Bacterial Agents and Their Antibiotic Susceptibility in Urinary Tract Infection (UTI) of Pediatric Age Group

Mohd Rafiq Lone*[1], Nisar Ahmad Ganie[1], Mohsin Rashid[1], Syed Muneeb Mohammad[1], Javid Ahmad[1], Nazir Ahmad Parray[2]

[1]*Senior Resident, Department of Pediatrics, SKIMS Medical College Bemina Srinagar*

[1]*Senior Resident, Department of Pediatrics, SKIMS Medical College Bemina Srinagar*

[1]*Senior Resident, Department of Pediatrics, SKIMS Medical College Bemina Srinagar*

[1]*Senior Resident, Department of Pediatrics, SKIMS Medical College Bemina Srinagar*

[1]*Senior Resident, Department of Pediatrics, SKIMS Medical College Bemina Srinagar*

[2]*Lecturer, Department of Pediatrics, SKIMS Medical College Bemina Srinagar*

ABSTRACT

Background: Urinary tract infections (UTIs) account for one of the common cause of hospital visits and therefore determination of the antimicrobial susceptibility patterns of uropathogens will help guide physicians to choice the best choice of antibiotics to affected patients. The aim of this study was to isolate the bacteriological agent causing the urinary tract infection and determination of their susceptibility to antibiotics.

Methods: Our study was hospital based prospective study in which patients suspected of UTI were admitted and urine sample were collected using 'urinary catheter' method in patients less than 3 years of age, while for older children 'mid stream clean catch' method was used. Cultures were bacteriologically analyzed using standard microbiological procedures and antimicrobial susceptibility test was performed for the isolated pathogens.

Results: 208 patients with suspected UTI were included in study, out of 208 patients, urine cultures were taken from all patients, 38 cultures (18.2%) were reported as positive. The most common pathogens isolated were Escherichia coli 27 (71%), Klebsiella Species 6 (15%), Enterococcussps 3(7.8%), Proteus sps 1(2.6%), Pseudomonas aeruginosa 1(2.6%). E. coli and Klebsiella showed the highest percentage of resistance to amoxicillin and ampicillin (100%) however, all isolates of E. coli and Klebsiella were susceptible to Nitofurantoin. Among all UTI isolates, least resistance was observed against drugs such as ceftriaxone, cefixime ciproflaxacilin and gentamicin.

Conclusion: The finding of our study showed that E. Coli was the most common uropathogen and there was high resistance to routinely used drugs in clinical practice. So it high time to change the empirical therapy from conventional drugs like ampicillin and amoxicillin to drugs like nitrofurantoin or ciprofloxacilin.

Keywords: Urinary tract infection, urine culture, antibiotic susceptibility.

*Corresponding Author.

†Email: drrafiqlone@gmail.com.

1 INTRODUCTION

Urinary tract infections (UTIs) are one of the common infection encountered by the clinicians worldwide especially in developing countries were the annual incidence is as high as 250 million[1,2]. UTIs are defined as the presence of pathogens within the urinary tract, it comprises of urethra (urethritis), bladder (cystitis) and kidneys (pyelonephritis).UTIs are classified into symptomatic or asymptomatic depending upon presence or absence of clinical features of UTI.It is further divided into uncomplicated that occur in a normal genitourinary tract with no prior instrumentation, whereas complicated infections are diagnosed in genitourinary tracts that have structural or functional abnormalities, including instrumentation such as indwelling urethral catheters[3,4].

It has been estimated that globally symptomatic UTIs result in as many as 7 million visits to outpatient clinics, 1 million visits to emergency departments, and 100,000 hospitalizations annually [5]. Many different microorganisms are responsible for UTIs but most common pathogen remains the E Coli and other members of enterobacteriacae family which together account for approximately 80% of total UTI burden worldwide. Complicated urinary tract infections are mainly due to organisms such as Enterococcus faecalis and Pseudomonas spp.

