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Antimicrobial Susceptibility Pattern of Multidrug Resistant Uropathogens

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ABSTRACT

UTI is a common infection in community, more common in sexually active women. Now a days incidence of infection by multidrug resistant uropathogens is increasing worldwide. Consequently, area specific monitoring studies to document the microorganisms causing UTIs and their antimicrobial susceptibility is mandatory for helping the selection of an effective empirical treatment. Therefore, the present study was aimed at gaining knowledge about the type of pathogens responsible for and their susceptibility patterns at this area.

We studied 300 isolates in which 241(80.3%) were gram negative bacilli, 44(14.6%) were gram positive cocci and 15(5%) were candida spp. Most commonly isolated organism was *E.coli* followed by *Klebsiella* spp, *Citrobacter spp Enterobacter spp*, *Proteus spp*, and *Acinetobacter* spp. In gram positive organism most common was *staphylococci aureus*, followed by *enterococci spp, coagulase negative staphylococcus.* In our study 23% were multi drug resistant. This percentage increase in klebsielllae spp 29% and E coli 24%. We did not found any pan drug resistant organism in our study.

In our study MDR were more found in IPD patients than OPD (61%). In MDR maximum resistant was seen to cephalosporines and amoxicillin/clvulanate while very less resistance to quinolones, netylmicin, gentamycin, piperacillin tazobactam and Imepenem.

Keywords: Uropathogens, Antibiotic Sensitivity Pattern, MDR

I. INTRODUCTION

Antimicrobial Susceptibility Pattern of Multidrug Resistant Uropathogens

Urinary tract infection (UTI) is a common infection in the community and health care facility. It is easily diagnosed and easily treatable in the young and healthy patients. Over last few years UTI caused by multidrug resistant uro-pathogens is increasing worldwide. (1)

Common etiological agents are *Escherichia coli*, *Klebsiella* species, *Enterobacter* species, *Proteus* species, *Staphylococcus aureus*, *Enterococcus* species, *Staphylococcus saprophyticus. E. coli* is the most common organism causing both community as well as hospital acquired infections although the distribution of pathogens that cause UTIs is changing. (2)

Women are at greater risk for UTI than men, because of the relatively short straight urethra, retrograde ascent of bacteria from the perineum. Sexually active women are at greater risk for UTI than other women who do not engage in sexual intercourse. Simple hygiene habits, including voiding before and after sexual intercourse and wiping from anterior to posterior, are often advocated to decrease the risk of UTI. Other risk factors like vesico-ureteral reflux, foreign body in the urinary system like urinary calculi, involving catheters may act as a nidus for infection and may be associated with recurrent infections. Post-menopausal women are at higher risk for UTI than younger women are, because

they lack estrogen, which is essential to maintain the normal acidity of vaginal fluid. This acidity is critical to permit the growth of *Lactobacillus* in the normal vaginal flora, which acts as a natural host defence mechanism against symptomatic UTI.(3)

Studies from various parts of India have shown occurrence of high rates of antimicrobial resistance among *E coli.* The resistance rates of uropathogenic *E. coli* to various antibiotics is increasing worldwide. In the last few decades there have been significant changes in the antimicrobial resistance patterns of uropathogens. Antibiotic resistance varies according to geographic locations and is directly proportional to the use and misuse of antibiotics. The resistance pattern of community acquired UTI pathogens has not been studied extensively.

Gram negative bacilli produce various types of beta lactamases like ESBL, Amp C MBL. Extended spectrum B lactamases (ESBLs) producing organism are resistant to penicillin, cephalosporin and monobactam but not to carbapenem.(4)

However, there is not much information available on etiology and resistance pattern of community acquired UTIs in India. Consequently, area specific monitoring studies to document the microorganisms causing UTIs and their antimicrobial susceptibility is mandatory for helping the selection of an effective empirical treatment. Therefore, the present study was aimed at gaining knowledge about the type of pathogens responsible for and their susceptibility patterns which will help the clinicians to choose the right empirical treatment.

II. METHODS AND MATERIAL

Aims and Objective

1. To study common etiological agents of UTI in our area and their antibiotic resistance pattern in different age group of both male and female.
2. Occurrence of multidrug resistant uropathogens

Study Design

Study was done prospectively on isolates obtained from consecutive, non-repetitive urine samples with significant growth.

Site of Study

Study was done at Research laboratory of Microbiology department of SHKM Govt Medical College and Hospital Nalhar, Mewat and NIMS Medical

Inclusion Criteria

The study included all clinical isolates obtained from growth of mid stream urine sample came to bacteriology lab both OPD as well as IPD.

