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Original Article

Antibiogram of Urinary Isolates in Chattogram

Moniat Mokarrama[1*]
Kawsar Sultana[2]
Sabira Salsabil[1]

[1]Department of Community Medicine & Public Health
Chattagram Maa-O-Shishu Hospital Medical College
Chattogram, Bangladesh.

[2]Manager-Quality Assurance
Evercare Hospital
Chattogram, Bangladesh.

Abstract

Background: *Despite the widespread availability of antibiotics, Urinary Tract Infection (UTI) is one of the most important causes of morbidity in general population and also the common cause of nosocomial infection among hospitalized patients. This is due to resistance of antibiotics and the ever changing pattern of the sensitivity. The purpose of the study was to identify the recent pattern of antibiogram and sensitivity and to help physician in prescribing empirical therapy against the newest sensitivity pattern.*

Materials and methods: *This cross-sectional study was carried out in the Department of Microbiology of Chattagram Maa Shishu-O-General Hospital, National Hospital Chattogram and Max Hospital Laboratory, Chattogram from February to July 2022. Sample size was 100 positive urine culture reports from each lab.*

Results: *The male to female ratio of the patients was 1:2.22. Escherichia coli was the dominant isolate (53%) followed by Klebsiella spp. (19%), Enterococcus spp. (16%), both Coagulase negative Staphylococcus and Pseudomona (5%) and Proteus (2%). The three most frequently isolated bacteria had resistance rates of 100% to Penicillin and sensitivity rates of 20-89% to Amikacin,67%-100% to Tigecycline, 42%-88% to Nitrofurantoin and 80%- 89% to Meropenam. E.coli and Klebsiella also had resistance rates of 69%- 94% to Cefixime and 83%-88% to Cefuroxime.*

Conclusion: *In the study area resistance rates to Penicillin, Cefixime and Cefuroxime were high. Since most isolates were sensitive to Tigecycline, Nitrofurantoin and Meropenam, they are considered as appropriate antimicrobials for empirical treatment urinary tract infections.*

Key words: Antibiogram; Antimicrobial resistance; Sensitivity.

INTRODUCTION

Urinary Tract Infections (UTIs) account for approximately 1 million annual hospital visits, representing one of the most common infections for which emergency physicians prescribe antibiotics. It is also among the most common bacterial diseases in humans. Around 405 million people are estimated to be affected globally and nearly 0.23 million people died of UTIs, contributing to 5.2 million Disability-Adjusted Life Years (DALYs) in 2019.[1] According to the report of WHO, it is estimated that approximately 45% of death are responsible in both South Asia and Africa due to multidrug resistance. It is the second most common infections in community practice with approximately 150 million diagnosed cases each year found in a study conducted in Dhaka City in 2015. UTI can be caused by both gram-negative and gram-positive bacteria, as well as certain Candida spp, Among them E. coli is the most prevalent cause of UTIs, followed by Klebsiella. Age, circumcision status, and indwelling catheters are risk factors for acquiring a UTI in children. UTI affect patients in all age groups and both sexes. Neonates, girls, young

*Correspondence to:
Dr. Moniat Mokarrama
Lecturer
Department of Community Medicine & Public Health
Chattagram Maa-O-Shishu Hospital Medical College
Chattogram, Bangladesh.
Mobile : +88 01676 44 86 02
Email : muniat.ahd@gmail.com

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women and older men are most susceptible to UTIs. In women, bacterial cystitis is the most common bacterial infection. Every woman has a 60% lifetime risk of developing bacterial cystitis, which develops mostly before the age of 24. Boys are more vulnerable during the first year of life, after which, due to differences in sex organs, the incidence is primarily higher in girls and uncircumcised male infants are at higher risk.[2]

Prescribing habits for uncomplicated UTIs are generally dictated by hospital antibiograms that vary greatly between certain patient populations and geographic locations. Despite the availability of such focused therapy, a significant percentage of patients still suffer from treatment failures, owing to prescribing of antimicrobials empirically. In a country like Bangladesh, where the healthcare system is burdened with an overwhelming population, prescription of medications empirically is common practice since many patients cannot afford investigation costs. Simultaneously, unauthorized and haphazard use of antibiotics for farming and food producing animals has continuously increased antimicrobial resistance. Since the pattern of sensitivity is constantly changing and becoming an evolving public health challenge, monitoring of the antimicrobial susceptibilities becomes more important. It provides information on the pathogenic organisms isolated from patients as well assist in choosing the most appropriate antimicrobial therapy till the culture reports become available.[3] This study is, therefore, designed to determine the antibiogram of urinary isolates in Chattogram city, Bangladesh.