Empirically therapy of UTI is based on information determined from the antimicrobial resistance pattern of the urinary pathogens [5]. However, erratic use of antibiotics has lead to the emergence of resistant bacterial infections [6-9]. As a result, the prevalence of antimicrobial resistance among urinary pathogens has been increasing worldwide. Resistance rates to the most common prescribed drugs used for the treatment of UTIs vary considerably in different areas world-wide, so the estimation of local etiology and susceptibility profile could support the most effective empirical treatment [10]. Thus, the aim of our study was to determine bacterial uropathogens and evaluate their susceptibility pattern to commonly used drugs.

2 MATERIAL AND METHODS

This study was hospital based prospective study conducted in a tertiary care hospital of North India, in which patients suspected of UTI were admitted and urine sample were collected using 'urinary catheter' method in patients less than 3 years of age, while for older children 'mid stream clean catch' samples were collected in a wide mouth sterile container. The study subjects who had not received antimicrobials within the previous fifteen days were included. Cultures were bacteriologically analyzed using standard microbiological procedures and antimicrobial susceptibility test was performed for the isolated pathogens.

Uropathogen isolation

Isolation of uropathogens was done by a surface streak procedure on both blood and MacConkey agar (Oxoid, Basingstoke Hampshire, England) using calibrated loops for semi-quantitative method and incubated aerobically at 37 °C for 24 hours, and those cultures which becomes negative at the end of 24 hrs incubations were further incubated for 48 hours. A specimen was considered positive for UTI if a single microorganism was cultured at a concentration of $\geq 10^5$ colony forming units per ml. Identification of bacteria was made by using biochemical tests, which included catalase, coagulase, citrate, indole, H2S production, lactose fermentation, oxidase, hydrolysis of urea, novobiocin susceptibility and mannitol fermentation [6].

Susceptibility Methods

The antimicrobial susceptibility test was carried out by the Kirby–Bauer disc diffusion method as per Clinical Laboratory Standards Institute

(CLSI—formerly NCCLS) guidelines on Mueller–Hinton agar (Oxoid, Basingstoke, Hampshire, England)(13). The antibiotic discs and their concentrations were: Amoxicillin (AMX, 10μg), Ampicillin (AMP, 10μg), Tetracycline (TE, 30μg), Clindamycin (CL, 2μg), Chloramphenicol (CP, 30μg), Ciprofloxacin (CIP, 5μg), Trimethoprim+Sulphamethazole (SXT, 25μg), Ceftriaxone (CTX, 30μg), Gentamicin (GN, 10μg), Nalidixic acid (NA, 30μg), and Nitrofurantoin (F, 300μg). A standard inoculum adjusted to 0.5 McFarland was swabbed on to Muller-Hinton agar (Oxoid, Basingstoke, Hampshire, England), antibiotic discs were dispensed after drying the plate for 3–5 min and incubated at 37°C for 24 hours.

Reference strains used as controls were *S. aureus* ATCC 25923, *E. coli* ATCC 25922, and *P. aeruginosa* ATCC 27853. Data was analyzed by using SPSS version 17. Discrete variables were expressed as percentages and proportions were compared using the Chi-square test. *P* values less than 0.05 were taken as statistically significant when looking for associations between dependent and independent variable.

