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Drug Resistance Pattern of the Isolated Organisms While Treating UTIs

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Abstract: Background: Urinary tract infections (UTI), which are caused by the presence and growth of microorganisms in the urinary tract, are perhaps the single commonest bacterial infections of mankind. Urinary tract infection is a most common infectious disease after respiratory tract infection in community practice. Aim of the study: The aim of this study is to assess the drug resistance pattern of the isolated organism while treating UTIs. Material & Methods: This was a prospective study carried out in the Molecular Biology Laboratory, Institute of Biological Sciences, University of Rajshahi, Bangladesh during the period of July 2008 to June 2011. In the planning phase, we estimated a total sample size of 750 cases. The study population comprised of four hundred fifty (450) female patients clinically suspected of having UTI aged between 15-45 years attending the OPDs or admitted to Rajshahi Medical College Hospital, Rajshahi, SZMCH, Bogra, Combined Military Hospital (CMH), Bogra, Bangladesh, Rangpur Medical College, Rangpur, Dinajpur Medical College, Dinajpur in the Northern regions of Bangladesh. Selection of the participants of the study population was done on the basis of some inclusion and exclusion criteria. Results: The prevalence rate of urinary tract infection (UTI) of the present study population was therefore 33.55%. Among the 151 confirm diagnosed UTI patients, asymptomatic UTI (Group A) was diagnosed in 54 women whereas, significant bacteriuria i.e. symptomatic UTI (Group B) was found in 97 patients. The prevalence of symptomatic UTI was therefore higher than asymptomatic UTI. The highest UTI patients 68 (44.44%) were women within the 26-35 years age group followed by Group-C 46 (31.08%) whose ages are within 36-45 years, while the Group-A women (15-25 years of age) were the least sufferers of UTI (24.83%). The antibiotic susceptibility pattern of isolated uropathogens (both Gram-negative and Gram-positive bacteria) from the urine samples of the study population has been shown. The results showed that in general most of the urinary isolates showed higher resistance to commonly used and comparatively old drugs namely- Nalidixic acid, Cotrimoxazole, Nitrofurantoin, Ceftazidime, Ceftriaxone and Azithromycin. Cephradine showed moderate resistance (55%). On the other hand, *Staphylococcus saprophyticus* was found to be highly sensitive to Imipenem (80%), followed by gentamicin (71.4%), Azithromycin (65.7%), Amikacin (64.3%). Ceftriaxone and Nirofurantoin both showed moderate sensitivity of 60%. *Staphylococcus aureus* showed highest resistance to Ceftazidine (78%), followed by Ciprofloxacin (77.5%), Cotrimoxazole and Nalidixic acid (75%), Ceftriaxone (66.7%). Conclusion: The major pathogen *E. Coli* causing UTI in the Northern regions of Bangladesh and other gram negative (as well as gram positive) isolates were more highly sensitive to Imipenem, Amikacin and Gentamicin as compared to the other antibiotics tested.

Keywords: Urinary Tract Infections (UTI), Microorganism, Drug Resistance Pattern, *E. coli*

