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Efficacy of Amikacin Antibiotic to Uropathogens Isolated from Patient's Urine Sample Causing Urinary Tract Infection in Selected Areas of Dhaka City, Bangladesh

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Abstract: Amikacin is a second line drugs that use in urinary tract infection (UTI) in Bangladesh. Normally it is used in secondary infection but now it is used randomly which is a crucial public health problem to resistance of this antibiotic to different types of bacteria. Our aim was to assess the efficacy of Amikacin which is an aminoglycosides antibiotic against uropathogens. We collected total 12943 urine samples in 2016 (Jan-Dec) and out of which 1236 (9.55%) were bacteriologically positive. 95.1% were gram negative and 4.9% gram positive organism were found among these isolated uropathogens. Male were found more prone to get UTI under 10 years and between 51-90 years of age and females were more affected in 10 to 50 years and over 90 years of age group. *E. coli* was the most prevalent (83.9%) isolate followed by *Klebsiella* spp. (6.7%), *Staphylococcus aureus* (2.6%), *Pseudomonas* spp. (2.2%), *Enterococcus* spp. (2.0%) and *Proteus* spp. (1.1%). The most predominant organism *Enterobacter* spp. (100%) were found sensitive to Amikacin in both male & female patients and most predominant resistant organism in male *Enterococcus* spp. (50.0%) and in female *Acinetobacter* spp. and *Streptococcus* group B (100%) were found. Around 12.6% males and 13.67% females were found resistant to *E. coli*.

Keywords: Amikacin, Aminoglycosides, UTI, Resistance, Uropathogen.

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Introduction

Antibiotic resistance is an increasing threat to life and morbidity and mortality. Urinary Tract Infection (UTI) is a predominant infection all over the world but it is more prevalent in developing south Asian countries like Bangladesh (Jahangir Alam *et al*., 2017). UTI represents as one of the most common diseases encountered in medical practices these days and encompasses a broad range of clinical fields that are associated with a common finding of positive urine cultures. Besides every year about 150 million people are affected by UTIs. Worldwide at a cost of about US$6 billion and even UTIs have demonstrated significant morbidity and mortality (Nazmul Hossain *et al*., 2017).

They are the second most common types of infection in humans accounting for 8.3 million doctor's visit annually in USA (Md. Jahangir Alam *et al*., 2017). UTI can be nosocomially ubiquitous in clinical environment so that prevalence rate of uropathogens is being alarmingly accelerated (Mohammad Asaduzzaman *et al*., 2018). UTI is more common in female than male, because of the short length of the urethra and its proximity to anus. Pregnancy and sexual activity also make female more susceptible to UTI. Different factors like age, sex, immunosuppression and urological instruments may affect prevalence of UTIs (Mohammad Asaduzzaman *et al*., 2018).

To prevent these pathogens, different types of antibiotics and their super generations are used irrespectively with different doses in misused and overused forms. So uropathogens are getting resistant to efficacious drugs adopting different mechanisms of mutations and genetic transformations (Mohammad Asaduzzaman *et al*., 2018). The etiology of UTIs and the antibiotic susceptibility of urinary pathogens, both in community and hospitals, have been changing over the past years and recently, the antibiotic resistance has become a major global problem (Mohammad Asaduzzaman *et al*., 2018). A large proportion of uncontrolled antibiotic usage has contributed to the emergence of resistant bacterial infections (Mohammad Asaduzzaman *et al*., 2018).

The early introduction of effective drugs against bacterial infections in the last century has changed the medical behavior and has significantly reduced the mortality rates due to these agents. However, the widespread use of antibiotics has induced different mechanisms of bacteria resistance to these drugs (Mohammad Asaduzzaman *et al*., 2018). Bacterial resistance is naturally developed, being a consequence of bacteria adaptation to the environment. The exposure of microorganisms to different antibiotics increases the selective pressure and favors the development of resistance (Mohammad Asaduzzaman *et al*., 2018). The most frequently prescribed antibiotics to treat UTIs are sulfamethoxazole+trimethoprim, fluoroquinolones (ciprofloxacin or norfloxacin), 1st, 2nd and 3rd generations of cephalosporins, amoxicillin + clavulanate and nitrofurantoin (Mohammad Asaduzzaman *et al*., 2018).