3   RESULTS

In this study there were 208 patients, 112 males and 96 females from whom urine cultures were taken. Cultures from 38 (18.2%) patients came positive 16(7.6%) males and 22(10.7%) females, indicating that there is female predominance in urinary tract infection among pediatric age group. [Figure 1]
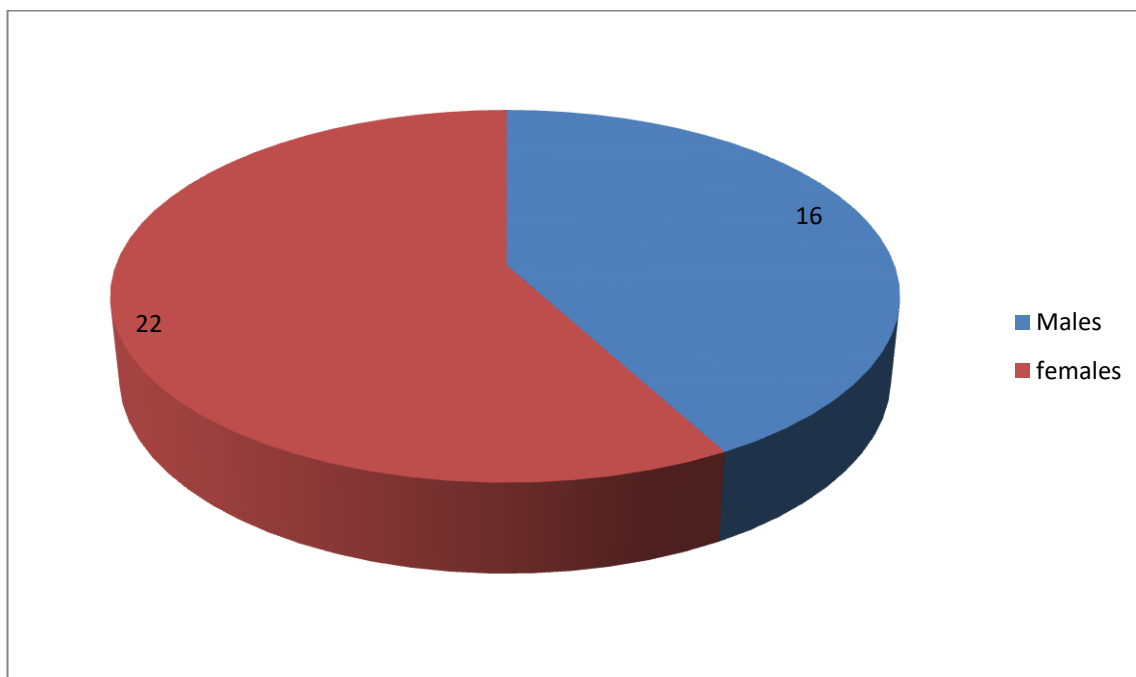

Figure 1. Distribution of UTI as per sex of patients

Most common age group affected was less than 3 years, 23(60.5%) cultures out of 38 came positive in this age group [**Table 1**]

Table 1. Distribution of UTI as per Age of patients

Age	Culture positive Males	Culture positive Females	Total culture positive	Percentage of total culture positive
Less than 3 Yrs	8	15	23	60.5%
3-6 Yrs	3	5	8	21.1%
7-12 Yrs	2	1	3	7.9%
13-15 Yrs	3	1	4	10.5%
	16	**22**	**38**	**100%**

The most common pathogens isolated were Escherichia coli 27 (71%), Klebsiella Species 6 (15%), Enterococcus sps 3(7.8%), Proteus sps 1(2.6%), Pseudomonas aeruginosa 1(2.6%) [**Table 2**]

Table 2. Bacterial agents isolated and their distribution as per sex of patients

Bacterial agent	Male	Female	Total
Escherichia coli	11	16	27
Klebsiella Species	2	4	6
Enterococcus sps	2	1	3
Proteus sps	--	1	1
Pseudomonas aeruginosa	1	--	1
	16	**22**	**38**

E. coli and Klebsiella showed the highest percentage of resistance to amoxicillin and ampicillin (100%) however, all isolates of E. coli and Klebsiella were susceptible to Nitofurantoin. Among all UTI isolates, least resistance was observed against drugs such as ceftriaxone, cefixime and gentamicin.