1. Introduction

Urinary tract infections (UTI), which are caused by the presence and growth of microorganisms in the urinary tract, are perhaps the single commonest bacterial infections of mankind. [1] Urinary tract infection is a most common infectious disease after respiratory tract infection in community practice. [2] It remains a major public health problem in terms of morbidity and financial cost with an estimated 150 million cases per annum worldwide, [3-5] costing global economy in excess of 6 billion US dollars. [6] Nearly 10% of people will experience a UTI during their lifetime. [7, 8] Generally, Urinary tract infections (UTIs) are most common health problem for both sexes i.e. male and female. [9] Although UTIs occur in all age groups including men and women, clinical studies suggest that the overall prevalence of UTI is higher in women. UTIs are most commonly found in women of childbearing age and rarely occur in men. An estimated 50% of women experience at least one episode of UTI at some point of their lifetime and between 20% and 40% of women can have recurrent episodes within one year. [10, 11] One half of all women will experience a UTI in their lifetime, and one in three women will receive antimicrobial therapy for a UTI. In addition, the financial impact is enormous with costs exceeding $1.6 billion for community acquired UTI. [12] Antimicrobial therapy is seldom indicated for the asymptomatic UTI; but it is usually indicated for symptomatic UTIs. [13] UTIs are often treated with different broad-spectrum antibiotics, one with a narrow spectrum of activity may be inappropriate because of emerging concerns about infection with resistant organisms. The most common antibiotics often used to treat routine, uncomplicated UTIs are Trimethoprim (sulfonamides), Trimethoprim/ Sulfamethoxazole, Cephalosporins, Fluoroquinolones (Ciprofloxacin, Ofloxacin, Norfloxacin, Trovafloxacin), Nitrofurantoin, Nalidixic acid, and Fosfomycin. [14] The emergence and spread of antibiotic resistance is a cause of increasing cancer. [5] Antibiotic resistance is the ability of a microorganism to withstand the effects of an antibiotic. It is one of the major causes of failure in the treatment of infectious diseases that results in increased morbidity, mortality, and costs of health care. [15] In the past decade, many kinds of resistant strains have been discovered. For example, Methicillin resistant *Staphylococcus aureus* (MRSA), [16] multidrug resistant *Pseudomonas aeruginosa* [17] and *Serratia marcescens,* [18] Vancomycin resistant *Enterococci* (VRE) [19] and extended spectrum beta lactamase (ESBL) resistant *Enterococci*. [20] Earlier reports in Bangladesh have shown on increased resistance of the urinary pathogens to commonly- used antibiotics. [21-23] Due to rising antibiotic resistance among uropathogens it is important to have local hospital-based knowledge of the organisms causing UTI and their antibiotic sensitivity patterns. This information would be relevant not only to the local hospital but would also be a vital regional database. Area-specific monitoring studies aimed to gain knowledge about the type of pathogens responsible for UTIs and their susceptibility patterns may help the clinicians to choose the right empirical treatment.

2. Methodology and Materials

This was a prospective study and was carried out in the Molecular Biology Laboratory, Institute of Biological Sciences, University of Rajshahi, Bangladesh during the period of July 2008 to June 2011, availing also some of the laboratory facilities of the Departments of Microbiology, Rajshahi Medical College Hospital, Rajshahi, SZMCH, Bogra, Combined Military Hospital, Bogra, Bangladesh, Rangpur Medical College Rangpur and Dinajpur Medical College Hospital, Dinajpur. We collected data from 450 patients with suspected UTI during the study. In the planning phase we estimated a total sample size of 750 cases. The study population comprised of four hundred fifty (450) female patients clinically suspected of having UTI aged between 15-45 years attending the OPDs or admitted to Rajshahi Medical College Hospital, Rajshahi, SZMCH, Bogra, Combined Military Hospital (CMH), Bogra, Bangladesh, Rangpur Medical College, Rangpur, Dinajpur Medical College, Dinajpur in the Northern regions of Bangladesh. Selection of the participants of the study population was done on the basis of some inclusion and exclusion criteria mentioned below.

1. Inclusion Criteria
   a. Married and unmarried women of reproductive (child bearing age) i.e. 18-45 years of age.
   b. Women having clinically suspected UTI. Clinical diagnostic criteria- dysuria, frequency, urgency and fever.
   c. Women who are willing to participate in the study
2. Exclusion Criteria
   a. Women below 18 and above 45 years of age and menopausal women.
   b. Patients currently on antibiotic therapy or having history of receiving antibiotics within two weeks prior to enrolment in the study.
   c. Women who are not willing to participate.
   d. Patients on continuous indwelling catheter.
   e. Women with severe concomitant diseases besides symptoms of UTI.

