



Causative Agent and Susceptibility Pattern of Pathogenic Bacteria in Urinary Tract Infection at Combined Military Hospital (CMH) Rangpur, Bangladesh

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Abstract

Background: The distribution of urinary pathogens and their resistance pattern to antimicrobial drugs vary regionally and even in the same region. The purpose of this study was to determine the prevalence of bacteriological pattern that causes of urinary tract infections (UTIs) and to assess their sensitivity to commonly used antimicrobial agents at Combined Military Hospital (CMH), Rangpur cantonment.

Materials & Methods: This retrospective cross sectional study was conducted by gaining the required information from 144 patients records for 3 months from September 2019 to November 2019 to find out the causative pathogens & their antibiotic sensitivity pattern of UTIs patients. Mid-stream urine samples were processed for microscopy and culture; the organisms were identified by standard methods. Antimicrobial sensitivity was carried out by Kirby-Bauer disk diffusion method according to clinical and laboratory standards institute guidelines.

Results: Out of total 144 mid-stream urine samples collected from suspected cases of UTIs of which total 32(22.22%) samples were positive for urine culture. Out of 32 culture positive samples 31(96.87%) were males and 1(3.12%) were females indicating that prevalence of UTIs is higher in male than female in Combined Military Hospital (CMH), Rangpur cantonment.

Conclusion: *Escherichia coli* is still the most common uropathogen & the choice of drugs in the treatment of UTIs is quite narrow today due to wide range of resistance of commonly used drugs which have been used previously.

Keywords: Bacteria, antibiotics.

Introduction

Urinary tract infection (UTI) states the microbial capture and infection of structures of the urinary tract. UTIs is categorized by infection site as pyelonephritis for kidney, cystitis for urinary bladder, urethritis for urethra or can classified as complicated or uncomplicated.¹ UTIs are among the most prevailing infectious diseases in the community with substantial clinical and financial burden.² Almost 95% of all UTIs are caused by bacteria, most of them by *Escherichia coli* (30%–90%, depending on clinical setting).¹ *Klebsiella*, *Enterobacter*, *Proteus*, *Pseudomonas*, *Enterococcus*, *Staphylococcus*, and others can also

cause of UTIs.^{1,3} Antibiotic resistance among bacteria causing common infections is increasing in all regions of the world.⁴ It is interesting that pattern of resistance observed varies from hospital to community, large hospital to small hospital, state to state, and even vary from country to country.⁵ Emergence of resistance to antibiotics illustrates importance of using evidence-based strategies for treatment.⁶ In UTIs cases, antibiotic treatment is often started empirically before the results of urine culture and susceptibility testing are available. Appropriate antibiotic use in patients with UTIs seems to reduce length of hospital stay and therefore favors patient

outcomes and healthcare costs.⁷ UTIs are the second most common infections observed in clinical practice following the infections of the respiratory tract.⁸ It was reported that approximately 10% of humans are being affected by UTIs at some stage during their lifetime.⁹ The appropriate treatment of UTIs constitutes a great proportion of prescription of antibiotic and the choice of antibiotics is affected by local resistance pattern of uropathogens.¹⁰ The distribution of urinary pathogens and their resistance pattern to antibiotics vary regionally; therefore, it is important to have regional hospital based knowledge of causative urinary pathogens and their susceptibility pattern to various antibiotics.¹¹ Periodic evaluation of antimicrobial susceptibility is essential as the pattern of antibiotic sensitivity may vary over short period of time.¹² Treatment of UTIs constitutes a major portion of prescription of antibiotics and urinary pathogens have shown a changing pattern of susceptibility to antibiotics, thus an increase trend of resistance against commonly prescribed antibiotics is observed.¹³ The antibiotic resistance is a global problem and requires taking measures to combat this problem. Therefore, it is necessary to identify the causative pathogens and their susceptibility to various antibiotics for a better therapeutic outcome. The purpose of this study is to determine the prevalence of bacteriological pattern that causes urinary tract infections and to assess their sensitivity to commonly used antimicrobial agents

at Combined Military Hospital (CMH), Rangpur cantonment.

