient department of Uttara Adhunik Medical College and Hospital (UAMCH), Dhaka. A total 41 Children of 1 month to 5 years of age with UTI admitted in Department of Pediatrics were included in the study after taking written informed consent and fulfilling the eligibility criteria. The culture positive UTI children were included in the study by purposive consecutive sampling. A structured data collection form was developed containing all the variables of interest which was finalized following pretesting. Data were collected from parents by face to face interview, observation and details clinical examination of patients and analysis of necessary investigations records. Each of the questionnaires was sorted for consistency and completeness. Then the cleaned data were coded and entered into the computer with the assistance of Statistical package for Social Science (SPSS) version 16.

Inclusion Criteria:

1. Children from 1 month up to 5 years of age diagnosed as UTI with urine Culture Sensitivity (C/S) positive
2. Children of either sex diagnosed as UTI.
3. Parents of children gave consent willingly.

Demography, Symptom and Antibiotic Sensitivity Pattern of Urinary Tract Infection in Hospitalized Children: A Cross-Sectional Observation in Bangladesh

459

Exclusion Criteria:

1. Critically ill children with other systemic illness.

2. Patients with UTI with other chronic illness.

3. Patients who received antibiotic prior to admission.

4. Children with congenital anomaly.

Variables studied:

The demographic variables age, sex, parents education, occupation, income were included in the study with Clinical variables fever, dysuria ,anorexia, flank pain, vomiting, poor feeding, constipation, convulsion, suprapubic discomfort were considered. Hematological variables Complete Blood Count (CBC), Erythrocyte Sedimentation Rate (ESR) with Biochemical variables C - reactive protein (CRP) and Radiological variables Ultrasonogram (USG) were considered.

Ethical Consideration

The researchers were properly concerned about the ethical issues relate to the study. Formal ethical clearance was taken from Ethical Review Committee, of UAMCH, to conduct this study. Participation was fully volunteered and informed written consent was taken from the parents. Keeping compliance with Helsinki Declaration for Medical Research Involving Human Subjects 1964, parents of the study subjects were informed verbally about the study design, the purpose of the study and right for withdrawing their children from the project at any time, for any reason, what so ever. Confidentiality of the persons and the information was maintained and observed and unauthorized persons did not have any access to the collected data.

Results

The mean age of the children was 2.76 years with SD of ± 1.63. 43.9% (18) respondents were under 2 years of old and 56.1% (23) were from 2-5 years of age, 15 (36.6%) were male and 26 were female (63.4%) (Table 1). There is a female preponderance with a male: female ratio of 1:1.73. Mean monthly income of the family was BDT 28219.51 with BDT ± 16154.740; majority of family have an income between taka 10000.00-25000.00.

Demographic Variables			
Gender	Gender	Frequency	Percent
	Male	15	36.6
	Female	26	63.4
Age	Age in Years	Frequency	Percent
	Below 2	18	43.9
	2 - 5 years	23	56.1
Income	Income (BDT)	Frequency	Percent
	< 10000	5	12.2
	10000 - 25000	22	53.7
	> 25000	14	34.1
Housing Status	Housing Status	Frequency	Percent
	Pacca	24	58.5
	Semipacca	17	41.5

Table 1: *Distribution of demographic variables among the respondents (n = 41).*

Demography, Symptom and Antibiotic Sensitivity Pattern of Urinary Tract Infection in Hospitalized Children: A Cross-Sectional Observation in Bangladesh

460

In majority of male child circumcision was not done 10 (70%), and the pattern indicates that UTI was common in uncircumscribed boys. Chi-square test done and showed significant (P value < 0.05) (Table 2).

Age	Circumcision done		P value
	No	Yes	
< 12 months	1	0	0.038
12 - 24 months	6	0	
> 24 months	3	5	
Total	10	5	

Table 2: *Circumcision status in male child.*

Fever was the most common presenting symptom and it was found in 36 (87.8%) children. In < 2 years age group, out of 7 male 6 had fever, andout of 11 female all had fever. In 2-5 years age group out of 8 male all, had fever, and out of 15 female, 11 had fever. Other common symptoms included dysuria 10 (24%); out of 15 male 4 had dysuria, and out of 26 female 6 had dysuria Vomiting 33 (80.5%); out of 15 male 12 had vomiting and out of 26 female 21 had vomiting. Anorexia was present in 34.1% study population, poor feeding (34.1%), flank pain (31.7%), malodour urine (26.8%), constipation (20%), voiding dysfunction (12%) (Table 3).