3. Results

Of the 450 patients screened for the presence of UTI, in the present study, one hundred fifty-one (151) patients were diagnosed of having UTI (both symptomatic and asymptomatic). The prevalence rate of urinary tract infection (UTI) of the present study population was therefore 33.55%, as shown in Table 1. As shown in Table 1, among the 151 confirm diagnosed UTI patients, asymptomatic UTI (Group A) was diagnosed in 54 women whereas, significant bacteriuria i.e. symptomatic UTI

(Group B) was found in 97 patients (Table 1). The prevalence of symptomatic UTI was therefore higher than asymptomatic UTI. The distribution of asymptomatic UTI (Group A) and symptomatic UTI (Group B) subjects with respect to medico-demographic characteristics i.e. marital status (single, married, widow/divorced), pregnancy (pregnant, non-pregnant), diabetes (diabetic, non-diabetic), and blood pressure (hypotension, hypertension, normal blood pressure) has been presented in Table 1. The incidence rate of UTI in relation to marital status, occurrence of pregnancy, presence of diabetes and high blood pressure has been graphically represented in the Figures 5a – 5d. In the current study, only married women were considered for the pregnancy group and unmarried pregnant women were ruled out of the study because in our society there is no concept of such unmarried pregnant women and such cases, if exist, are not disclosed and thus are not available. The prevalence of UTI in relation to age of the subjects of the present study has been shown in Figure 1. The highest UTI patients 68 (44.44%) were women within the 26-35 years age group (i.e. group-B women) followed by Group-C 46 (31.08%) whose ages are within 36-45 years, while the Group-A women (15-25 years of age) were the least sufferers of UTI (24.83%) i.e. 37 patients. The prevalence rate of UTI based on the educational qualifications of the respondents has been presented in Table 2. Education seems to play a significant role in preventing the incidence of UTI as patients having an educational qualification of Master's degree and above had a very low (4.64%) incidence of UTI; while the incidence rate of UTI was very high (nearly 45.03%) among the Illiterate. The frequency of occurrence of pathogens in urine samples of the study women has been shown in Table 3. Of the 151 isolates obtained, Gram-negative bacteria occurred more frequently than Gram-positive bacteria, constituting 99 (65.56%) of the total isolates. Among the isolates, *E. coli* had the highest frequency of isolation with a frequency of 64 (42.38%), followed by *Pseudomonas aeruginosa* 19 (12.58%), *Klebsiella spp.* 8 (5.29%) and *Proteus sp* also 8 (5.29%). Gram-positive bacteria accounted for 40 (34.44%) of the total isolates, with *Staphylococcus saprophyticus* 31 (20.52%) and *Staphylococcus aureus* 9 (5.96%). Mixed cultures of *Klebsiella spp.* and *Staphylococcus spp*. accounted for 12 (7.947%) of the total isolated as shown in Table 4. Antibiotic susceptibility testing of the isolated uropathogens was performed by using the disc diffusion method described by Bauer et al. on Mueller Hinton Agar (Oxoid). The antibiotic susceptibility pattern of isolated uropathogens (both Gram-negative and Gram-positive bacteria) from the urine samples of the study population has been shown in Table 4. The results showed that in general most of the urinary isolates showed higher resistance to commonly used and comparatively old drugs namely- Nalidixic acid, Cotrimoxazole, Nitrofurantoin, Ceftazidime, Ceftriaxone and Azithromycin (Table 4, bar graph Figure 2 and Photographic Figure 4 showing very higher resistance (smaller zone of inhibition) by a urinary isolate. Ciprofloxacin and gatifloxacin exhibited moderate resistance and susceptibility (Photographic Figure 5 marked D and E). On the other hand, Imipenem, Gentamicin and Amikacin displayed very high sensitivity towards most of the isolated organism from urine samples (Table 4, bar graph Figure 2 and Photographic Figure 4 marked (A), (B) and (C). *E. coli* showed highest resistance to Azithromycin (85%), followed by Nalidixic acid (77%), Cotrimoxazole (68%), Ceftazidine (63%) and Ceftriaxone (60%). Ciprofloxacin and Gatifloxacin with (55.56%) and (48%) resistance respectively were moderately resistant. On the other hand, *E coli* showed highest sensitivity (91.2%) to Imipenem, followed by Amikacin (83.55%) and Gentamicin (78%) sensitivity. *Klebsiella* showed highest resistance to Azithromycin (82%), followed by Cefixime (78.5%), Nalidixic acid (77.45%), Gatifloxacin (77%), Ceftriaxone (75.95%), Ciprofloxacin (70%) and Cotrimoxazole (60.55%). On the other hand, *Klebsiella* was found to be highly sensitive towards Imipenem (92.08%), Amikacin (91.5%) and moderately sensitive to Cephradine (65.5%). *Proteus* showed highest resistance to Nitrofurantoin (79.35%), followed by Azithromicin (78%), while *Proteus* showed moderate resistance of 55% to Nalidixic acid and Cotrimoxazole (52.3%). On the other hand, *Proteus* was found to be highly sensitive to Amikacin (92.5%), Ceftriaxone (89.17%), Gentamicin (86.45%), Gatifloxacin (75%), Ceftazidine (72.55%), Cirprofloxacin a cefixime and Cephradine (60%). *Pseudomonas* showed highest resistance against Cephradine (90%), followed by Gatifloxacin (85%) and Azithromicin (85%), Cefixime (82%), Nalidixic acid resistance (81.12%), Cotrimoxazole (78.5%), Ceftazidine (75.5%), Ceftriaxone (73.85%). *Pseudomonas* was found to be highly sensitive towards Imipenem (94.5%), Gentamicin (78.72%), Amikacin (77%) and moderately sensitive to Ciprofloxacin (55.32%). *Staphylococcus saprophyticus* showed highest resistance to Nalidixic acid (78%), Ceftazidine (77%), Gatifloxacin (75.5%), Cotrimoxazole (72%), Ciprofloxacin (70%). Cephradine showed moderate resistance (55%). On the other hand, *Staphylococcus saprophyticus* was found to be highly sensitive to Imipenum (80%), followed by Gentamicin (71.4%), Azithromycin (65.7%), Amikacin (64.3%). Ceftriaxone and Nirofurantoin both showed moderate sensitivity of 60%. *Staphylococcus aureus* showed highest resistance to Ceftazidine (78%), followed by ciprofloxacin (77.5%), Cotrimaxazole and Nalidixic acid (75%), Ceftriaxone (66.7%). On the contrary, *Staphylococcus aureus* showed highest sensitivity towards Imipenem (89%), followed by Azithromycin (78%), Gentamicin (75%), Amikacin (71%) and Gatifloxacin (70%) while Cephradine showed (65%) and Cefixime (60%) sensitivity which can be considered as moderate sensitivity.