Material & Methods

This retrospective cross sectional study on sensitivity pattern of uropathogens was conducted by gaining the required information from patients' record in microbiology department of Combined Military Hospital (CMH), Rangpur cantonment for the period of 3 months from September 2019 to November 2019. Mid-stream urine samples were processed for microscopy and culture; the organisms were identified by different biochemical test. The biochemical test used for identification of oxidase test, triple sugar iron agar, citrate utilization test, motility test, in dole and urease test. Antibiotic sensitivity was carried out by Kirby-Bauer disk diffusion method according to clinical and laboratory standard institute guideline.

Results

Table I: Rate of urinary pathogens growth (N=144)

Pathogens	Positive Culture(n)	%
Growth	32	22.22
Non growth	112	77.78
Total	144	100.00

Table I shows out of 144 urine samples, collected from suspected case of UTIs for culture sensitivity testing, of which 32 (22.22%) sample were positive for urine culture.

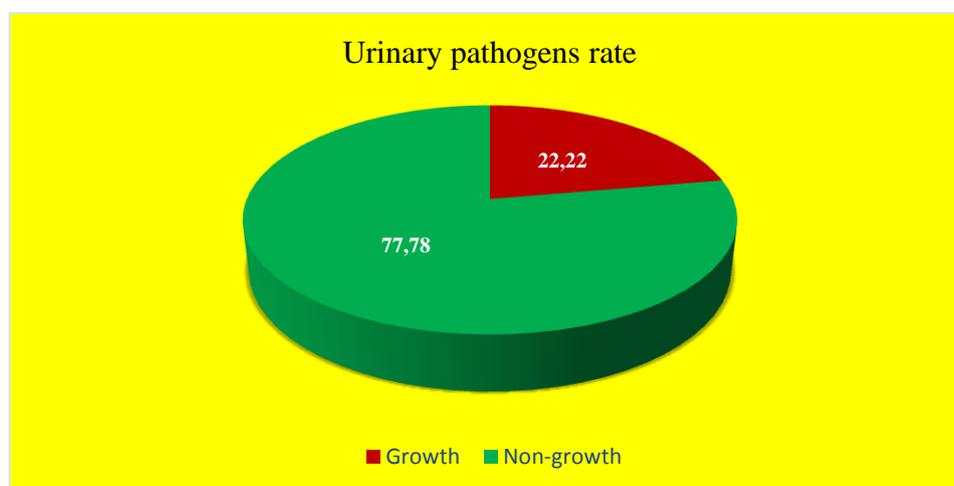


Figure: 1 Urinary pathogens rate

Table II: Type of urinary pathogens of positive growth patients (n=32)

Type of Microorganisms Isolates	n	%
Escherichia coli	11	34.37
Acinetobacter	10	31.25
Staphylococcus species	5	15.63
Klebsiella	4	12.5
Pseudomonas	2	6.25
Total	32	100.00

Table II shows that the common microorganisms isolated was Escherichia coli 11(34.37%), followed by Acinetobacter 10(31.25%), Staphylococcal species 5(15.62%), Klebsiella

4(12.5%) and Pseudomonas 2(6.25%). Escherichia coli was the most common organism causing urinary tract infection in both male and female of all age group.