MATERIALS AND METHODS

This was conducted a cross-sectional study to evaluate differences in antimicrobial susceptibility patterns in urine culture. It was conducted in Chattagram Maa Shishu-O-General Hospital, National Hospital Chattagram and Max Hospital, Chittagong. 100 samples with positive urine cultures from each microbiology labs of these institutions were obtained. Positive urine cultures were defined by the institutions microbiology department. Study period was 6 months starting from February 2022 to July 2022. As many as 100 culture and sensitivity reports that came back positive for various organisms were consecutively collected after obtaining permission from appropriate laboratory authorities. Data such as age and gender were collected by the laboratory personnel from the patient when they came to submit their urine sample for culture and sensitivity. To protect patient privacy, only gender, age and date of sample collection along with case registration number were provided along with the culture-sensitivity test reports. Ethical approval was taken from the ethical committee of the institute.

Urine samples were tested by using multiple reagent strips and microscopic urinalysis. All samples were inoculated on Blood agar and Mac- Conkey Agar by the semi quantitative culture technique using a standard wire loop and incubated at 37ºC for 24-48 hours in an incubator. The approximate number of colonies and the number of bacteria was counted. Bacteriuria was defined as any micro-organisms growth of $\geq 10^5$ CFU/ml or $\geq 10^3$ CFU/ml in symptomatic patients. The isolated organisms were identified by standard methods which involves morphological appearance of the colonies, staining reactions and biochemical properties, motility test. Antimicrobial susceptibility of isolates was tested by Kirby- Bauer disk diffusion method using Mueller-Hilton agar. Results were read according to the National Committee for Clinical Laboratory Standards guidelines (NCCLS).

Data were collected by collecting and recording reports of laboratory investigations. All the collected data were checked and compiled and then tabulated. The data were entered and analyzed into Microsoft Excel 2010.

RESULTS

A total of 100 urine culture positive reports of UTI patients were obtained and analyzed for identification of antimicrobial sensitivity. The age of the patients ranged from 1 year to 92 years, with mean age of 34.73 (SD=24.071) years. The mean ages of male and female patients were 1.41 (SD=1.07) and 2.15 (SD=1.42) years, respectively. Sixty nine (69.0%) urines samples were from female and thirty one (31.0%) were from male patients with male to female ratio of 1:2.22. The demographic characteristics of the patients are shown in Table I.

Table I Age and sex distribution of patients with suspected UTI

Demographic Characteristics		Total (%)
Age Interval (Years)	1-10	20%
	11-20	7%
	21-30	23%
	31-40	14%
	41-50	8%
	51-60	10%
	61-70	7%
	71-80	9%
	81-90	1%
	91-100	1%
Male		31%
Female		69%

The highest isolation rate was observed in the age group between 21 to 30 years of age (Table 1). *E. coli* was the most predominant pathogen isolated from urine samples with prevalence of 53%. *Klebsiella* spp, *Enterococcus* spp, Coagulase Negative Staphylococci (CNS) *Psudomonas* spp and *Proteus* spp accounted for 47% of the isolates (Figure 1).

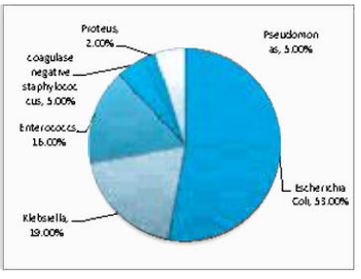

Figure 1 Bacterial isolates from urine samples of patients with UTI

The overall susceptibility profiles of bacterial isolates are shown in Table II. Penicillin had the highest overall resistance of (100%) followed by Ampicillin (96%) and Cefixime (90%). Nitrofurantoin, Gentamycin and Ciprofloxacin had overall resistance rates of 15%, 28% and 38% respectively (Table II). Species specific antimicrobial resistance rates are displayed in Table III. E. coli, the most frequently isolated bacterium, showed high resistance rates (100%) to Penicillin, Ampicillin and 94% to Cefixime. The other two most common isolates (Klebsiella spp. and Enterococcus spp.) exhibited resistance rates (80%-100%) to Penicillin, Ampicillin, Cefixime and Cefuroxime. E. coli isolates were susceptible to Tigecycline (100%), Meropenam (93%) and Vancomycin (90%) with resistance rate of 00%, 07% and 10% respectively. Klebsiella spp.were >88% sensitive to Ciprofloxacin, Gentamycin, Nitrofurantoin and Amikacin. Enterococcus and Coagulase negative Staphylococcus spp. were both sensitive to Linezolid (93% and 100% respectively).

