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Urinary Tract Infections in Tertiary Care Hospital in North India: Etiology and Antimicrobial Susceptibility Pattern

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ABSTRACT

Background: *Urinary tract infection (UTI) is one of the most prevalent bacterial infections. Most are mild in nature but, can be complicated with renal involvement and bacteremia. Inappropriate selection of antimicrobials results in emergence of drug resistance and further complications. Microorganisms causing UTI vary in their susceptibility to antimicrobials from place to place and time to time. Hence, there is always need of local susceptibility pattern to determine the therapy.*

Aims: *The present study was designed to determine etiological pathogens and antibiotic susceptibility patterns of common bacterial isolates causing UTI.*

Methods and Material: *Total of 3000 urine samples were included. Isolation and identification was done by semi-quantitative culture technique, Gram's staining and biochemical tests. Antimicrobial susceptibility testing was done by Modified Stroke's disc diffusion method.*

Results: *Out of 3000 samples 306 (10.25%) showed significant bacteriuria. Rate of isolate was higher in females 179 (58.49%). E. coli (70.9%) was most common isolate followed by Klebsiella spp. (17.97%). Highest sensitivity of E. coli was observed with Nitrofurantoin. Higher efficacy of Nitrofurantoin was also observed against Klebsiella spp. Pseudomonas was highly sensitive to Piperacillin + Tazobactam. Ceftriaxone was most effective for Acinetobacter spp.*

Conclusions: *The pattern of sensitivity of bacteria to antibiotics varies over time and with different geographical regions, thus, antibiotic treatment of infections should be based on local experience of Antibiotic Susceptibility patterns.*

INTRODUCTION

Urinary tract infections (UTIs) are one of the most prevalent extra intestinal bacterial infections. UTI is second only to respiratory tract in causing microbial infection especially in females[1]. About 150 million people are diagnosed as having UTI per annum with a high risk of morbidity and mortality. Majority of UTIs are not life threatening and do not cause any irreversible damage. However, when the kidneys are involved, there is a risk of tissue damage with an increased risk of bacteremia[2]. Urinary tract infection may involve only the lower urinary tract or both the upper and the lower tracts. More than 95% of urinary tract infections are caused by a single bacterial species. *E. coli* is the most frequent infecting organisms in acute infection. *Klebsiella*, *Staphylococcus*, *Proteus*, *Pseudomonas*, *Acinetobacter* and *Enterococci* species are more often isolated from inpatients, whereas *E.coli* is mostly isolated from out patient population[3,4].

Microorganisms causing UTI vary in their susceptibility to antimicrobials from place to place and from time to time. The present study was undertaken to determine the prevalence and antibiotic susceptibility patterns of common bacterial isolates causing urinary tract infections.

MATERIAL AND METHOD

In total, 3000 patients with clinical symptoms of UTI, were investigated. Clean catch mid stream urine of the patients was collected in a sterile wide mouth plastic container and immediately transported to the laboratory. Then the bacterial

uropathogens were isolated and tested for antimicrobial drug sensitivity pattern.

For direct microscopy, a wet film preparation was made with 50µl of well-mixed uncentrifuged urine on a slide and a cover slip placed on it. It was viewed under a high power objective. The presence of one pus cell/ 7 hPF was considered significant pyuria[5]. Gram's staining was performed. Isolation of uropathogens was performed by surface streak procedure on both blood and Mac Conkey's agar using calibrated loops for semi-quantitative method and incubated aerobically at 37⁰C for 24 hour, and those cultures which became negative at the end of 24 hours incubations were further incubated for 48 hours. Bacterial growth was considered significant if the culture media showed growth of one or two organisms at a concentration of $\geq 10^5$ CFU/ml. Bacterial identification was made using standard biochemical tests.

Antimicrobial susceptibility testing of isolates was done for all bacterial uropathogens by Modified Stokes' disc diffusion method. The antibiotic discs used were Nitrofurantoin, Gentamycin, Ceftriaxone, Ciprofloxacin, Amoxycillin, Cephalexin, Aztreonam, Ceftazidime, Amikacin, Piperacillin + Tazobactam, Erythromycin and Ofloxacin. The following are the quality control strains used: *Pseudomonasaeruginosa* – NCTC 10662, *Staphylococcus aureus* – NCTC 6571, *Escherichia Coli* – NCTC 10418.

RESULT

Out of 3,000 urine samples collected from the study, 306(10.2%) showed the significant bacteriuria. The isolates are shown in Table 1. The most sensitive antibiotic pattern of the isolated pathogens are shown in Table 2. In case of *E.coli* which was the principal isolate, most susceptible antibiotics were Nitrofurantoin (76%),

Gentamicin (34%), Ceftriaxone (29%), Ciprofloxacin (20.2%) followed by Cephalexin (17%) and Amoxicillin (7.37%). *Klebsiella* species which was the second most isolated organism showed high susceptibility to Nitrofurantoin (58.18%), Ciprofloxacin (49%), Gentamycin (43.6%) followed by Ceftriaxone (41.8%), Cephalexin (37.7%) and Amoxicillin (1.81%) (Table 3).