However, Amikacin is an antibiotic used for a number of bacterial infections. This includes joint infections, intra-abdominal infections, meningitis, pneumonia, sepsis, and urinary tract infections. It is also used for the treatment of multidrug-resistant tuberculosis. It is used either by injection into a vein or muscle. Amikacin is an aminoglycoside antibiotics made from kanamycin. Though it can cause hearing loss, balance problems, and kidney problems, it is very effective drugs in the world. Amikacin was patented in 1971 and came into commercial use in 1976. It is on the World Health Organization's List of Essential Medicines, the most effective and safe medicines needed in a health system. The wholesale cost in the developing world is 13.80 to 130.50 USD for a month. In the United States a typical course of treatment costs 25 to 50 USD (Amikacin, cited 2018 July 22).

Amikacin irreversibly binds to 16S rRNA and the RNA-binding S12 protein of the 30S subunit of prokaryotic ribosome and inhibits protein synthesis by changing the ribosome's shape so that it cannot read the mRNA codons correctly. It also interferes with the region that interacts with the wobble base of the tRNA anticodon. It works in a concentration-dependent manner, and has better action in an alkaline environment. At normal doses, amikacin-sensitive bacteria respond within 24-48 hours (Amikacin, cited 2018 July 22).

Materials and Methods

Materials

Study Design: A cross sectional study.

Study Location: This was a retrospective analysis of laboratory data routinely collected from the microbiology department of IBN SINA Diagnostic and Consultation Center, Badda, Dhaka-1212, Bangladesh from 1st January, 2016 to 31st December, 2016. The total sample volumes were 12943.

Methods

Sample Collection and Bacteriological Assessment: Early morning midstream urine samples were collected aseptically from 12943 (Male-3638 & female-9305) patients. The urine samples were collected into sterile wide container (China) with screw cap tops. On the label were the name, age, sex and time of collection. All the patients were instructed on how to collect the urine samples aseptically and taken to the laboratory immediately for culture. In the diagnostic laboratory, each well mixed urine sample (1µL) was inoculated on MacConkey agar (Oxoid) and Blood agar (Oxoid) media plate under a Biosafety level-II cabinet (NUVO Sanaji Malzemelzeni, Imalat Vc Ticaret A.S, Turkey). The inoculum on the plate was streaked out for discrete colonies with a sterile wire loop sterilized by auto loop sterilizer (Germany) following standard procedures. The culture plates were incubated at 37°C by an incubator (Germany) for 48 hours and observed for the growth of bacteria through formation of colonies. All the bacteria were isolated and identified using morphological, microscopy (Japan) and biochemical tests like TSI (HiMedia), MIU (HiMedia) and Simmons Citrate (HiMedia) agar following standard procedures (Jahangir Alam *et al*., 2017).

Antibiotic Susceptibility Assessment: The disc diffusion technique was used for antibacterial susceptibility testing of the isolates using commercial antibiotics containing discs. We used the commercial antibiotic disc Amikacin (30µg, Oxoid). Interpretation of results was done using zone sizes. Zones of inhibition for *Enterobacteriaceae Staphylococcus* spp., *Pseudomonas* spp. and *Acinetobacter* spp. ≥17 mm was considered sensitive, 15-16 mm intermediate and ≤14 mm resistant Isolates were classified as either sensitive or resistant based on the definition of the Clinical and Laboratory Standard Institute (Clinical and Laboratory Standard Institute, 2006). Some laboratory stains of known sensitivity of *Staphylococcus aureus* ATCC 29213, *Enterococcus faecalis* ATCC 29212, *Escherichia coli* ATCC 25922, *Pseudomonas aeruginosa* ATCC 27853 and *Streptococcus pneumoniae* ATCC 49619 were used as quality control strains for the antimicrobial discs.

