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Causative Agents and Sensitivity Pattern of Pathogenic Bacteria in Urinary Tract Infection at A Tertiary Level Hospital

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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. **Objective:** The purpose of this study was to determine the prevalence of bacteriological pattern that causes UTIs and to assess their sensitivity to commonly used antimicrobial agents in Rangpur community medical college hospital. **Methodology:** This cross sectional study was conducted by gaining the required information from the patient's records to find out the causative pathogens & their antibiotic sensitivity pattern in of urinary tract infections (UTIs) patients. Midstream 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. **Result:** Out of total 542 mid- stream urine samples collected from suspected cases of UTIs of which total 273 (50.06%) samples were positive for urine culture. Of 273 culture positive samples of which 97 (35.53%) were males and 176 (64.46%) were females indicating that prevalence of UTIs is higher in females than males. Maximum patients were from 21-30 yrs age group. *Escherichia coli* (56.04%) was found the most common organism followed by *Staphylococcus species* (36.26%), *Klebsiella species* (1.09%) and *Pseudomonas species* (0.73%). *Escherichia coli* was more sensitive to meropenem (98.68%), nitrofurantoin (95.65%), amikacin (92.15%) and least sensitive to most commonly used drugs like cefuroxime (35.92%), cefixime (43.39%) , cotrimoxazole (47.71%) and ciprofloxacin (48.92%). **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 infections (UTIs) are the second most common infections observed in clinical practice after the infections of the respiratory tract.¹ It was reported that approximately 10% of humans are being affected by UTIs at some stage during their lifetime.² 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.³ 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.⁴ Periodic evaluation of antimicrobial

susceptibility is essential as the pattern of antibiotic sensitivity may vary over short periods of time.⁵ Treatment of UTIs constitutes a major portion of prescription of antibiotics and urinary pathogens have shown a changing pattern of susceptibility to antibiotics, thus there is an increase in resistance pattern to commonly prescribed antibiotics.⁶

The antibiotic resistance is a global problem and requires taking measures to combat this problem. The distribution of urinary pathogens and their resistance pattern to antimicrobial drugs vary regionally and even in the same region. 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 in Rangpur community medical college hospital.

Materials and Methods

This cross sectional study on the sensitivity pattern of uropathogens was conducted by gaining the required information from the patient's records in microbiology department of Rangpur Community Medical College Hospital, for the period of 1 year from May 2014 to April 2015. Mid stream urine samples were processed for microscopy and culture, the organisms were identified by different biochemical test. The biochemical tests used for identification were oxidase test, triple sugar iron agar, citrate utilization test, motility test, indole and urease test. Antibiotic sensitivity was carried out by Kirby-Bauer disk diffusion method according to clinical and laboratory standards institute guidelines.

Results

Table I shows out of 542 urine samples, collected from suspected case of UTIs for culture sensitivity testing, of which 273 (50.06%) samples were positive for urine culture.

Table-I: Rate of growth of isolation from the urine samples collected (n=542).

Pathogens	No of positive culture
Growth	273 (50.06%)
No growth	269 (49.63%)
Total	542(100%)

Table II shows Out of 273 growth positive samples a total 176 (64.46%) were from female patients and 97 (35.53%) were from male patients indicating that prevalence of UTIs is higher among females. It is clear that in female the UTIs are more common among patients within 21 to 30 years of age, where as in males the UTIs are more prevalent among the patients above 61 years of age, as shown in table II.

Table-II: Age and sex distribution of the study population (n=273).

Age group (Year)	Male n	Female n	Total no. of patients n
1 – 11	01	01	02
1 – 10	02	00	02
11 – 20	11	26	37
21 – 30	11	47	58
31 – 40	09	33	42
41 – 50	11	31	42
51 – 60	16	18	34
>61	36	20	56
Total	97 (35.53%)	176 (64.46%)	273 (100.00%)

Table III shows that the common microorganisms isolated were *Escherichia coli* (56.04%), *Staphylococcal species* (36.26%), *Klebsiella species* (1.09%) and *Pseudomonas species* (0.73%). *Escherichia coli* is the most common microorganism causing urinary tract infection in both men and women of all age groups.

