Research Article

ANTIBIOTIC SUSCEPTIBILITY PATTERNS OF UROPATHOGENS ISOLATED FROM PEDIATRIC PATIENTS IN A SELECTED HOSPITAL OF BANGLADESH

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ABSTRACT

World-wide the pediatric patients are frequently affected by UTI and in most of the cases; antibiotics are given as empiric therapy. On the other hand, the uropathogens causing UTI are becoming resistant against most of the conventional antibiotics used. The present study was conducted to assess the antibiotic susceptibility pattern of the common causative agents of UTI in the selected hospital for evaluating the effective therapeutic options for the pediatric patients. A retrospective analysis of data from pediatric urine samples processed at the microbiology laboratory of ICH was undertaken for a period of two years (January 2009 - January 2011). Antibiotic susceptibility testing was performed using the disk diffusion method according to the guidelines of the Clinical and Laboratory Standards Institute. Out of 518 patients, 45% (n = 213) UTI cases were found culture-positive and the male-female ratio was 1:1.1. *E. coli* was the most common (87.9%) causative agent followed by *Klebsiella spp.* (10.8%) and other (1.3%). The *E. coli* isolates were found to be highly resistant against ampicillin (95.1%), nalidixic acid (88.7%), cotrimoxazole (77.8%) and cefalexin (77.8%), meropenem (0%) and ciprofloxacin (66%). High level of resistance was also found for *E. coli* against third generation cephalosporins, such as cefotaxime (63.1%), ceftriaxone (60.6%) and ceftazidime (50.2%). A large number of the *E. coli* isolates were sensitive to each of meropenum (94.8%), imipenem (93.6%), netilmicin (75.9%), gentamicin (65%) and nitrofurantoin (59.1%). Almost similar findings were observed with *Klebsiella spp.* Urine culture and sensitivity should be performed routinely to evaluate antibiotic susceptibility of the urinary pathogens before therapy is instilled. The resistance pattern also emphasizes the necessity to redefine treatment strategy and thus optimize the best utilization of the available antibiotics.

Keywords: Pediatric patients, Uropathogens, UTI, Antibiotic susceptibility, Causative agent.

INTRODUCTION

Urinary tract infection (UTI) is the most common bacterial infection of the infants and children, despite the widespread availability of antibiotics.[1,2] Children having UTI are usually given empiric antibiotic therapy without knowledge about the causative organisms and their sensitivity to antibiotics. Consequently, the resistance of uropathogens to antibiotics increases.[3-5] The ability to identify patients at risk for resistant organisms has important implications.

The periodic evaluation of antibacterial activity and current knowledge of the organisms that cause UTI and their antibiotic susceptibility is required to ensure appropriate therapy.[6-8] The choice of antibiotics for treatment of UTI should be, therefore, based on antibiotic susceptibility data. The present study was conducted to determine the antibiotic susceptibility patterns of the organisms isolated from patients with UTI in the ICH, Dhaka, Bangladesh.

MATERIALS AND METHODS

The study is a retrospective analysis of bacteria isolated from patients of suspected urinary tract infection, performed during the 2-year period from January 2009 to January 2011 at Institute of Child Health and Shishu Shasthya Foundation Hospital, Mirpur, Dhaka. Children with known urinary tract malformations or antimicrobial prophylaxis were excluded. Urine contained 5 or more white cells per HPF (high power field) on microscopy were sent for culture. Semi quantitative urine culture using a calibrated loop was used to inoculate blood agar and MacConkey plates by the method described elsewhere.[9] Only a single positive culture per patient, culture grew only one micro-organism and ≥ 100,000 (10^5) colony forming units per milliliter were taken for analysis. Antibiotic susceptibility testing was performed using the disk diffusion method according to the guidelines of the Clinical and Laboratory Standards Institute (CLSI). Inhibition zone was interpreted for each isolate to determine susceptibility, which was defined as susceptible, intermediate, or resistant.[10] Hi-Media kits' manufacturer instructions were followed to identify species of these organisms.