Statistical Analysis: Data were assessed using the Statistical Package for Social Science (IBM SPSS Statistics, version 18, IBM Corporation, SPSS Inc. Chicago, III, USA). Percentage analysis and chi-square (χ^2) tests were applied. The criterion for statistical significance was set at the value of $p < 0.05$.

The χ^2 statistic is most commonly used to evaluate Tests of Independence when using a crosstabulation. It presents the distributions of two categorical variables simultaneously, with

the intersections of the categories of the variables appearing in the cells of the table. The test of Independence assesses whether an association exists between the two variables by comparing the observed pattern of responses in the cells to the pattern that would be expected if the variables were truly independent of each other. Calculating the χ^2 statistic and comparing it against a critical value from the χ^2 distribution allows the researcher to assess whether the observed cell counts are significantly different from the expected cell counts. The Chi-Square statistic appears as an option when requesting a crosstabulation in SPSS. The output is labeled Chi-Square Tests; the χ^2 statistic used in the Test of Independence is labeled Pearson χ^2. It is easier to simply examine the p-value provided by SPSS. To make a conclusion about the hypothesis with 95% confidence, the value labeled Asymp. Sig. (which is the p-value of the χ^2 statistic) should be less than 0.05 (which is the alpha level associated with a 95% confidence level).

If p-value is less than 0.05 than we can conclude that the variables are not independent of each other and that there is a statistical relationship between the categorical variables.

Results

The total 12943 urine samples collected from patients, 1236 (9.55%) samples were positive and 11707 (90.45%) samples were negative at 2016 (January-December) in selected areas (Badda, Gulshan, Baridhara, Rampura, Doyagonj, Gandaria, Jatrabari and Sayedabad of Dhaka, Bangladesh).

Tabel 1. Distribution table of Urinary Tract Infection (UTI) patients by age groups and gender (n=1236)

Age (Years)	<10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	>90
Male	53	05	19	16	26	38	73	38	05	02
Female	103	83	181	113	149	130	124	56	14	08
Total	156	88	200	129	175	168	197	94	19	10

In our study, table-1 showed the distribution table of urinary tract infection affected patients by their age groups and gender. The highest of the study subjects under goes to the 21-30 years age group (200 patients=181 female + 19 male) and followed by 61-70 years age group (197 patients=124 female + 73 male), 41-50 years age group (175 patients=149 female + 26 male), 51-60 years age group (168 patients= 130 females + 38 males) and <10 years age group (156 patients= 103 females + 53 males) respectively. Most prevalent frequency of female and male patients affected by uropathogens was found in 21-30 years and 61-70 years age group respectively.

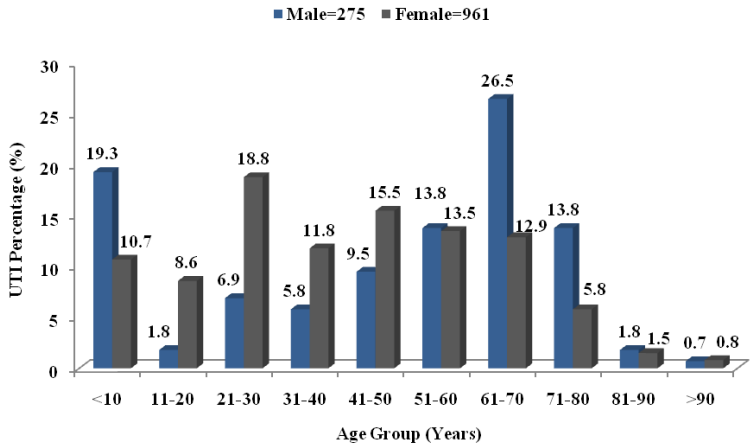

Figure 1. UTI percentage among different age groups of male (N=275) and female (N=961)