Table 1. *Distribution of asymptomatic UTI (Group A) and symptomatic UTI (Group-B) subjects with respect to medico-demographic characteristics (n= 151).*

Characteristics	Group A (Asymptomatic UTI)		Group B (Symptomatic UTI)		Total	
	No.	%	No.	%	No.	%
Marital status						
Single	12	22.22	37	38.14	49	32.45
Married	38	70.37	57	58.76	95	62.91
Widow/divorced	04	7.41	03	3.09	07	4.64
Total	54	100	97	100	151	100
Pregnancy						
Non-pregnant (married)	16	29.63	29	29.90	45	29.80
Pregnant	48	88.89	68	70.10	116	76.82
Total	54	100	97	100	151	100
Diabetes						
Non-diabetic	22	40.74	36	37.11	58	38.41
Diabetic	32	59.25	61	62.88	93	61.58
Total	54	100	97	100	151	100
Blood Pressure (BP)						
Hypotension	1	1.85	3	3.09	4	2.64
Hypertension	30	55.55	58	59.79	88	58.27
Normal BP	23	42.59	36	37.11	59	39.07
Total	54	100	97	100	151	100

Table 2. *The prevalence rate of UTI based on the educational qualifications of the women (n=151).*

Educational Qualification	UTI Positive cases (%)
Illiterate	68 (45.03)
Primary	38 (25.17)
SSC	24 (15.89)
HSC/ Graduate	14 (9.27)
Masters and above	7 (4.64)
Total	151 (100%)

Table 3. *Frequency of isolation of pathogens in urine samples of women. (n=151).*

Bacteria isolated	No. of isolates (%)
Gram-negative bacteria	
Escherichia coli	64 (42.38)
Pseudomonas sp	19 (12.58)
Klebsiella sp.	8 (5.29)
Proteus sp.	8 (5.29)
Total Gram -ive bacteria	99 (65.56%)
Gram-positive bacteria	
Staphylococcus saprophyticus	31 (20.52)
Staphylococcus aureus	9 (5.96)
Total Gram + ive bacteria	40 (26.49)
Total Single bacterial growth (Gram + ive + Gram –ive)	139 (30.88)
Mixed bacterial growth of *Klebsiella and Staphylococcus spp.*	12 (7.947)
Total	151 (100.0)