RESULTS

Among the samples (n = 518), 231 (44.6%) was found culture positive [Table 1]. *E. coli* was the most predominant (87.9%) uropathogen followed by *Klebsiella spp.* (10.8%) and other organisms (1.3%).

Among the culture positive patients, the most prevalent age group was 1-3 years (30%) [Table 2] and the next to

follow was the age group below 1 year (24%). Table 2 also shows that 48% of the boys were culture positive which is 52% in case of the girl with a male-female ratio of 1:1.1.

Table 1: Culture positivity and organisms

	No.	%
Culture positive	231	44.6
E. coli	203	87.9
Klebsiella spp	25	10.8
Other	3	1.3
Total	518	100

Antibiotic sensitivity pattern [Table 3] demonstrates that most of the *E. coli* showed high degree of resistance against most of the antibiotics used. The *E. coli* strains were mostly resistant against ampicillin (95.1%), nalidixic acid (88.7%), cotrimoxazole (77.8%), cephalexin (77.8%), meropenem (0%) and ciprofloxacin (66%). A considerably high-level of resistance was also observed with *E. coli* against third generation cephalosporins, namely cefotaxime (63.1%), ceftriaxone (60.6%) and ceftazidime (50.2%). A large number of the *E. coli* isolates were sensitive to each of meropenem (94.8%), imipenem (93.6%), netilmicin (75.9%), gentamicin (65%) and nitrofurantoin (59.1%). Almost similar findings were observed with *Klebsiella. spp.*

Table 2: Age and sex distribution of culture-positive UTI patients

Age group	Frequency		Male		Female	
	No.	%	No.	%	No.	%
<1 year	56	24	27	48	29	52
1-3 years	70	30	32	46	38	54
3-5 years	52	23	26	50	26	50
5-10 years	48	21	21	44	27	56
>10 years	5	2	4	80	1	20
Total	**231**	**100**	**110**	**48**	**121**	**52**

Table 3: Antibiotic sensitivity pattern of the urinary isolates

Antibiotic	No. (%) of Organism								
	E. coli			*Klebsiella spp*			Others		
	R	M	S	R	M	S	R	M	S
Ciprofloxacin	134 (66)	8 (4)	61 (30)	13 (52)	4 (16)	8 (32)	2 (66.7)	0 (0)	1 (33.3)
Ampicillin	193 (95.1)	3 (1.5)	7 (3.4)	25 (100)	0 (0)	0 (0)	3 (100)	0(0)	0 (0)
Imipenem	10 (4.9)	3 (1.5)	190 (93.6)	1 (4)	1 (4)	23 (92)	0 (0)	0 (0)	3 (100)
Cotrimoxazole	158 (77.8)	1 (0.5)	44 (21.7)	23 (92)	0 (0)	2 (08)	3 (100)	0 (0)	0 (0)
Nitrofurantoin	73 (36)	10 (4.9)	120 (59.1)	20 (80)	2 (08)	3 (12)	2 (66.7)	0 (0)	1 (33.3)
Cefotaxime	128 (63.1)	20 (9.9)	55 (27.0)	18 (72)	2 (08)	5 (20)	2 (66.7)	0 (0)	1 (33.3)
Netilmicin	42 (20.7)	7 (3.4)	154 (75.9)	3 (12)	0 (0)	22 (88)	1 (33.3)	0 (0)	2 (66.7)
Cephalexin	158 (77.8)	17 (8.4)	28 (13.8)	21 (84)	1 (4)	3 (12)	3 (100)	0 (0)	0 (0)
Ceftazidime	102 (50.2)	26 (12.8)	75 (36.9)	14 (56)	5 (20)	6 (24)	2 (66.7)	0 (0)	1 (33.3)
Aztreonam	122 (60.1)	26 (12.8)	55 (27.1)	17 (68)	3 (12)	5 (20)	3 (100)	0 (0)	0 (0)
Gentamicin	70 (34.5)	1 (0.5)	132 (65)	9 (36)	0 (0)	16 (64)	2 (66.7)	0 (0)	1 (33.3)
Nalidixic acid	180 (88.7)	3 (1.5)	20 (9.9)	21 (84)	0 (0)	4 (16)	3 (100)	0 (0)	0 (0)
Ceftriaxone	123 (60.6)	12 (5.9)	68 (33.5)	17 (68)	3 (8)	6 (24)	2 (66.7)	0 (0)	1 (33.3)
Meropenem	0(0)	3 (5.2)	55 (94.8)	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)