The percentage of male patients were more porne besides female patients (19.3% > 10.7%) under 10 years age groups. In between 11-20, 21-30, 31-40 and 41-50 years of age group female UTI infection (8.6%, 18.8%, 11.8% and 15.5% respectively) is higher than male (1.8%, 6.9%, 5.8% and 9.5% respectively). In between 51-60, 61-70 , 71-80 and 81-90 years age male infection (13.8%, 26.5%, 13.8% and 1.8% respectively) is higher than female (13.5%, 12.9%, 5.8 % and 1.5% respectively). Above 90 years age female infection (0.8%) is higher than male (0.7%) but here number of patients were very few.

Table 2. Distribution of specific uropathogen mediated UTI among UTI patients

Organisms	Percentage (n=1236)		
	Male	Female	Total
E. coli	222(18.0%)	815(65.9%)	1037(83.9%)
Klebsiella spp.	17(1.4%)	66(5.3%)	83(6.7%)
Staphylococcus aureus	5(0.4%)	27(2.2%)	32(2.6%)
Pseudomonas spp.	15(1.2%)	12(1.0%)	27(2.2%)
Enterococcus spp.	8(0.6%)	17(1.4%)	25(2.0%)
Proteus spp.	6(0.5%)	8(0.6%)	14(1.1%)
Enterobacter spp.	1(0.1%)	9(0.7%)	10(0.8%)
Acinetobacter spp.	1(0.1%)	1(0.1%)	2(0.2%)
Serretia spp.	0(0.0%)	2(0.2%)	2(0.2%)
Staphylococcus saprophyticus	0(0.0%)	2(0.2%)	2(0.2%)
Citrobacter spp.	0(0.0%)	1(0.1%)	1(0.1%)
Streptococcus Group B	0(0.0%)	1(0.1%)	1(0.1%)
Total	275(22.2%)	961(77.8%)	1236(100.0%)

Table-2 showed that the most predominant organism *E. coli* 1037(male 222 and female 815) found in UTI patients. According to number or percentage distribution, the second prevalent organism was *Klebsiella* spp. 83 (male 17 & female 66) followed by *Staphylococcus aureus* 32 (male 5 and female 27), *Pseudomonas* spp. 27 (male 15 and female 12), *Enterococcus* spp. 25 (male 8 and female 17), *Proteus* spp. 14 (male 6 and female 8) and *Enterobacter* spp. 10 (male 1 and female 9) respectively. In total bacteriologically positive cases, the most prone organism in male and female were *E.coli* (18.0% and 65.9 %) respectively. Moreover, all the isolated organisms were found highest in female except *Pseudomonas* spp. in contrast male

patients. On the other hand the study showed that the total 22.2% male patients and 77.8% female patients were found.

Table 3. Prevalence of different uropathogens among male and female patients

Organisms	Male (n=275)		Female (n=961)	
	Number	Percentage	Number	Percentage
E. coli	222	80.7%	815	84.8%
Klebsiella spp.	17	6.2%	66	6.9%
Staphylococcus aureus	5	1.8%	27	2.8%
Pseudomonas spp.	15	5.5%	12	1.2%
Enterococcus spp.	8	2.9%	17	1.8%
Enterobacter spp.	1	0.4%	9	0.9%
Proteus spp.	6	2.2%	8	0.8%
Serretia spp.	0	0.0%	2	0.2%
Staphylococcus saprophyticus	0	0.0%	2	0.2%
Acinetobacter spp.	1	0.4%	1	0.1%
Citrobacter spp.	0	0.0%	1	0.1%
Streptococcus Group B	0	0.0%	1	0.1%
Total	275	100.0%	961	100.0%