Table-III: Rate of isolation of pathogen from urine samples (n=273).

Pathogens	No of positive culture
<i>Escherichia coli</i>	153 (56.04%)
<i>Staphylococcal species</i>	99 (36.26%)
<i>Klebsiella species</i>	03 (1.09%)
<i>Pseudomonas species</i>	02 (0.73%)
Others	16 (5.86%)
Total	273 (100%)

Table IV shows that *Escherichia coli* are more sensitive to meropenem (98.68%), nitrofurantoin (95.65%), Amikacin (92.15%) and resistant to most commonly used drugs cefuroxime (64.07%), cefixime (56.60%), cotrimoxazole(52.28%) and ciprofloxacin (51.07%).

Staphylococcal species are more sensitive to nitrofurantoin (95.60%), amikacin (94.94%), meropenem (92.70%), and amoxycylav (92.59%) and resistant to cefixime (66.66%), azythromycin(65.30%), ciprofloxacin (50.54%). *Klebsiella species* are 100% sensitive to amikacin,

amoxyclav, cefixime, ceftazidime, cefuroxime, cotrimoxazole, meropenam and nitrofurantoin and resistant to azythromycin (33.33%), ceftriaxone (33.33%), ciprofloxacin (33.33%) & levofloxacin (33.33%).

Pseudomonas species are 100% sensitive to amikacin, amoxyclav, azythromycin, meropenem and nitrofurantoin and 100% resistant to cefixime, ceftazidime, ceftriaxone and cefuroxime.

Table–IV: Rate of sensitivity pattern of isolated organism (n=273).

Name of antibiotics	E. coli (N=153)			Staph. Sp. (N=99)			Klebsiella sp. (N=3)			Pseudomonas (N=2)		
	Isolates tested	Sensitive	Resistance	Isolates tested	Sensitive	Resistance	Isolates tested	Sensitive	Resistance	Isolates tested	Sensitive	Resistance
Amikacin	153	141 (92.15%)	12 (7.84%)	99	94 (94.94%)	05 (5.05%)	3	03 (100%)	00 (00%)	2	02 (100%)	00 (00%)
Amoxyclav	88	69 (78.40%)	19 (21.59)	54	50 (92.59%)	04 (7.40%)	2	02 (100%)	00 (00%)	1	01 (100%)	00 (00%)
Azythromycin	148	98 (66.21%)	50 (33.78%)	98	34 (34.69%)	64 (65.30%)	3	02 (66.66%)	01 (33.33%)	2	02 (100%)	00 (00%)
Cefixime	53	23 (43.39%)	30 (56.60%)	39	13 (33.33%)	26 (66.66%)	1	01 (100%)	00 (00%)	1	00 (00%)	01 (100%)
Ceftazidime	151	115 (76.15%)	36 (23.84%)	96	65 (67.70%)	31 (32.29%)	3	03 (100%)	00 (00%)	2	00 (00%)	02 (100%)
Ceftriaxone	151	97 (64.23%)	54 (35.76%)	97	75 (77.31%)	22 (22.68%)	3	02 (66.66%)	01 (33.33%)	2	00 (00%)	02 (100%)
Cefuroxime	103	37 (35.92%)	66 (64.07)	67	53 (79.10%)	14 (20.89%)	2	02 (100%)	00 (00%)	1	00 (00%)	01 (100%)
Ciprofloxacin	139	68 (48.92%)	71 (51.07%)	91	45 (49.45%)	46 (50.54%)	3	02 (66.66%)	01 (33.33%)	2	01 (50%)	01 (50%)
Cotrimoxazole	153	73 (47.71%)	80 (52.28%)	97	54 (55.67%)	43 (44.32%)	3	03 (100%)	00 (00%)	2	01 (50%)	01 (50%)
Levofloxacin	111	60 (54.05%)	51 (45.94%)	76	56 (73.68%)	20 (26.31%)	3	02 (66.66%)	01 (33.33%)	2	01 (50%)	01 (50%)
Meropenem	152	150 (98.68%)	02 (1.31%)	96	89 (92.70%)	07 (7.29%)	3	03 (100%)	00 (00%)	2	02 (100%)	00 (00%)
Nitrofurantoin	138	132 (95.65%)	06 (4.34%)	91	87 (95.60%)	04 (4.39%)	3	03 (100%)	00 (00%)	2	02 (100%)	00 (00%)