DISCUSSION

Several studies[11, 12] have shown that *E. coli* and *Klebsiella spp.* are the most predominant and common cause of UTI among pediatric patients. Many other studies reported *E. coli* to be the single most predominant causative organism for UTI[13, 14]. Our study also confirms *E. coli* (87.9%) to be the major cause of the infection followed by *Klebsiella spp.* (10.8%) as isolated from the study population [Table 1].

In a study[15], Prais *et al.* found *E. coli* to be more common in girls than in boys, and younger patients were less likely than older patients to be infected with *E. coli*. In the present study, the frequency of UTI [Table 2] was higher among girls (52%) as compared to the boys (48%). Other studies in developing countries demonstrate a significantly higher prevalence of UTI in girls in hospital settings[13]. Another study by Riccabona estimated that UTI are diagnosed in 1% of boys and 3-8% of girls[18].

Prospective studies from South Africa reported that 26% of children, aged 0-12 years, admitted to a teaching hospital in Durban and 17% of children, aged 1 week to 8 years, attending a primary health care (PHC) setting had bacteriuria[16, 17]. Our study demonstrates that UTI was more prevalent among the pediatric patients aged less than 1 year to more 10 years [Table 2].

The present study reveals higher incidence of UTI among the girls as compared to the boys except in the age groups of 3-5 years (50% male vs. 50% female) and >10 years (80% male vs. 20 % female). Study by Riccabona estimated that 3% of prepubertal girls and 1% of prepubertal boys are diagnosed with urinary tract infections. In the first year of life UTI is more prevalent in boys with rates of 2.7% compared with 0.7% in girls[18].

Antimicrobial resistance is an evolving and growing problem in UTI[19]. A study from Germany confirmed that resistance rates of causative agents to ampicillin and netilmicin were 51% and 7%, respectively[20] which are 95.1% and 20.7%, respectively in the present study [Table 3].

Almost seventy eight percent (77.8%) isolates have been found resistant against cotrimoxazole, whereas, in other countries the resistance rates have been reported to be as high as 40%[15, 20]. Similarly, high-level of resistance were observed with other conventional antibiotics used for the treatment of UTI in the present study. The isolated urinary pathogens also showed pretty high resistance against third generation cephalosporins (cefotaxime, ceftriaxone and ceftazidime). Such resistance against cephalosporins may be suggestive of the extended spectrum betalactamase (ESBL) mechanism of resistance[21], which is an emerging problem in *Enterobacteriaceae* and hydrolyze extended spectrum cephalosporins with an oxyimino side chain[22]. These include ceftazidime, ceftriaxone, cefotaxime, and the oxyimino-monobactam aztreonam. In many countries, cephalosporins are the favorite antimicrobial agents for the empirical treatment of not only UTI but also community-acquired respiratory tract infections, including otitis media. Moreover, in secondary and tertiary care centers cephalosporins are widely used, e.g., in intensive care units and hematology/ oncology wards.

CONCLUSION

Antibiotic resistance has become an important factor to be considered in the treatment of infections. Therefore, antibiotic susceptibility testing should be used to tailor appropriate therapy with an antibacterial agent having narrowest spectrum, least cost, and few adverse effects. It is also necessary to redefine the treatment strategy and to give antibiotics such as meropenem, imipenem, nitrofurantoin, gentamicin and netilmicin as guided by the susceptibility test.

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