In this study, the urinary tract infections of female patients (961) were more prone to male patients (275). In male, the most predominant uropathogens were *E. coli* (80.7%) followed by *Klebsiella* spp. (6.2%), *Pseudomonas* spp. (5.5%), *Enterococcus* spp. (2.9%), *Staphylococcus aureus* (1.8%). In female, the most prevalent uropathogen were *E.coli* (84.8%) followed by *Klebsiella* spp. (6.9%), *Staphylococcus aureus* (2.8%), *Enterococcus* spp. (1.8%), *Pseudomonas* spp. (1.2%). The study noted that female patients were more infected by all of the isolated organism (*E.coli*, *Klebsiella* spp.. *Staphylococcus aureus, Enterobacter* spp, *Serretia* spp., *Staphylococcus saprophyticus, Citrobacter* spp. and *Streptococcus* Group B) except some organisms (*Pseudomonas* spp and *Enterococcus* spp., *Proteus* spp. and *Acinetobacter* spp.*)* but here the number were very few.

Table 4. Susceptibility pattern of Amikacin against uropathogens among male UTI patients (n=275)

Name of organisms	Sensitive		Resistant	
	Number	Percentage	Number	Percentage
E. coli	194	87.4%	28	12.6%
Proteus spp.	6	100.0%	0	0.0%
Pseudomonas spp.	12	80.0%	3	20.0%
Klebsiella spp.	14	82.4%	3	17.6%
Enterobacter spp.	1	100.0%	0	0.0%
Staphylococcus aureus	3	60.0%	2	40.0%
Enterococcus spp.	4	50.0%	4	50.0%
Acinetobacter spp.	1	100.0%	0	0.0%
Total	235	85.5%	40	14.5%

Table-4 showed that Amikacin sensitive against isolated uropathogenic bacteria in total male patients were 85.5% and rest of resistant 14.5%. All of them (100%) *Acinetobacter* spp. *Proteus* spp. and *Enterobacter* spp. were sensitive to Amikacin but here the numbers were

very few. On the other hand the most prevalent resistant organism was *Enterococcus* spp. (50.0%). In contrast of frequency, *E.coli* was the most significant organism which was 87.4 % sensitive and 12.6 % resistant to Amikacin. However, the other isolated bacteria's sensitive pattern to Amikacin followed by *Pseudomonas* spp. (80.0%), *Klebsiella* spp. (82.4%), *Staphylococcus aureus* (60.0%) and *Enterococcus* spp. (50.0%) and resistant pattern followed by *Pseudomonas* spp. (20.0%), *Klebsiella* spp. (17.6%) and *Staphylococcus aureus* (40.0%) respectively.

Table 5. Susceptibility pattern of Amikacin against uropathogens among female UTI patients (n=961)

Name of organisms	Sensitive		Resistant	
	Number	Percentage	Number	Percentage
E. coli	704	86.4%	111	13.6%
Proteus spp.	7	87.5%	1	12.5%
Pseudomonas spp.	9	75.0%	3	25.0%
Klebsiella spp.	61	92.4%	5	7.6%
Enterobacter spp.	9	100.0%	0	0.0%
Staphylococcus aureus	23	85.2%	4	14.8%
Enterococcus spp.	9	52.9%	8	47.1%
Acinetobacter spp.	0	0.0%	1	100.0%
Citrobacter spp.	1	100.0%	0	0.0%
Streptococcus Group B	0	0.0%	1	100.0%
Serretia spp.	2	100.0%	0	0.0%
Staphylococcus saprophyticus	2	100.0%	0	0.0%
Total	827	86.1%	134	13.9%