Exclusion Criteria

1. Patients with urinary tract surgery
2. Patient took antibiotic in last 48 hour.
3. h/o trauma involving urinary tract
4. Patient of HIV or any other immunological disorder

Methodology

A clean voided early morning midstream urine specimens was collected in a sterile container after proper anogenital toilet, before starting antibiotics. Urine samples was examined & processed in the laboratory as soon as possible after collection. In laboratory specimens were examined by wet mounts and Gram staining. Presence of any pus cells, micro-organisms, RBC's cast and crystals or any other finding has to be noted and cultured on Cysteine lactose electrolyte deficient agar (CLED), MacConkey agar and 5% Blood agar using Semi quantitative standard loop method of culture using 0.01mm calibrated loop. These plates were incubated 24 to 48 hrs at 37^0C and observed for growth.

Significant Colony Counts

Obtained growth consider as significant growth when colony count was as follows-

$>10^5$ CFU/ml of midstream urine sample in a female with no risk factors.

$>10^3$ CFU/ml of midstream urine sample in a symptomatic female or in a pregnant female

CFU : colony forming unit

Identification and Antibiotic Susceptibility Test

The isolate was identified on the basis of routine bacteriology protocol Colony morphology, Motility testing, and Biochemical tests. Antibiotic sensitivity test was done on Mueller-Hinton agar by Kirby-Bauer disc diffusion test as per Clinical and Laboratory Standard Institute (CLSI 2014) guidelines.(6,7)

The isolate was considered as multidrug resistant (MDR) when non-susceptible to at least one agent in more than three antimicrobial categories/groups and extensively drug resistant (XDR) if non-susceptible to at least one agent in all but two or fewer antimicrobial categories/ groups i.e. bacterial isolates remain susceptible to only one or two categories. Isolate non-susceptible to all agents in all antimicrobial categories was considered as pan drug-resistant (PDR).(8)

III. RESULTS AND DISCUSSION

We studied 1110 urine samples in which 300 (27%) had significant growth. In those samples 19% were indoor patients while 81% were from various departments in which 207(69%) were female and 93(31%) were male (p value >0.05). Mean age was 24.6years and maximum patients (61.1%) were from age group 15 to 40 years. In total isolates 241(80.3%) were gram negative bacilli, 44(14.6%) were gram positive cocci and 15(5%) were candida spp. Culture positivity in total sample were 19.6% while in female it was high than male (31%, 19%). Culture positivity was highest in female 15 to 40 years, followed by male more than 40 years and least positivity was in male from 16 to 40 years. In our study maximum patients were female from 15 to 40 years age group with high culture positivity rate (38%), Male female ratio in our study were 1:1.7. It was found in many studies that UTI more common in sexually active young females. Our findings were similar to other investigators from various places of country. (9,10,11)

In older age group male were affected more than female, reason behind it might be male have some risk factor like prostate enlargement and other age related problems. Most commonly isolated organism was *E.coli* followed by *Klebsiella* spp, *Citrobacter spp Enterobacter spp, Proteus spp,* and *Acinetobacter* spp. In gram positive organism most common was *staphylococci aureus*, followed by *enterococci spp, coagulase negative staphylococcus*. Our findings are similar to many other studies conducted in different countries either in the region or internationally. (11-15)

The antibiotic sensitivity pattern for gram positive cocci revealed that they were completely susceptible to vancomycin followed by Ciprofloxacin, Gentamicin, Amoxycillin/clavulanate and Ofloxacin. The maximum resistance was seen against cotrimoxazole, cefepime, azithromycin and Erythromycin. The antibiotic sensitivity pattern of the gram negative bacilli revealed that they were highly susceptible to Imipenem, ciprofloxacin and Piperacillin/ Tazobactam followed by Cefoxitin, Amoxycillin/ clavunate, cefepime, amikacin. The maximum resistance was seen against ceftazidime, piperacillin, cotrimoxazole and cefotaxime. Our findings were similar to other studies in country and abroad. (13-16)

Urinary pathogens showed resistance to commonly used antibiotics, on the basis of this study we can conclude that the resistance of commonly used antibiotic is very crucial. The antibiotic treatment should be limited to symptomatic urinary tract infections and be initiated after sensitivity testing only. As drug resistance among pathogens is an evolving process, routine surveillance and monitoring studies should be conducted to provide physicians with knowledge about the most effective empirical treatment of UTIs. All efforts to minimizing the spread of resistant bacteria through appropriate infection control would be quite important and may represent a first step in resolving the issue of resistant microorganisms. Bacterial infection of the urinary tract is one of the common causes for seeking medical attention in the community. Urine is one of the sterile body fluids but the presence of bacteria in urine is called bacteriuria.(16)

In our study 23% were multi drug resistant. This percentage increase in klebsielllae spp 29% and E coli 24%. We did not found any pan drug resistant organism in our study.