Symptoms	Frequency	Percentage
Fever	36	87.8
Dysuria	10	24.4
Crying during urination	7	17.1
Failure to thrive	1	2.4
Anorexia	14	34.1
Flank pain	13	31.7
Frequency of micturation	7	17.1
Vomiting	33	80.5
Malodourous urine	11	26.8
Poor feeding	14	34.1
Diarrhoea	9	22.0
Body/Leg swelling	1	2.4
Convulsion	8	19.5
Supra pubic discomfort	10	24.4

Table 3: *Distribution of Symptoms among the respondents (n = 41).*

Out of 41, 25 had neutrophil count > 60%, 33 had raised ESR >20, 39 patient had high CRP > 6 (Table 4).

Demography, Symptom and Antibiotic Sensitivity Pattern of Urinary Tract Infection in Hospitalized Children: A Cross-Sectional Observation in Bangladesh

461

Laboratory findings	Male		Female		P- value
Total count of WBC /mm³	< 2	2 - 5	< 2	2 - 5	
< 11000	4	5	4	8	0.352
> 11000	3	7	3	7	0.510
Neutrophil count					
< 60	3	2	4	7	0.583
> 60	4	6	7	8	0.290
Haemoglobin %					
< 10	4	4	6	6	0.648
> 10	3	4	5	9	0.490
ESR mm/hour					
< 20	0	2	4	2	0.108
> 20	7	6	7	13	0.456
CRP					
< 6	0	0	0	2	
> 6	7	11	8	13	0.415

Table 4: Distribution of Laboratory findings in the respondents (n = 41).

The commonest organism cultured in this study is *E. coli* 33 (80.5%) followed by *Klebsiella* spp 8 (19.5%) (Figure 1).
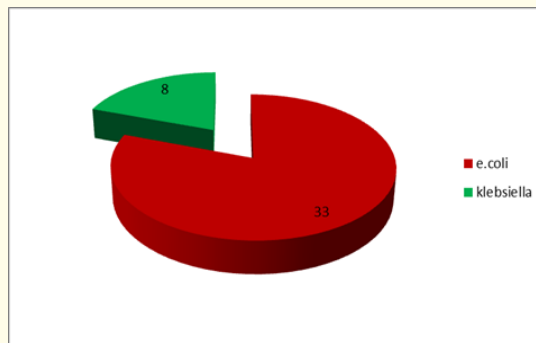

Figure 1: Distribution of Organisms cultured from the urine among the respondents (n = 41).

Isolated pathogens *E. coli* and *Klebsiella* spp were highly resistant to Ampicillin (78.8%, 75.0%), Amoxyclav (72.7%, 87.5%), Cotrimoxazole (78.8%, 87.5%) and Cephalexin (81.1%, 87.5%), and highly sensitive to Amikacin(100.0%), Meropenem (100.0%), Imipenem (97.0%, 87.5%) and Nitrofurantoin (90.9% ,100.0%) (Table 5).

Citation: Nayeema Sadia., *et al.* "Demography, Symptom and Antibiotic Sensitivity Pattern of Urinary Tract Infection in Hospitalized Children: A Cross-Sectional Observation in Bangladesh". *EC Paediatrics* 3.5 (2017): 457-464.

Demography, Symptom and Antibiotic Sensitivity Pattern of Urinary Tract Infection in Hospitalized Children: A Cross-Sectional Observation in Bangladesh

462

Antibiotic	Escherichia coli		Klebsiella spp	
	Resistant	Sensitive	Resistant	Sensitive
Ampicillin	78.8	21.2	75.0	25.0
Amoxyclav	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	25.0	75.0
Ceftizoxime	72.7	24.3	12.5	87.5
Ceftriaxone	24.2	75.8	12.5	87.5
Cefuroxime	27.3	72.7	0.0	100.0
Cefixime	57.6	42.4	25.0	75.0
Nitrofurantoin	9.1	90.9	0.0	100.0
Amikacin	0.0	100.0	0.0	100.0
Ciprofloxacin	51.5	48.5	75.0	25.0
Levofloxine	57.6	42.4	100.0	0.0
Netilmicine	12.1	87.9	12.5	87.5
Meropenem	0.0	100.0	0.0	100.0
Imipenem	3.0	97.0	12.5	87.5

Table 5: *Distribution of Antibiotic Resistance and Sensitivity Pattern.*

Discussion

Among the 41 children admitted in hospital for UTI, there was a female preponderance with a male: female ratio of 1:1.73 which is in aligned with the other study results where incidence rate in girls was 8 times as high as in boys and male to female ratio has been reported as 1:2.8 [11-13] (Table 1). The other Demographic findings of this study were consistent with other studies [2,12]. Among male child (15) of the study population circumcision was not done in majority of patient (70%) and significant association was found (Table 2).