Table 1: Frequency of bacterial isolates

Organism	Frequency(%)
<i>E. coli</i>	217 (70.91%)
<i>Klebsiella spp</i>	55 (17.97%)
<i>Pseudomonas spp</i>	17 (5.55%)
<i>Proteus spp</i>	4 (1.30%)
<i>Acinetobacter spp</i>	3 (0.98%)
<i>Staphylococcus aureus</i>	10 (3.26%)

Table 2: Sensitivity pattern of bacterial isolates (n=306)

Organism	Most sensitive antibiotic	No.(%)
<i>E.coli</i>	<i>Nitrofurantoin</i>	165 (76)
<i>Klebsiella spp</i>	<i>Nitrofurantoin</i>	32 (58.18)
<i>Pseudomonas spp</i>	<i>Piperacillin + Tazobactam</i>	13 (76.4)
<i>Proteus spp</i>	<i>Ceftriaxone</i>	3 (75)
<i>Acinetobacter</i>	<i>Ceftriaxone</i>	2 (66.66)
<i>Staphylococcus aureus</i>	<i>Amoxicillin</i>	7 (70)

Table 3: Antimicrobial sensitivity pattern of bacterial isolates from urine culture (% of sensitive strains)

Organism	Fd	CiP	GM	CTX	AX	CF	AK	CFZD	PT	OF	Em	ATM
<i>E.coli</i>	76	20.27	34.10	29.03	7.37	17.05	-	-	-	-	-	-
<i>Klebsiella spp</i>	58.18	49.09	43.63	41.81	1.81	32.72	-	-	-	1.81	1.81	-
<i>Pseudomonas spp</i>	-	64.70	52.94	-	-	-	35.29	70.58	76.47	-	-	70.58
<i>Proteus spp</i>	25	50	50	75	25	-	-	-	-	-	-	-
<i>Acinetobacter spp</i>	-	33.33	33.33	66.66	-	33.33	-	-	-	-	-	-
<i>Staphylococcus aureus</i>	50	40	30	-	70	20	-	-	-	10	30	-

Fd – Nitrofurantion, Cip – Ciprofloxacin, GM – Gentamycin, CTX – Ceftriaxone, Ax – Amoxicillin,

CF – Cephalexin, Ak – Amikacin, CFZD – Ceftazidime, PT – Piperacillin + Tazobactam,

OF – Ofloxacin, Em – Erythromycin, ATM – Aztreonam.

DISCUSSION

The changing trends in the pathogenesis of urinary tract infections and the increasing resistance to the antimicrobial agents are a matter of worldwide concern. Even with adequate preventive measures and the advances in therapy, UTIs still remain the commonest infections, both in the inpatients and in the outpatients. This may be due to advancing age, immunocompromised state, long stay in hospitals, poor hygiene, instrumentation and functional and anatomical abnormalities [6]. Indiscriminate use of antimicrobials also plays an important role in emergence of resistant strains.

Microorganisms causing UTI vary in their susceptibility to antimicrobials from place to place and time to time. Effective management of patients suffering from bacterial UTIs commonly

relies on the identification of the type of organisms that caused the disease and the selection of an effective antibiotic agent to the organism.

The present study provided an outlook on the prevalence and the antibiogram of the uropathogens which were isolated in Maulana Azad Medical College, New Delhi, India. The prevalence of significant isolates observed in our study was 10.2%, which was lower in comparison to the finding Rai et al. in Kathmandu (37.4%) [7] and Mohanty et al. at AIIMS, India (14.7%)[8]. However, it was higher in comparison to the finding of Beyene et al 9.2% in Ethiopia[9] and Saeedi et al 4.95% in Iran[10].

The rate of isolation was higher in females 179 (58.49%) in our study increased susceptibility of

females to UTIs than males, it is similar to the finding which were done by Manjunath et al[11] and Barate D L et al[12]. The increased incidence of infection among females is due to differences between male and female genitourinary systems in anatomy and microflora[13].

The prevalence of Gram positive cocci was not higher in our study; this is similar to other studies in different countries[14]. The enterobacteriaceae families were the most common microorganisms isolated from urinary tract infection in present study accounting 96.3% of total isolated bacteria. There are earlier studies in agreement to present finding[15,16].

E.coli (70.91%) was the predominant organism which was isolated followed by *Klebsiella spp* (17.97%) which was similar to the findings of other Indian studies by Supriya et al[17] and Pallavi Khanna et al[18].

The most effective antibiotic for *E. coli* in this study observed was *Nitrofurantoin*. Higher efficacy of *Nitrofurantoin* was also observed against *Klebsiella spp* in this study. Similar results were reported by Kothari et al[19]. *Pseudomonas spp* was highly sensitive to *Piperacillin+Tazobactam*. Similar results are reported from other countries[20]. Ceftriaxone was the most effective drug of choice for *Acinetobacter spp*. This was because *Acinetobacter* species were widely isolated in hospital shows resistance to the most of the antimicrobial agents[21].

CONCLUSION

The result of our study showed that among the heterogeneous causative organisms of UTI, Enterobacteriaceae are the predominant pathogens. Among Enterobacteriaceae, *E.coli* is the most prevalent pathogen involved in urinary tract infections. The susceptibility pattern of all isolates in this study have shown that Nitrofurantoin possess the highest efficacy for Enterobacteriaceae. Resistance to commonly used antibiotics was observed among most uropathogens. Because the pattern of sensitivity of bacteria to antibiotics varies over time and is different geographical regions, antibiotic treatment of infections should be based on local experience of sensitivity and resistance patterns.

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