In our study table-5 showed that Amikacin sensitive against isolated uropathogenic bacteria in total female patients were 86.1% and rest of resistant 13.9%. All of them (100%) *Enterobacter* spp., *Serretia* spp., *Citrobacter* spp. and *Staphylococcus saprophyticus* were sensitive to Amikacin but here the numbers were very few. On the other hand the most prevalent resistant organism was *Streptococcus* Group B and *Acinetobacter* spp. (100%) but here the numbers were very few. By contrast of frequency, *E. coli* was the most significant organism which was 86.4 % sensitive and 13.6 % resistant to Amikacin. However, the other isolated bacteria's sensitive pattern to Amikacin followed by *Proteus* spp. (87.5%), *Pseudomonas* spp. (75.0%), *Klebsiella* spp. (92.4%), *Staphylococcus aureus* (85.2%) and *Enterococcus* spp. (52.9%) and resistant pattern followed by *Proteus* spp.(12.5%), *Pseudomonas* spp. (25.0%), *Klebsiella* spp. (7.6%), *Staphylococcus aureus* (14.8%) and *Enterococcus* spp. (47.1%) respectively.

Discussion

Because of misuse or abuse of antibiotics, the bacterial resistance is increased. This study aimed to evaluate the pattern of antimicrobial effectiveness of bacteria isolated from patients with UTI seen at the IBN SINA diagnostic center, Badda, Dhaka, Bangladesh. Moreover, we have identified the crucial bacterial species associated with UTI and described the profile of resistance to Amikacin. It is important that clinicians are aware of the regional antibiotic resistance rates before initiating experimental antimicrobial therapy for UTI treatment, as it is well-described that urinary infection with a resistant pathogen is more likely to lead to bacteriological/clinical failures (Jahangir Alam *et al*., 2017). In our study, we tested total

12943 urine samples and 1236 (9.55%) were bacteriological positive and 11707 (90.45%) were bacteriological negative found.

In our study we found The highest of the study subjects under goes to the 21-30 years age group (200 patients=181 female + 19 male) and followed by 61-70 years age group (197 patients=124 female + 73 male), 41-50 years age group (175 patients=149 female + 26 male), 51-60 years age group (168 patients= 130 females + 38 males) and <10 years age group (156 patients= 103 females + 53 males) respectively. According to frequency in total infected patients, we saw that mostly female patients are affected by uropathogens in all the age groups in contrast male patients. It was noted that the highest frequency of UTIs observed in women when compared to men, which is often attributed to a shorter urethra that facilitates colonization by these microorganisms (Jahangir Alam *et al*., 2017). Most prevalent frequency of female and male patients affected by uropathogens was found in 21-30 years and 61-70 years age group respectively. However, there were found significant difference between the age groups and sex of urinary tract infection patients at 5% ($P<0.05$).

In the fugure we saw the percentage of male patients were more porne in contrast female patients (19.3% > 10.7%) under 10 years age groups. Our finding is supported by the fact that uncircumcised male infants appear to be at increased risk of UTIs in the first three months of life. In a study of 100 otherwise healthy infants ranging in age from five days to eight months and admitted to the hospital because of a first known UTI. Most of the UTIs in infants younger than three months of age were in males, but female infants predominated thereafter (Zhanel *et al.*, 2006). We also found in between 11-20, 21-30, 31-40 and 41-50 years of age group female UTI infection (8.6%, 18.8%, 11.8% and 15.5% respectively) is higher than male (1.8%, 6.9%, 5.8% and 9.5% respectively). In between 51-60, 61-70 , 71-80 and 81-90 years age male infection (13.8%, 26.5%, 13.8% and 1.8% respectively) is higher than female (13.5%, 12.9%, 5.8 % and 1.5% respectively). Above 90 years age female infection (0.8%) is higher than male (0.7%) but here number of patients were very few. The most predominat age gorup was 21-20 years in female patients. Incidence of infection in females increases directly with sexual activity and child-bearing. In the women, 25-30% of women between 20-40 years of age will get UTIs. The anatomical relationship of the female urethra and the vagina makes it liable to trauma during sexual intercourse as well as bacteria been massaged up the urethra into the bladder during pregnancy and child birth. It has been reported in several studies that women who are sexually active, and especially if they use contraceptives, foams, gels, diaphragm and spermicides which are known to promote greater colonization of the vagina are at higher risk of developing UTIs (Jahangir Alam *et al.*, 2017a; Laisa Ahmed Lisa *et al.*, 2015; Grude *et al.*, 2001). Furthermore, another mechanism that could explain the lower frequency of UTI in men would be the prostatic fluid, which has antibacterial substances (Mbata, 2007). We got 961 (77.8%) female and 275 (22.2%) male patients. However, there were found significant difference between the percentage of age groups and sex of urinary tract infection patients at 5% ($P<0.05$).