4   DISCUSSION

Urinary tract infection is one of the common cause of medical illness in a community [11]. This study was conducted to determine the bacterial agents responsible for UTI along with their antibiotic susceptibility so that an effective management strategy could me made. In this study 208 patients were enrolled with suspected UTI out of 208, 38 patients had urine culture positive giving the prevalence of UTI 18.2% which is similar to studies done in Egypt [12] and Iran[13] were prevalence of UTI were 15.05% and 16.2% respectively. However, the result obtained by this study (18.2%) appeared to be higher when compared with those reported in USA [14] and Nigeria [15]. The prevalence rates reported were 7.0% and 3.0%, respectively. On the contrary, the prevalence rate of UTI obtained in this study was less than that reported by Olowu [1996], which was 28.1%.

This study showed a higher incidence of urinary tract infection in females than in males. Of the 96 females, 22 (22/96; 22.9%) came up with positive cultures, while 16 (16/112; 14.2%) out of 112 males had culture positive UTI indicating that female patients were more affected than male patients.

The age group most common affected was below the age of 3 years, in our study 60.5% of patients with culture positive were less than 3 years of age which was comparable to that reported in Nigeria [16]. The most common pathogens isolated were Escherichia coli 27 (71%), Klebsiella Species 6 (15%), Enterococcus sps 3(7.8%), Proteus sps 1(2.6%), Pseudomonas aeruginosa 1(2.6%).The bacterial isolates obtained in this study were comparable with studies done in Iran [13] which showed that, among bacterial isolates, 40% accounted for *E. coli*, and this was followed by *Klebsiella* spp. (17.9%), *Enterococcus* spp. (8.7%), and *Pseudomonas* spp. (6.7%). A study conducted in Egypt [12] indicated that, among all the bacteria isolated in their study, *E. coli* and *Klebsiella* spp. were the most commonly isolated bacteria accounting for 58.1% and 41.9%, respectively. Another study conducted in Nigeria [16] reported a total of 36 bacterial isolates, of which, *E. coli* was the predominant organism 52.77% and was followed by *Klebsiella* spp. (25%), *Proteus mirabilis* (13.89%), *Streptococcus faecalis* (5.56%), and *Pseudomonas aeruginosa* (2.78%). Similarly this study was comparable with the study conducted in different areas [17,18,19]. Antibiotic susceptibility profile in this study was variable. E. coli and Klebsiella showed the highest percentage of resistance to amoxicillin and ampicillin (100%), however, all isolates of E. coli and Klebsiella were susceptible to Nitofurantoin. Among all UTI isolates, least resistance was observed against drugs such as ceftriaxone, cefixime ciproflaxacilin and gentamicin.

5   CONCLUSION

The finding of our study showed that E. Coli was the most common uropathogen and there was high resistance to routinely used drugs in clinical practice. So it high time to change the empirical therapy from conventional drugs like ampicillin and amoxicillin to drugs like nitrofurantoin or ciprofloxacilin.

Conflict of interest

The authors declare that they have no conflicts of interest.

REFERENCES

[1]   Ronald AR, Nicolle LE, Stamm E, et al. Urinary tract infection in adults: research priorities and strategies. Int J Antimicrob Agents. 2001;17:343–348

[2]   Barisˇic´ Z, Babic´-Erceg A, Borzic´ El, et al. Urinary tract infections in South   Croatia: aetiology   and

antimicrobial. Intl J Antimicrob Agents. 2003;22:S61–S64.

[3] Gonzalez CM, Schaeffer AJ. Treatment of urinary tract infection: what's old, what's new, and what works. World J Urol. 1999;17:372–382.

[4] Stamm WE, Hooton TM. Management of urinary tract infections in adults. N Engl J Med. 1993;329:1328–1334.

[5] Wilson ML, Gaido L. Laboratory Diagnosis of Urinary Tract Infections in Adult Patients. Clin Infect Dis. 2004;38:1150–1158.

[6] Bonadio M, Meini M, Spetaleri P, Gilgi C. Current microbiological and clinical aspects of urinary tract infections. Eur J Urol. 2001;40:439–445.