Clinically UTI is characterized by any or all of the following: abdominal or flank pain, fever, malaise, nausea, vomiting, constipation and, occasionally, diarrhea and Infant may show nonspecific symptoms such as poor feeding, irritability, and weight loss [2]. In the present study, UTI clinically presented most commonly with fever followed by vomiting, anorexia, and others (table 3). Dysuria, crying at time of urination, failure to thrive, diarrhea, were not as frequent as reported before [2]. Although eneuresis is also a frequent presentation of childhood UTI .But in the present study this was not found in any of study population. This may be due to inclusion of < 5 years old children in the study .Because these group of children mostly have physiological eneuresis and therefore significant co- relation with UTI was not found.

The mean WBC count was 12,190 ± 6976 thousands/mm^3 (range 1100 - 30000/mm3). More than fifty percent of patients had neutrophilic leukocytosis, 95% had raised CRP > 6 mg /L (Table 4).

In this study the organisms cultured from the urine showed that the commonest organisms cultured was *E. coli* followed by *Klebsiella* spp (Figure 1). *Klebsiella pneumoniae* is more common among children less than 2 years old, while *E. coli* was predominantly cultured in

Demography, Symptom and Antibiotic Sensitivity Pattern of Urinary Tract Infection in Hospitalized Children: A Cross-Sectional Observation in Bangladesh

463

the urine of female children. This finding was similar other studies [13], that was 77% and also to Mathai., *et al*. 2001 study findings [14]. The emergence of resistant bacteria is a significant problem in UTI chemotherapy. In Japan, isolation of fluoroquinolone-resistant *E. coli* from patients with UTI is reported as a serious therapeutic problem [15]. In the present study, *E. coli* showed 78.8%, and 81.8% resistance to ampicillin, cotrimoxazole, and cephalexin, respectively. In most studies in Canada, Europe, Africa, Turkey, Spain, Taiwan, and Israel, the majority of isolated pathogens were resistant to ampicillin and cotrimoxazole [14-17]. The present study results showed that the best activity against *E. coli* was achieved with amikacin, nitrofurantoin, and meropenem followed by third-generation cephalosporins which is consistent with other studies [18,19]. *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%). Yuksel reported a low rate of resistance of *Klebsiella* spp against amikacin (50%) and ciprofloxacin (50%), and a higher level of resistance against ampicillin (82%). Sensitivity of *Klebsiella* spp to cotrimoxazole in the present study was 12.5%, while other studies reported 65% - 75% sensitivity to this antibiotic due to uncontrolled administration of the drug [14-19]. Comparing the present study with a recent study by Mortazavi and Shahin, in East Azerbaijan, demographic characteristics and prevalence of bacterial causes of UTI did not change [20]. Comparing the antibacterial resistance of *E. coli* to Mortazavi and Shahin's study, resistance to ampicillin increased and resistance to gentamicin, nalidixic acid, ceftazidime, and cefixime decreased but remained unchanged against other antibiotics [20]. Also, *Klebsiella* spp showed increased antibacterial resistance against nalidixic acid, cefixime, and cotrimoxazole, and decreased resistance to amikacin and nitrofurantoin [15]. Finally, the present study is a small and results show that there is a need for large longitudinal national studies to determine prevalence, demographic characteristics, possible etiology, and antibiotic resistance. The present study has also evaluated the pattern of antibiotic resistance among hospitalized children with diagnosis of UTI, which provides important information concerning this region.

Conclusion

The proportion of UTI in females is higher than males. Most patients presented with more than one symptom but most commonly presented with fever. *E. coli* is the most common isolated bacteria in hospitalized children with a principal diagnosis of UTI. Most of the isolated pathogens are highly resistant to ampicillin, cotrimoxazole, and highly sensitivity to amikacin, nitrofurantoin and meropenem. Further large scale, multi centred study would better to generalize the results of the current study.