Table 4. *Antimicrobial susceptibility (S) and resistance (R) pattern of clinical bacterial strains isolated from UTI patients (N=151).*

Antimicrobial agents	Sensitivity pattern	*E. coli* n (%)	*Klebsiella spp* n (%)	*Proteus spp* n (%)	*Pseudomonas spp* n (%)	*S. saprophyticus spp* n (%)	*S. aureus spp* n (%)
Cephradine	R	33.3	34.5	40	90	55	35
	S	66.7	65.5	60	10	45	65
Cefixime	R	25	78.5	30	82	45	40
	S	75	21.5	70	18	55	60
Ciprofloxacin	R	55.56	70	30	44.68	70	77.5
	S	44.44	30	70	55.32	30	22.5
Gatifloxacin	R	48	77	25	85	75.5	30
	S	52	23	75	15	24.5	70
TMP/SMZ Cotrimoxazole	R	68	60.55	52.3	78.5	72	75
	S	32	39.45	47.7	21.5	28	25
Nitrofurantoin	R	34	41.67	79.35	80	40	45
	S	66	58.33	20.65	20	60	55
Nalidixic Acid	R	77	77.45	55	81.12	78	75

Antimicrobial agents	Sensitivity pattern	*E. coli* n (%)	*Klebsiella* spp n (%)	*Proteus* spp n (%)	*Pseudomonas* spp n (%)	*S. saprophyticus* spp n (%)	*S. aureus* spp n (%)
Ceftazidime	S	23	22.55	45	18.88	22	25
	R	63	80	27.45	75.5	77	78
Ceftriaxone	S	37	20	72.55	24.5	23	22
	R	60	75.95	10.83	73.85	40	66.7
Amikacin	S	40	24.05	89.17	21.15	60	33.3
	R	16.45	8.5	7.5	23	35.7	29
Gentamicin	S	83.55	91.5	92.5	77	64.3	71
	R	22	39.87	13.55	21.28	28.6	25
Azithromycin	S	78	60.13	86.45	78.72	71.4	75
	R	85	82	78	85	34.3	22
Imipenem	S	15	18	22	15	65.7	78
	R	8.8	7.92	70	5.5	20	11
	S	91.2	92.08	30	94.5	80	89

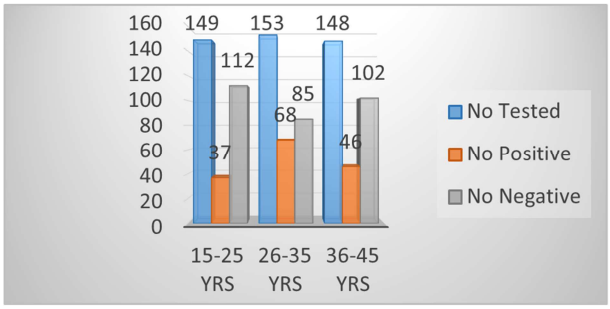

Figure 1. *Age-wise distribution of women of the study population (n=450).*

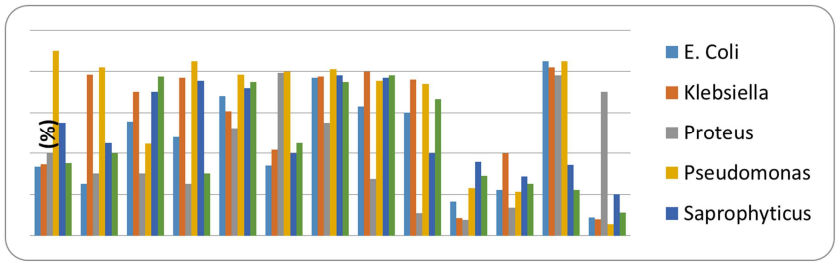

Figure 2. *Antibiotic resistance pattern of the bacterial species isolated from urine samples.*