Table II Overall antimicrobial susceptibility profiles of bacteria isolates from patients suspected of UTIs

Antimicrobial agents	No. of Antimicrobials tested	Susceptibility patterns		
		Resistant No. (%)	Sensitive No. (%)	Percentage (%)
Levofloxacin	100	40(40%)	56(56%)	04(4%)
Ciprofloxacin	96	36(38%)	54(56%)	06(6%)
Gentamycin	96	27(28%)	60(63%)	09(9%)
Nitrofurantoin	96	14(15%)	72(75%)	10(10%)
Amikacin	85	14(16%)	64(75%)	07(8%)
Cotrimoxazole	79	28(35%)	48(61%)	03(4%)
Cefixime	68	61(90%)	7(10%)	0(0%)
Meropenam	65	05(8%)	57(88%)	03(5%)
Ceftrixaone	57	31(54%)	23(40%)	3(5%)
Cefuroxime	57	46(81%)	07(12%)	04(7%)
Amoxiclav	45	32(71%)	13(29%)	0(0%)
Ceftazidime	44	23(52%)	14(32%)	07(16%)
Cefepime	39	33(85%)	06(15%)	0(0%)
Collistin	30	7(23%)	22(73%)	01(3%)
Cefotaxime	28	14(50%)	10(36%)	04(14%)
Ampicillin	25	24(96%)	1(4%)	0(0%)
Linezolid	20	01(5%)	19(95%)	0(0%)
Tigecycline	20	03(15%)	16(80%)	01(05%)
Vancomycin	20	1(05%)	19(95%)	0(0%)
Impenam	15	03(20%)	10(67%)	02(13%)
Penicillin	13	13(100%)	0(0%)	0(0%)

Table III Antimicrobial resistance pattern of bacterial isolates from patents with suspected UTI.

Antimicrobial agents	E Coli		Klebsiella		Enterococcus		CNS		Proteus		Pseudomonas	
	#T	%R	#T	%R	#T	%R	#T	%R	#T	%R	#T	%R
Levofloxacin	53	43	19	37	16	44	05	20	02	50	05	20
Ciprofloxacin	52	44	17	12	15	47	05	40	02	50	05	20
Gentamycin	52	19	19	11	15	73	04	25	02	00	04	75
Nitrofurantoin	51	10	19	11	15	13	04	00	02	50	02	80
Amikacin	51	14	18	11	05	80	05	20	02	00	04	00
Cotrimoxazole	50	42	18	17	02	00	04	50	01	100	04	25
Cefixime	47	94	13	69	01	100	01	100	02	100	04	100
Meropenam	44	07	12	17	05	00	02	00	01	00	01	00
Ceftrixaone	35	71	15	27	00	00	00	00	02	50	04	25
Cefuroxime	42	88	06	83	01	100	00	00	01	50	02	100
Amoxiclav	34	82	03	67	04	00	02	00	01	100	01	100
Ceftazidime	26	62	13	38	00	00	00	00	02	50	03	33
Cefepime	34	85	04	75	00	00	00	00	00	00	01	100
Collistin	25	16	03	33	00	00	00	00	01	100	01	100
Cefotaxime	10	70	13	31	00	00	00	00	00	00	05	60
Ampicillin	13	100	03	100	08	88	01	100	00	00	00	00
Linezolid	00	00	00	00	15	07	05	00	00	00	00	00
Tigecycline	12	00	00	03	03	33	00	00	01	100	01	100
Vancomycin	00	00	00	00	15	07	05	00	00	00	00	00
Impenam	05	40	06	00	00	00	00	00	01	00	03	33
Penicillin	02	100	01	100	10	100	00	00	00	00	00	00

#T: Number of isolates tested against each antimicrobial agent, % R: Percent of isolates resistant to the antimicrobial agent.