Table-2 showed that the most predominant organism *E. coli* 1037 (male 222 and female 815) found in UTI patients. According to number or percentage distribution, the second prevalent organism was *Klebsiella* spp. 83 (male 17 & female 66) followed by *Staphylococcus aureus* 32 (male 5 and female 27), *Pseudomonas* spp. 27 (male 15 and female 12), *Enterococcus* spp. 25 (male 8 and female 17), *Proteus* spp. 14 (male 6 and female 8) and *Enterobacter* spp. 10 (male 1 and female 9) respectively. In total bacteriologically positive cases, the most prone organism in male and female were *E.coli* (18.0% and 65.9 %) respectively. There is fecal contamination of periurethral area, then the bacteria spreads on ascending through the bladder

and causes cystitis. These infections of the lower urinary tract, in some cases, can affect the kidneys and cause acute pyelonephritis, which consequently may result in bacteremia and sepsis (Mobley H, 2016). Moreover, all the isolated organisms were found highest in female except *Pseudomonas* spp. in contrast male patients. On the other hand the study showed that the total 22.2% male patients and 77.8% female patients were found. Moreover, there were found significant difference between the isolated organism and sex of urinary tract infection patients at 5% (P<0.05).

In this study, the urinary tract infections of female patients (961) were more prone to male patients (275). In male, the most predominant uropathogen were *E.coli* (80.7%) followed by *Klebsiella* spp. (6.2%), *Pseudomonas* spp. (5.5%), *Enterococcus* spp. (2.9%), *Staphylococcus aureus* (1.8%). In female, the most prevalent uropathogen were *E.coli* (84.8%) followed by *Klebsiella* spp. (6.9%), *Staphylococcus aureus* (2.8%), *Enterococcus* spp. (1.8%), *Pseudomonas* spp. (1.2%). Several studies have shown that *E. coli* is the major bacterial species associated with UTIs, and *Klebsiella pneumoniae* is the second most important bacteria in this type of infection (Jahangir Alam *et al*., 2017). The study noted that female patients were more infected by all of the isolated organism (*E.coli*, *Klebsiella* spp.. *Staphylococcus aureus*, *Enterobacter* spp, *Serretia* spp., *Staphylococcus saprophyticus, Citrobacter* spp. and *Streptococcus* Group B) except some organisms (*Pseudomonas* spp. and *Enterococcus* spp., *Proteus* spp. and *Acinetobacter* spp.*)* but here the number were very few. However, there were found significant difference between the percentage and frequency of isolated organism and sex of urinary tract infection patients at 5% (P<0.05).

Table-4 showed that Amikacin sensitive against isolated uropathogenic bacteria in total male patients were 85.5% and rest of resistant 14.5%. All of them (100%) *Acinetobacter* spp. *Proteus* spp. and *Enterobacter* spp. were sensitive to Amikacin but here the numbers were very few. On the other hand the most prevalent resistant organism was *Enterococcus* spp. (50.0%). In contrast of frequency, *E.coli* was the most significant organism which was 87.4 % sensitive and 12.6 % resistant to Amikacin. However, the other isolated bacteria's sensitive pattern to Amikacin followed by *Pseudomonas* spp. (80.0%), *Klebsiella* spp. (82.4%), *Staphylococcus aureus* (60.0%) and *Enterococcus* spp. (50.0%) and resistant pattern followed by *Pseudomonas* spp. (20.0%), *Klebsiella* spp. (17.6%) and *Staphylococcus aureus* (40.0%) respectively.