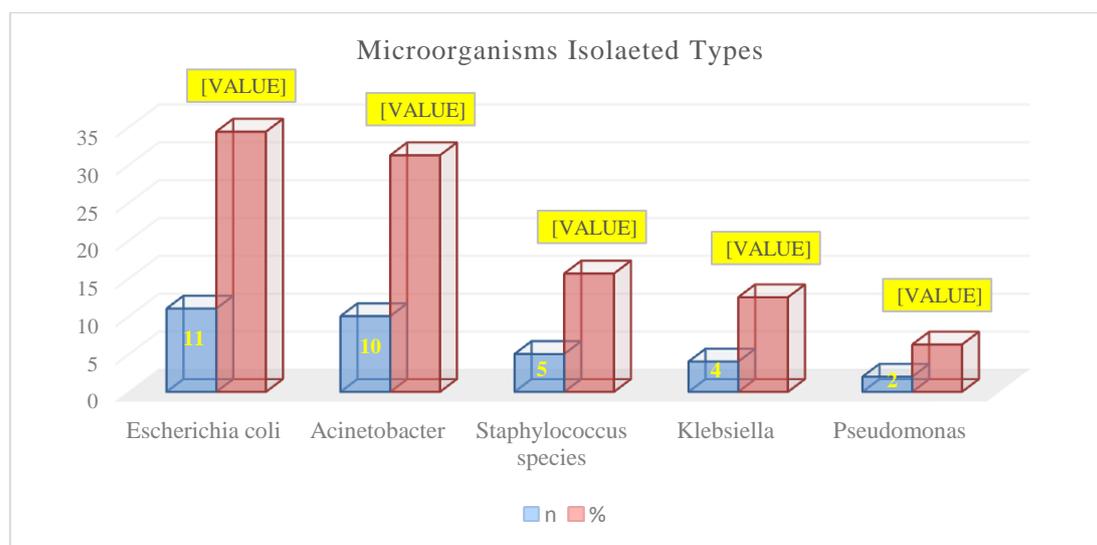


Figure: 2 Urinary pathogens rate

Table III: Age & sex distribution of study population (n=32)

Age group	Male	Female	Total
Up to 10 years	4	Nil	4
11-20 years	1	Nil	1
21-30 years	10	Nil	10
31-40 years	9	Nil	9
41-50 years	1	Nil	1
51-60 years	2	Nil	2
>60 years	4	1	5
Total	31(96.87%)	1(3.13%)	32

Table III shows out of 32 growths positive sample highest 31(96.87%) were from male patients and 1 (3.13%) were from female patient indicating that prevalence of UTIs is higher among males than

female. 21-30 age group were highest 10 of UTIs among male patients followed by the age group 31- 40, which were 9 in figure.

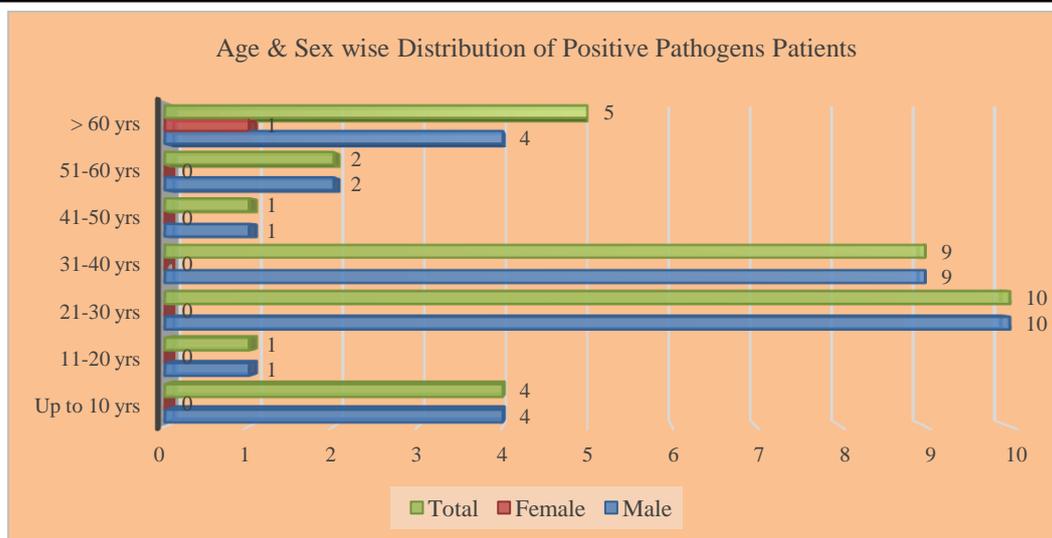


Figure: 3 Age & Sex wise Distribution of Positive Urinary Pathogens Patients

Table IV: Antimicrobial susceptibility patterns of isolated pathogens (n=5).