DISCUSSION

UTIs are one of the most common diseases diagnosed worldwide. Availability of new antimicrobials has improved the management of UTIs. However, the management of UTI infections has been jeopardized by increase in emmergence of antimicrobial drug resistance. In this study E. coli was the most predominant (53%) bacterium isolated from urine, followed by Klebsiella spp. (19%) Enterococcus (16%) Coagulase negative Staphylococcus (5%) Proteus spp. (5%) Pseudomonas spp (2%). A study from Kathmandu, Nepal showed that Escherichia coli was the most prevailing organism (81.3%).[4] Another study done in India where Escherichia coli was 31.25%, Pseudomonas 15.62%, Proteus 15.62%, Klebsiella 6.25% which did not correlate with our findings.[5] The isolation rates of E. coli and other pathogens in this study were comparable to the rates documented in a previous study which was conducted in Mumbai.[6] E.coli have a number of virulence factors specific for colonization and invasion of urinary epithelium. Some of these include adhesins, such as P-fimbria and S-fimbria, which enhance binding to vaginal and uroepithelial cells. Gram negative bacteria were found to be more responsible for UTI than Gram positive bacteria. Bacterial etiologies of UTI can show geographic variations and may even vary over time within a population. This study shows differences in the prevalence rates between females and males. Physiological and anatomical differences are accounted for the differences in males and females. In female the external third of the short urethra is often colonized by pathogens from normal vagina flora. Risk of infection increases with age, most likely due to the hypoestrogenic state with vaginal mucosal atrophy, impaired voiding, and changes in hygiene. Other risk factors include medical conditions such as diabetes, obesity, and sickle cell trait; anatomical congenital abnormalities, urinary tract calculi; and neurological or anatomical disorders that require indwelling or repetitive bladder catheterization.[7] Significant association was observed for prevalence of uropathogens among age groups where uropathogens were more prevalence in reproductive age groups than others. The most frequently isolated bacterial isolates were found to be highly resistant to multidrugs (3 or more) like Penicillin, Ampicillin and Cefixime. Ampicillin resistance rate is almost similar to a study conducted in Southeast Ethiopia.[8] The other two most common isolates (Klebsiella spp. and Enterococcus spp.) exhibited higher resistance rates to Penicillin, Ampicillin, Cefixime and Cefuroxime. E. coli isolates were susceptible to Tigecycline (100%) Meropenam (93%) and Vancomycin (90%) with resistance rate of 00%, 07% and 10% respectively. Klebsiella spp. were >88% sensitive to Ciprofloxacin. Gentamycin, Nitrofurantoin and Amikacin. Enterococcus and Coagulase negative Staphylococcus spp. were both sensitive to Linezolid (93% and 100% respectively).

This retrospective study is based on the results of routine microbiological tests. Due to the nature of the retrospective analysis we couldn't trace patients' clinical settings. Thus the study did not consider such features as inpatient and outpatients, catheterized and non-catheterized patients.

The higher antibiotic resistance in the present study might be due to the fact that common antibiotics are sold over the counter in Bangladesh and people of any age can buy them without doctor's prescription. The rise in antimicrobial resistance in this study emphasizes the importance of sound hospital infection control policies, rational antimicrobial prescribing practices. Antimicrobial resistance survey from various hospitals can be useful for comparison between resistance rates at national levels. The study should be periodically repeated to know any significant change in the antimicrobial susceptibility of uropathogens over time. We recommend that every hospital should have its own antimicrobial policy based on microbiological data to combat rise in emergence of antimicrobial resistance.

CONCLUSION

Due to wide scale resistance of the drugs used to treat UTI, choice of drugs in the treatment of UTI is quite narrow. In country like Bangladesh, awareness for prevention of UTI should be encouraged among the community level as it affects all age groups. Multidrug resistance to commonly used antimicrobials in uropathogens has caused considerable alarm which suggests the importance of judicious use of antimicrobials. A strong antimicrobial stewardship program is needed which should be followed by the physicians. An infection control measure is a must to control infection and to prevent the spread of these notorious drug resistant organisms.
In this study E coli was the most predominant uropathogen by which adult females were more affected. Tigecycline, Meropenem and Vancomycin were the most promising drugs against Gram negative organisms. Linezolid and Vancomycin were highly effective drugs against Gram positive organism. Nitrofurantoin can be considered as the alternative option in the empirical treatment of UTI.

DISCLOSURE

All the authors declared no competing interest.

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