Treatment of urinary tract infections is becoming more complicated with an increase of the number of resistant strains to antibiotics and prevalence of antibiotic resistance mechanisms. Table-4 showed that Amikacin sensitive against isolated uropathogenic bacteria in total male patients were 85.5% and rest of resistant 14.5%. All of them (100%) *Acinetobacter* spp., *Proteus* spp. and *Enterobacter* spp. were sensitive to Amikacin but here the numbers were very few. On the other hand the most prevalent resistant organism was *Enterococcus* spp. (50.0%). In contrast of frequency, *E. coli* was the most significant organism which was 87.4 % sensitive and 12.6 % resistant to Amikacin. However, the other isolated bacteria's sensitive pattern to Amikacin followed by *Pseudomonas* spp. (80.0%), *Klebsiella* spp. (82.4%), *Staphylococcus aureus* (60.0%) and *Enterococcus* spp. (50.0%) and resistant pattern followed by *Pseudomonas* spp. (20.0%), *Klebsiella* spp. (17.6%) and *Staphylococcus aureus* (40.0%) respectively. There were no significant difference among the susceptibility pattern of Amikacin, isolated organism and sex of the patients at 5% (P>0.05).

In our study table-5 showed that Amikacin sensitive against isolated uropathogenic bacteria in total female patients were 86.1% and rest of resistant 13.9%. All of them (100%)

Enterobacter spp., *Serretia* spp., *Citrobacter* spp. and *Staphylococcus saprophyticus* were sensitive to Amikacin but here the numbers were very few. On the other hand the most prevalent resistant organism was *Streptococcus* Group B and *Acinetobacter* spp. (100%) but here the numbers were very few. By contrast of frequency, *E. coli* was the most significant organism which was 86.4 % sensitive and 13.6 % resistant to Amikacin. However, the other isolated bacteria's sensitive pattern to Amikacin followed by *Proteus* spp. (87.5%), *Pseudomonas* spp. (75.0%), *Klebsiella* spp. (92.4%), *Staphylococcus aureus* (85.2%) and *Enterococcus* spp. (52.9%) and resistant pattern followed by *Proteus* spp.(12.5%), *Pseudomonas* spp. (25.0%), *Klebsiella* spp. (7.6%), *Staphylococcus aureus* (14.8%) and *Enterococcus* spp. (47.1%) respectively. There were significant difference among the susceptibility pattern of Amikacin, isolated organism and sex of the patients at 5% ($P<0.05$).

The knowledge on the regional pattern of bacterial resistance is critical to guide the medical staff to choose an appropriate antibiotic for the treatment of UTI patients (Jahangir Alam *et al*., 2017). Bacterial resistance has become a public health issue and has increasingly been associated with risk factors that put life in danger (Nazmul Hossain *et al*., 2017). Awareness is needed of both the population and health professionals about the importance for the correct use of antibiotics, and it is mandatory to take into account the result of antibiotics susceptibility tests. The Amikacin use should be performed only after the microbial susceptibility confirmation, and it is necessary to find other alternatives for the empirical treatment. The bacterial resistance prevention can be performed through control measures that limit the spread of resistant bacteria and the rational use of antimicrobial policy.

Conclusion

In a nutshell, the results showed that there was a high prevalence of occurrence of urinary tract infection among patients of areas (Badda, Gulshan, Baridhara, Rampura, Doyagonj, Gandaria, Jatrabari and Sayedabad of Dhaka, Bangladesh). Most of the bacteria were susceptible to Amikacin. The prescribed Amikacin antibiotic were still effective and safe against the uropathogens, but should be reserved for only complicated UTIs and should use to follow the antibiotic guidelines in order to prevent emergence of multi drug resistant organisms.

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