Antibodies	Sensitivity Pattern	E. coli (n=11)	Acenetobacter (n=10)	Staphylococcal species (n=5)	Klebsiella (n=4)	Pseudomonas (n=2)
Amoxicillin	Sensitive	4(37%)	1(10%)	0(0%)	2(50%)	0(0%)
	Resistant	7(63%)	9(90%)	5(100%)	2(50%)	2(100%)
Azithromycin	Sensitive	3(27%)	5(50%)	1(20%)	1(25%)	1(50%)
	Resistant	8(73%)	5(50%)	4(80%)	3(75%)	1(50%)
Amikacin	Sensitive	6(55%)	5(50%)	3(60%)	2(50%)	2(100%)
	Resistant	5(45%)	5(50%)	2(40%)	2(50%)	0(0%)
Co-trimoxazole	Sensitive	0(0%)	1(10%)	0(0%)	0(0%)	0(0%)
	Resistant	11(100%)	9(90%)	5(100%)	4(100%)	2(100%)
Ciprofloxacin	Sensitive	8(73%)	8(80%)	3(60%)	4(100%)	2(100%)
	Resistant	3(27%)	2(20%)	2(40%)	0(0%)	0(0%)
Cephadrine	Sensitive	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)
	Resistant	11(100%)	10(100%)	5(100%)	4(100%)	2(100%)
Ceftriaxone	Sensitive	6(55%)	5(50%)	5(100%)	4(100%)	2(100%)
	Resistant	5(45%)	5(50%)	0(0%)	0(0%)	0(0%)
Ceforoxime	Sensitive	7(63%)	8(80%)	2(40%)	2(50%)	1(50%)
	Resistant	4(37%)	2(20%)	3(60%)	2(50%)	1(50%)
Gentamycin	Sensitive	10(91%)	8(80%)	3(60%)	3(75%)	2(100%)
	Resistant	1(9%)	2(20%)	2(40%)	1(25%)	0(0%)
Levofloxacin	Sensitive	3(27%)	3(30%)	3(60%)	2(50%)	1(50%)
	Resistant	8(73%)	7(70%)	2(40%)	2(50%)	1(50%)
Meropenem	Sensitive	7(63%)	8(80%)	2(40%)	1(25%)	1(50%)
	Resistant	4(37%)	2(20%)	3(60%)	3(75%)	1(50%)
Nitrofurantoin	Sensitive	8(73%)	10(100%)	4(80%)	4(100%)	2(100%)
	Resistant	3(27%)	0(0%)	1(20%)	0(0%)	0(0%)

Table IV shows that escherichia coli was more sensitive to gentamycin (91%), nitrofurantoin (73%), ciprofloxacin (73%) and resistant to most commonly used drugs cephradine (100%), cotrimoxazole (100%) and azithromycin (73%). Acenetobacter species were sensitive to nitrofurantoin (100%), ciprofloxacin (80%), gentamycin (80%) and meropenem (80%) and

resistant to cephradine (100%), amoxicillin (90%), co- trimoxazole (90%). Staphylococcal species were more sensitive to ceftriaxone (100%), nitrofurantoin (80%), amikacin (60%), ciprofloxacin (60%), levofloxacin (60%) and resistant to amoxicillin (100%), cephradine (100%), co- trimoxazole (100%), azithromycin (80%). Klebsiella species were 100% sensitive to

ceftriaxone (100%) & nitrofurantoin (100%) and resistant to co-trimoxazole(100%), cephradine (100%), meropenem (75%) and azithromycin (75%). Pseudomonas species were 100% sensitive to amikacin, gentamycin, ciprofloxacin, ceftriaxone and nitrofurantoin and 100% resistant to amoxicillin, co- trimoxazole, cephradine.