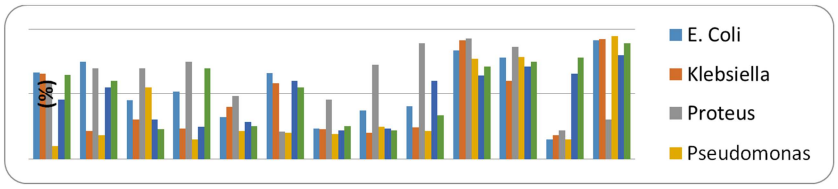

Figure 3. *Antibiotic sensitivity pattern of the bacterial species isolated from urine samples.*

Figure 4. *Azithromycin in antibiotic susceptibility testing by disc diffusion method.*

Figure 5. *Sensitivity of Imipenem (A), Gentamicin (B), Amikacin (C), Ciprofloxacin (D) and Gatifloxacin (E) exhibited moderate resistance and moderate susceptibility.*

4. Discussion

In the present study, midstream urine samples were collected from female patients having clinically suspected UTI attending the OPDs or admitted to Rajshahi Medical College Hospital, Rajshahi, SZMCH, Bogra, Rangpur Medical College, Rangpur, Dinajpur Medical College, Dinajpur, Combined Military Hospital (CMH), Bogra located in the Northern regions of Bangladesh. In the present study, the predominance of both asymptomatic and symptomatic UTIs among pregnant women (88.89 vs. 70.10%) was noticed as compared to non-pregnant (29.63% vs. 29.90%). The urinary tract undergoes profound physiological and anatomical changes during pregnancy facilitating the development of bacteriuria both symptomatic and asymptomatic in women. [24] Diabetes mellitus (DM) has long been considered to be a predisposing factor for urinary tract infection [25] and the urinary tract is the principle site of the infection in diabetics with increased risk of complications of UTI. [26] It is evident from literature that diabetic subjects are at high risk of UTIs. For instance, in a study [27], the prevalence of UTI in diabetic subjects were found to be higher when compared with non-diabetic subjects (9% vs. 0.78%). Symptomatic and asymptomatic UTIs occur more frequently in women with diabetes mellitus than women without diabetes mellitus. [28] However, gestational diabetes mellitus was not associated with increased risk of UTls. [29] Observation of the current study is that symptomatic and asymptomatic UTIs were more common in hypertensive subjects (59.79% vs. 55.55%) than subjects with normal blood pressure (37.11% vs. 42.59%) and hypotension (3.09% vs. 1.85%). Study of age-wise incidence of UTI showed that the highest UTI sufferers (44.44%) were the most sexually active women (26-35 years age group) followed by (31.08%) of 36-45 years; while the least sufferers of UTI (24.83%) were women of 15-25 years. A study conducted in Bangladesh by Kawser Parveen et al. [30] reported high incidence of UTI in 21–25 years age group (44.61%) and show disagreement with our finding. Education seems to play a significant role in preventing the incidence of UTI and its incidence was extremely low (4.64%) in patients having Master's degree; while very high (45.03%) among the Illiterate in the present study. This is consistent with many studies, which shows that UTI is more prevalent among young married women. This finding of ours shows good harmony with another similar study conducted in our country by Kawser Parveen et al. [30] In their study, the significance of education was also evidenced by the fact that only 10% of the patients suffering from bacteriuria were educated while 90% were illiterate. Of the 151 isolates analyzed, Gram-negative bacteria occurred more frequently than Gram-positive bacteria, constituting 99 (65.56%) of the total isolates. Among the Gram (–)ve organisms the significant isolate was *E. coli* which had the highest percentage of isolation 64 (42.38%), followed by *Pseudomonas aeruginosa* 19 (12.58%), *Klebsiella spp.* 8 (5.29%) and *Proteus sp* 8 (5.29%). Gram-positive bacteria accounted for 40 (34.44%) of the total isolates, with *Staphylococcus saprophyticus* 31 (20.52%) and *Staphylococcus aureus* 9 (5.96%). Mixed cultures of *Klebsiella spp.* and *Staphylococcus spp.* accounted for 12 (7.947%) of the total isolates. The most common bacterial isolates from midstream urine samples of women from asymptomatic UTI and symptomatic UTI enrolled in our study were Gram – negative *Escherichia coli* (42.38%),) followed by *Pseudomonas aeruginosa* (12.58%). Rahman et al. [31] and Ahmed and Rashid [32] in their studies in Bangladesh also reported *E. coli* as being the commonest pathogen responsible for bacteriuria which is consistent with the findings of this study. The findings of *E. coli* are also in agreement with the study done by Sharmin [33] in Bangladesh. Another study done by Hasan et al. [34] in a tertiary hospital in Indian study showed 50.7% incidence of UTI caused by *E. coli*, which was nearer to our study. UTI caused by *P. aeruginosa* isolated were 10.78% reported by Sharmin [33] in Bangladesh. Anbumani and Mallika [36] showed 11% UTI caused by *P. aeruginosa* were very close to our finding. As per findings of our study, *E coli* exhibited highest sensitivity (91.2%) towards Imipenem, followed by Amikacin (83.55%) and Gentamicin (78%) sensitivity (Table 4) which is in good agreement with the same findings by Sharmin [34] in Bangladesh. Our study found *Klebsiella* showing highest resistance to Azithromycin (82%), followed by Cefixime (78.5%), Nalidixic acid (77.45%), Gatifloxacin (77%), Ceftriaxone (75.95%), Ciprofloxacin (70%) and Cotrimoxazole (60.55%). In our study similarly, *Klebsiella* was found to be highly sensitive towards Imipenem (92.08%), Amikacin (91.5%). Farzana Rahman et al. [36] in their study in Dhaka City reported *Klebsiella spp.* also showed high sensitivity to Amikacin (91.5%) and Imipenem (92.08%) which is in harmony with our findings. In our study *Proteus* species showed highest resistance to Nitrofurantoin (79.35%), followed by Azithromicin (78%). Study done in India showed almost similar results observed by us where *Proteus* was 100% resistant towards Nitrofurantoin. [35] Kenechukwu et al. [37] also reported in another study that Proteus was 70% resistant to Nitrofurantoin shows good harmony with our study findings. In our study *Proteus* showed moderate resistance of 55% to Nalidixic acid and Cotrimoxazole (52.3%). High sensitivity was also observed to Gentamicin (86.20%) and Ceftriaxone (72.41%), which is consistent with our finding.