[7] National Committee for Clinical Laboratory Standards, author. Performance standards for antimicrobial disc susceptibility tests. 7th ed. Wayne, Pennsylvania, USA: NCCLS; 2000.M2-A7.

[8] Grude N, Tveten Y, Kristiansen BE. Urinary tract infections in Norway: bacterial etiology and susceptibility, a retrospective study of clinical isolates. Clin Microbiol Infect. 2001;7:543–547.

[9] Kripke C. Duration of therapy for women with uncomplicated UTI. Am Fam Physician. 2005;72:2219.

[10] Farajnia S, Alikhani MY, Ghotaslou R, Naghili B, Nakhlband A. Causative agents and antimicrobial susceptibilities of urinary tract infections in the northwest of Iran. Int J Infect Dis. 2009;13:140–144

[11] Kebira AN, Ochola P, Khamadi SA. Isolation and antimicrobial susceptibility testing of *Escherichia coli* causing urinary tract infections. J Appl Biosci. 2009:1320–1325.

[12] Yousssef D. M., Elfateh H. A., Sedeck R., Seleem S. Epidemiology of urinary tract infection in neonatal intensive care unit: a single center study in Egypt. *Journal of Academy of Medical Sciences*. 2012;2(1):25–29. doi: 10.4103/2249-4855.104012.

[13] Ranjbar R., Haghi-Ashtiani M. T., Jonaidi Jafari N., Abedini M. The prevalence and antimicrobial susceptibility of bacterial uropathogens isolated from pediatric patients. *Iranian Journal of Public Health*. 2009;38(2):134–213.

[14] Shaikh N., Morone N. E., Bost J. E., Farrell M. H. Prevalence of urinary tract infection in childhood: a meta-analysis. *Pediatric Infectious Disease Journal*. 2008;27(4):302–308. doi: 10.1097/inf.0b013e31815e4122.

[15] Muoneke V. U., Ibekwe M. U., Ibekwe R. C. Childhood urinary tract infection in Abakaliki: etiological organisms and antibiotic sensitivity pattern. *Annals of Medical and Health Sciences Research*. 2012;2(1):29–32. doi: 10.4103/2141-9248.96933.

[16] Aiyegoro O. A., Igbinosa O. O., Ogunmwonyi I. N., et al. Incidence of urinary tract infections (UTI) among children and adolescents in Ile-Ife, Nigeria. *African Journal of Microbiology Research*. 2007:13–19.

[17] Adedoyin O. T., Oyeymi B. O., Aiyedehin O. V. Screening of febrile children on hospital admission for urinary tract infections (UTI) *African Journal of Clinical and Experimental Microbiology*. 2003;4(1):56–62. doi: 10.4314/ajcem.v4i1.7325.

[18] Beyene G., Wondewosen T. W. Bacterial uropathogens in urinary tract infection and antibiotic susceptibility pattern in Jimma University Specialized Hospital, Southwest Ethiopia. *Ethiopian Journal of Health Sciences*. 2011;21(2):141–146. doi: 10.4314/ejhs.v21i2.69055.

[19] Lin C. W., Chiou Y. H., Chen Y. Y., et al. Urinary tract infection in neonates. *Journal of Clinical Neuroscience*. 1999;6(2):1–4.

AUTHOR BIOGRAPHY

Mohd Rafiq Lone, Senior Resident, Department of Pediatrics, SKIMS Medical College Bemina Srinagar

Nisar Ahmad Ganie, Senior Resident, Department of Pediatrics, SKIMS Medical College Bemina Srinagar

Mohsin Rashid , Senior Resident, Department of Pediatrics, SKIMS Medical College Bemina Srinagar

Syed Muneeb Mohammad, Senior Resident, Department of Pediatrics, SKIMS Medical College Bemina Srinagar

Javid Ahmad, Senior Resident, Department of Pediatrics, SKIMS Medical College Bemina Srinagar

Nazir Ahmad Parray, Lecturer, Department of Pediatrics, SKIMS Medical College Bemina Srinagar