Discussion

In community and hospital settings the etiology of UTIs and the antimicrobial sensitivity of UTI causing organisms changes rapidly over short period.^{7,8} The purpose of this study was to determine the prevalence of bacteriological pattern that causes UTIs and to assess their sensitivity to commonly used antimicrobial agents in Rangpur community medical college hospital. Amongst the bacteria causing UTIs, *E. coli* remains a common etiology (60%), other bacteria like Enterobacteriaceae other than *E. coli*, Gram-negative bacilli e.g. *Pseudomonas aeruginosa*, and Gram-positive bacteria *Staphylococcus aureus* are frequently isolated. overall, aetiology and resistance patterns are not predictable for those with serious UTIs, necessitating confirmation by culture and susceptibility testing⁹.

A total 542 urine samples were analyzed in our study between 2014 to April 2015. The prevalence of *E. coli* was the highest with 56.04% among other uropathogens. Other pathogens are *Staph. Species* with 36.26%, *Klebsiella species* with 1.09% & *Pseudomonas* with 0.73%. In a similar study done on Saint Camille Medical Center Pakistan, indicated that *E. coli* was the leading agent that causing UTIs with 32.76%, followed by *S. aureus* 22.74% and *K. pneumoniae* with 10.45%.¹⁰

In our study the females are more susceptible to UTIs than males and the prevalence of UTIs in females & males were 64.46% & 35.53% respectively, indicating that prevalence of UTI is higher among females.

In our study the *E. coli* isolated showed higher sensitivity to meropenem (98.68%), nitrofurantoin (95.65%) & Amikacin (92.15%). Resistance seen maximum to most commonly used drugs cefuroxime (64.07%), cefixime (56.60%), cotrimoxazole (52.28%) & ciprofloxacin (51.07%). 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.¹¹ In a similar study done in Britain it was found that approximately 99% of all isolates were sensitive to Norfloxacin and Ciprofloxacin, 95% to Co-amoxiclav, 87% to Nitrofurantoin, 75% to trimethoprim & the cephalosporins & 50% to amoxicillin.¹² Shalini et al in their study found that nitrofurantoin was effective against 93% isolates of *E. coli* & amikacin (98.91%) showed highest sensitivity against *E. coli*.¹³ In a study Rajbhandari et al have reported that nitrofurantoin is the most sensitive antibiotic (68.8%) followed by gentamycin, norfloxacin & ciprofloxacin.¹⁴ Our study suggests that nitrofurantoin, amikacin & meropenem were effective against *E. coli*, *Staph. species*, *Klebsiella species* & also against *Pseudomonas*. In another recent study it was found that more than 90% of *E. coli* was suspected to produce extended-spectrum beta-lactamase (ESBL) and amikacin & nitrofurantoin were the only drugs to which more than 90% of *E. coli* were susceptible.¹⁵ In our study *E. coli* isolates were resistant to most commonly used drugs cefuroxime (64.07%), cefixime (56.60%), cotrimoxazole (52.28%) & ciprofloxacin (51.07%). Over the last decade, the treatment choice for UTIs has changed from co-trimoxazole to quinolones because of high level of resistance & therapeutic failure to co-trimoxazole.¹⁶ Kumari et al conducted a study in eastern part of Nepal & it was found that *E. coli* was resistant to ampicillin & ciprofloxacin.¹⁷ In a study in Pakistan it was found that among the oral agents Nitrofurantoin & ciprofloxacin and among the parenteral agents, amikacin & gentamicin had highest activity against *E. coli*. The activity of ceftriaxone, nalidixic acid & cephalaxine against *E. coli* has decreased significantly over six years ($P < 0.05$).¹⁸ 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 first & second generation fluoroquinolones. This may be due to wide use of these drugs as empirical therapy for the treatment of UTIs.

Conclusion

This study revealed that *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. 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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