Acknowledgement

Funding

Conflict of Interest

None.

Bibliography

1. Christensen A and Shaw KN. "Urinary tract infection in childhood". In: Laplan BS, Meyers KE, eds. Pediatric Nephrology and Urology: The Requisites in Pediatrics. Philadelphia: Elsevier Mosby (2004): 214-219.

2. Elder JS. "Urinary tract infections". In: Kliegman RM, Behrman RE, Jenson HB, Stanton B, editors. Nelson Textbook of Pediatrics. 18th ed. Philadelphia: Saunders Elsevier 2 (2007): 1655-1671.

3. Owa JA. "Urinary tract infections in children". In: Azubuike JC, Nkangineme KE, editors. Paediatrics and Child Health in a Tropical Region. Owerri: African Educational Services (1999): 326-330.

Demography, Symptom and Antibiotic Sensitivity Pattern of Urinary Tract Infection in Hospitalized Children: A Cross-Sectional Observation in Bangladesh

464

4. Musa-Aisien AS., *et al*. "Prevalence and antimicrobial sensitivity pattern in urinary tract infection in febrile under-5s at a children's emergency unit in Nigeria". *Annals of Tropical Paediatrics* 23.1 (2003): 39-45.

5. Ibadin OM and Abiodun PO. "Urinary tract infection in children with acute nephritic syndrome". *Nigerian Medical Practitioner* 45 (2004): 5-6.

6. Lutter SA., *et al*. "Antibiotic resistance patterns in children hospitalized for urinary tract infections". *Archives of Pediatrics and Adolescent Medicine* 159.10 (2005): 924-928.

7. Farrell DJ., *et al*. "A UK multicentre study of the antimicrobial susceptibility of bacterial pathogens causing urinary tract infection". *Journal of Infection* 46.2 (2003): 94-100.

8. Arafat SMY. "Anti-Ulcerants: The Driving Force of the Pharma Market of Bangladesh". *International Journal of Perceptions in Public Health* 1.1 (2016): 1-2.

9. Uddin MS., *et al*. "Does Mind Exist in Physician's Mind? A Brief Phone Survey in Bangladesh". *International Journal of Neurorehabilitation* 3 (2016): 234.

10. Arafat SMY. "Doctor Patient Relationship: an Untouched Issue in Bangladesh". *International Journal of Psychiatry* 1.1 (2016): 2.

11. Schlager TA. "Urinary tract I,nfections in children younger than 5 years of age: epidemiology, diagnosis, treatment, outcomes and prevention". *Paediatric Drugs* 3.3 (2001): 219-227.

12. Dutta P. "Paediatric nursing". New Delhi: Jaypee Brothers Publications (2007): 361.

13. Raya SHM. "Prevalence of urinary tract infection among children of primary schools in Nablus". Public Health Science Research Dissertation (2009).

14. Mathai D., *et al*. "Epidemiology and frequency of resistance among pathogens causing urinary tract infections in 1,510 hospitalized patients: a report from the SENTRY Antimicrobial Surveillance Program (North America)". *Diagnostic Microbiology and Infectious Disease* 40.3 (2001): 129-136.

15. Muratani T and Matsumoto T. "Bacterial resistance to antimicrobials in urinary isolates". *International Journal of Antimicrobial Agents* 24.1 (2004): S28-S31.

16. Ziaaedin G., *et al*. "Demographic features and antibiotic resistance among children hospitalized for urinary tract infection in northwest Iran". *Infection and Drug Resistance* 4 (2011): 171-176.

17. Oladeinde HB., *et al*. "Urinary tract infection in a rural community of Nigeria". *North American Journal of Medical Sciences* 3.2 (2011): 75-77.

18. Turnidge J., *et al*. "Pathogen occurrence and antimicrobial resistance trends among urinary tract infection isolates in the Asia-Western Pacific Region: report from the SENTRY Antimicrobial Surveillance Program, 1998–1999". *International Journal of Antimicrobial Agents* 20.1 (2002): 10-17.

19. Yuksel S., *et al*. "Antibiotic resistance of urinary tract pathogens and evaluation of empirical treatment in Turkish children with urinary tract infections". *International Journal of Antimicrobial Agents* 28.5 (2006): 413-416.

20. Mortazavi F and Shahin N. "Changing patterns in sensitivity of bacterial uropathogens to antibiotics in children". *Pakistan Journal of Medical Sciences* 25.5 (2009): 801-805.