In our study MDR were more found in IPD patients than OPD (61%). In MDR maximum resistant was seen to cephalosporines and amoxicillin/clvulanate while very less resistance to quinolones, netylmicin, gentamycin, piperacillin tazobactam and Imepenem.(11).

Table 1 . List of isolates

Organism	Total number	Percentage
Escherichia coli	163	57.19
Pseudomonas	19	6.67
Citrobacter spp	18	6.3
Enterobacter spp	11	3.8
Acinetobacter spp	11	3.8
Klebsiella spp	10	3.5
Proteus spp	9	3.15
Staphylococcus aureus	29	10.17
CoNS	8	2.8
Enterococci	7	2.4
Total	285	

Table 2. Antibiotic sensitivity pattern of Gram positive cocci

	Cons n=8	*Staphylococcus aureus n=29*	*Enterococci n= 7*
Vancomycin	8(100%)	29(100%)	7(100%)
Erythromycin	5(62.5%)	19(65.5%)	3(42.85%)
Clindamycin	5(62.5%)	18(62.06%)	4(57.14%)
Cefotaxime	4(50%)	17(58.62%)	-
Cefepime	3(37.5%)	16(55.17%)	-
Ciprofloxacin	7(87.5%)	23(79.31%)	7(100%)
Teicoplanin	7(87.5%)	22(75.86%)	7(100%)
Gentamycin	6(75%)	24(82.75%)	5(71.42%)
Amoxycillin-clavulenate	5(62.5%)	19(65.51%)	5(71.42%)
Ampicillin	4(50%)	15(51.72%)	4(57.14%)

Table No. 3 Antibiotic sensitivity pattern of Gram negative Bacilli

	E.coli n=163	Psedomonas n=19	Citrobacter n=18	Enterobacter n=11	Acinetobacter n=11	Klebsiella n=10	proteus n=9
Ampicillin	93(57.05%)	-	6(33.34%)	4(36.36%)	5(45.45%)	4(40%)	7(77.77%)
Amikacin	153(93.86%)	15(78.94%)	15(83.32%)	8(72.72%)	7(63.63%)	8(80%)	8(88.88%)
Ceftazidime	132(80.98%)	12(63.15%)	8(44.44%)	6(54.54%)	7(63.63%)	6(60%)	4(44.44%)
Cefazolin	98(60.12%)	-	9(50%)	4(36.36%)	8(72.72%)	5(50%)	3(33.33%)
Cefepime	78(47.85%)	-	7(38.88%)	5(45.45%)		5(50%)	3(33.33%)
Ciprofloxacin	132(80.98%)	-	13(72.22%)	8(72.72%)	9(81.81%)	8(80%)	7(77.77%)
Piperacillin-tazobactam	144(88.34%)	15(78.95%)	17(94.44%)	10(90.90%)	9(81.81%)	8(80%)	9(100%)
Imepenem	159(97.54%)	18(94.73%)	15(83.32%)	11(100%)	10(90.90%)	9(90%)	9(100%)
Gentamycin	141(86.5%)		17(94.44%)	8(72.72%)	8(72.72%)	7(70%)	8(88.88%)
Cefotaxime	87(53.37%)		11(61.11%)	6(54.54%)	4(36.36%)	7(70%)	6(66.66%)
Netilmicin	98(60.12%)	16(84.2%)	12(66.66%)	7(63.63%)	6(54.54%)	8(80%)	7(77.77%)
Amoxycillin-clavulenate	91(55.82%)	-	14(77.77%)	9(81.81%)	7(63.63%)	7(70%)	7(77.77%)
Aztreonam	65(39.87%)	-	6(33.33%)	4(36.36%)	3(27.27%)	4(40%)	3(33.33%)
cotrimoxazol	123(75.46%)	-	7(38.88%)	8(72.72%)	6(54.54%)	6(60%)	6(66.66%)
Ofloxacin	-	13(68.42%)	-				-
Tetracyclin	87(53.37%)	-	4(22.22%)	6(54.54%)	6(54.54%)	6(60%)	2(22.22%)

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