Discussion

UTIs is a one of the most common diseases diagnosed worldwide. Availability of new antimicrobials has improved the management of UTIs. However, the management of UTIs infections has been jeopardized by increase in emergence of antimicrobial resistance.¹⁴ Escherichia coli is the most commonly reported pathogen causing UTIs.¹⁴⁻¹⁸ This is also reflected in this study. In the study done by Durgesh et al¹⁰ Escherichia coli was the Predominant (31.25%) isolates causing UTIs, followed by staphylococcus Aureus (25%), Pseudomonas aeruginosa (15.62%), Proteus mirabilis (15.62%), Klebsiella Pneumonia (6.25%) and Serratia (6.25%) where as in our study the most common organism causing UTI was Escherichia coli (67%) followed by Klebsiella Pneumonia (21%), Non Haemolytic Streptococcus (4%), Enterobacter (2%), Acinetobacter (2%), Proteus (2%) and similarly, in the study done by Yolbas et al¹⁵ and Mostafa et al¹⁷ escherichia coli was the most common organism causing urinary tract infection followed by Klebsiella which was similar to our study. Similar results were observed in studies done by Rehaman et al¹² and CW kwan et al.¹⁹ This difference may be due to the variation in community and hospital settings, the etiology of UTIs and the antimicrobial sensitivity of UTI causing organisms change rapidly over short period.^{20, 21}

In a study done by Uwaezuoke & Ogbulie in Nigeria in 2006, found that nitrofurantoin and gentamicin were found to be 80% effective against strains of E. coli.²² The selection of antibiotic against any urinary tract pathogen depends on the antibiotic resistance pattern, its

pharmacokinetic properties, dose quantity and timings, its effects and adverse effects caused by that drug.²³ Antimicrobial resistances is a big problem and cause of great concern throughout the world. Knowledge of the antibacterial resistance among uropathogens is essential to provide appropriate cost effective therapy.²⁴ Amongst the bacteria causing UTIs, E. coli remains a common etiology (34.37%), other bacteria like Acinetobacter, Gram-negative bacilli e.g. Pseudomonas, and gram-positive bacteria staphylococcus species are frequently isolated. Overall, aetiology and resistance patterns are notpredictable for those with serious UTIs, necessitating confirmation by culture and susceptibility testing.²⁵ A total 144 urine samples were analyzed in our study between September 2019 to November 2019. The prevalence of E. coli was the highest with 34.37 % among other uropathogens. Other pathogens are acinetobacter (31.25%) Staphylococcus species with 15.62%, klebsiella species with 12.05% & pseudomonas with 6.25%. In our study the escherichia coli are more sensitive to gentamycin, (91%), nitrofurantoin (73%), ciprofloxacin (73%) and resistant to most commonly used drugs cephradine (100%), cotrimoxazole (100%) and azithromycin (73%). As the antibiotic sensitivity pattern changes very rapidly especially true for developing countries there are some differences in sensitivities to antimicrobial drugs between centers of study around the world.²⁵ From all the studies, it is evident that the uropathogens are least resistant to amikacin & meropenem. This may be due to less common use of these injectable antibiotics. Moderate resistance is seen with cephalosporins & third generation fluoroquinolones. More resistant pattern is seen with co-trimoxazole. This may be due to wide use of these drugs as empirical therapy for the treatment of UTIs. In this study population, male patients are higher and females are less due to male patients are more in the outpatient departments and in the intensive care unit of Combined Military Hospital (CMH), Rangpur

cantonment than female patients. Besides these, male individuals are greater in number than females in the cantonment.

Conclusion

Escherichia coli is the most common uropathogen causing urinary tract infection. Amikacin remains the first line intravenous antibiotic in hospitalized patients. It has also demonstrated an increasing resistance to co-trimoxazole, cephadrine and amoxicillin. Sensitivity to amikacin, nitrofurantoin and meropenem are still retained and are good choices for treatment of UTIs. But these sensitivity patterns are getting changes each year due to empirical use. Therefore, routine monitoring of sensitivity pattern is necessary for empirical treatment of UTIs for the clinicians and for preparation of antibiotic guideline for individual institute.

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