5. Limitations of the Study

In spite of maximum sincerity and dedication invested to carry out the present study; it is never free of limitations as the sample size was not large enough. Again, due to lack of proper logistic support, the genetic analysis of resistant bacteria that could help us finding the actual cause behind the emerging drug resistance could not be performed by us.

6. Conclusion and Recommendations

Under the present study, very alarming level of antibiotic

resistance has been observed were Ciprofloxacin and even newer floroquinones like Gatifloxacin, the broad-spectrum antibiotics and major anti-pseudomonad weapons are becoming moderately sensitive to bacteria causing UTI. Ciprofloxacin, Gatifloxacin, Cephradine and Cefixime (Except *Klebsiella* and *Pseudomonas* showing > 79 and 90% resistance, respectively) exhibited moderate to less moderate sensitivity in many cases under the study. The overall antibiotic susceptibility testing of the major isolated uropathogen *E. coli.* and other uropathogens of the present study indicated that most uropathogens exhibited very higher level of resistance to the commonly used antibiotics such as Azithromycin, Nalidixic acid and Cotrimoxazole. These drugs have limited value for the treatment of UTI and should no longer be used. Moreover, from the findings of the study it can be concluded that the major pathogen *E. coli* causing UTI in the Northern regions of Bangladesh and other gram negative (as well as gram positive) isolates were more highly sensitive to Imipenem, Amikacin and Gentamicin as compared to the other antibiotics tested. It is recommended that, antibiotics should be prescribed after performing a routine microscopy and culture/ sensitivity of urine in order to inhibit acquisition and spread of drug resistance by the bacteria. Antimicrobial sensitivity testing is needed for selection of antibiotics for treatment of UTI patients. Routine monitoring of drug resistance pattern will help to identify the resistance trends regionally.

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Self

Conflict of Interest

Not declared

Declaration

Dr. Rozina Aktar Zahan is also a PhD Fellow, Institute of Biological Sciences, University of Rajshahi, Rajshahi, Bangladesh

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