Original Article

Urinary tract infections in intensive care unit of a tertiary care hospital

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Abstract

Introduction: Nosocomial infections are threat to patients, especially in high-risk areas such as intensive care units (ICU). Urinary tract infections are the most common among them. **Aim:** To study the occurrence, spectrum and antibiotic resistance profile of urinary tract infections in high risk areas. **Methods:** A study was carried out for six months during Feb-July, 2012 in 819 urine samples received from ICU department. Allurinary samples were collected under sterile conditions. Culture was done on Blood agar and MacConkey Agar. Isolates were identified by standard biochemical tests. Antibiotic sensitivity testing was done on Muller Hilton Agar (MHA) by disk diffusion method and interpreted using CLSI guidelines. **Results:** Out of 819 urine samples from ICU patients, 93(11.4%) had significant bacteriuria. *Candida spp.* 30(32.3%), was the most common followed by *Enterococcus spp*. 19(20.4%), and *Escherichia coli* 12(12.9%). Nitrofurantoin (66.7%) and Piperacillin-tazobactum (58.3%) was mostly sensitive and second generation Cephalosporins, Ampicillin and Amoxicillin clavulanate were the most resistant among all. ThreeImipenem resistant bacteria were isolated. Above 90% resistance was seen in aminoglycosides and fluroquinolone group of drugs. Vancomycin was resistant in 8(42.1%) isolates of *Enterococcus spp.* whereas all isolates were sensitive to Linezolid. **Conclusion:** The Spectrum of uro-pathogens and their resistant pattern to common antimicrobial agents is changing and must be taken into account when selecting treatment strategies.

Keywords: Urinary infection, ICU patients, drug resistance.

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INTRODUCTION

Infections of the urinary tract are responsible for about 40% of all hospital acquired infections and constitute a major source for nosocomial septicemia and related mortality in acute care hospitals. It is one of the most common nosocomial infection thus posing a threat to patients admitted in critical care areas of a hospital such as intensive care units (ICU). The vast majority of urinary tract infections (UTI) occur in patients with temporary indwelling bladder catheters[1]. UTI in ICU patients are commonly found in women admitted in medical units (9%) compared to surgical units (2%). It increases the length of ICU stay and cost of hospitalization[2]. The microbial agents usually responsible for UTI in ICU patients include *Escherichia coli* (E.coli), *Pseudomonas spp., Klebsiella spp., Proteus mirabilis, Staphylococcus spp., Enterococcus spp., and Candida spp.*[2]. The changes in patterns of microbial infection and their antibiotic resistance differ widely and pose a recurrent problem[3]. Studies have shown that the rates of drug resistance are more in ICUs when compared to general wards and outpatient departments, and ICU admission may be an independent risk factor for microbial infection withmultidrug-resistance[4]. Although UTIs are common hospital acquired infection in ICU, the studies on these infections in India are limited. This study was designed to determine the occurrence of nosocomial UTI in ICU patients, to study the etiology and antimicrobial resistance patterns.

MATERIAL AND METHODS

The study was carried out for six months during February to July, 2012 at the Department of Microbiology. Mid-

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stream urine samples from the suspected UTI patients in ICU department were collected under sterile conditions. The collected urine samples were inoculated on 5% Sheep blood agar and MacConkey medium and cultured media were incubated aerobically at 37°C. The culture plates were examined for significant growth of $\geq 10^5$colony forming units/ml of urine. Isolates were identified by standard biochemical tests. Antibiotic sensitivity was done on Muller Hinton agar by disk diffusion method and interpreted using CLSI guidelines.[5] Theantibiotics tested were Nitrofurantoin, Amoxy-clavulanic acid, Cefuroxime, Amikacin, Cotrimoxazole, Gentamicin, Piperacillin-Tazobactam, Ceftazidime, Cefoxitin, Nalidixic acid, Norfloxacin, Ampicillin, Vancomycin, Linezolid, Imipenem and Colistin.

OBSERVATIONS AND RESULTS

Out of 819 urine samples from ICU patients, 93(11.4%) had significant bacteriuria. In ICU, *Candida spp.* 30(32.3%), was the most common followed by *Enterococcus spp*. 19(20.4%), *Escherichia coli* 12 (12.9%), *Pseudomonas aeruginosa* 11 (11.8%), *Klebsiellapneumoniae* 8 (8.6%), *Stapylococcusaureus* 5 (5.4%), *Acinetobacter spp.* 4 (4.3%), *Proteus mirabilis* 3 (3.2%), *Citrobacterfreundii* 1(1.1%). (Table: 1) Nitrofurantoin (66.7%) and Piperacillin-tazobactum (58.3%)was mostly sensitive and second generation Cephalosporins, Ampicillin and Amoxicillin clavulanate were the most resistant drugs among all bacterial isolates. For *Pseudomonas aeruginosa*Imipenem and Colistin were most sensitive followed by Piperacillin-Tazobactam (63.6%). Carbapenam resistance was also noted among 3 (7.7%) gram negative bacteria. Above 90% resistance was seen in aminoglycosides and fluroquinolone group of drugs. All 19 Enterococcus isolates were sensitive to Linezolid and resistant to Penicillin, Vancomycin (42.1%) and high level aminoglycoside (78.9%). (Table: 2)

Table 1: Urinary Isolates from ICU patients (N= 819)

Urinary Pathogens	Number (%) of isolates
Candida spp.	30(32.3)
Enterococcus spp.	19(20.4)
Escherichia coli	12(12.9)
Pseudomonas aeruginosa	11(11.8)
Klebsiellapneumoniae	8(8.6)
Staphylococcus aureus	5(5.4)
Acinetobacter spp.	4(4.3)
Proteus mirabilis	3(3.2)
Citrobacterfreundii	1(1.1)
Total	**93(11.4)**

Table 2: Antimicrobial resistance pattern of bacterial isolates

ANTIBIOTICS	Bacterial Isolates No. (%) Resistant							
	E. coli (n=12)	*P. aeruginosa*(n=11)	*K. pneumoniae* (n=8)	*Acinetobacter sp.* (n=4)	*Proteus mirabilis* (n=3)	*C. freundii* (n=1)	*S. aureus* (n=5)	*Enterococcus sp.* (n=19)
AMP	12(100)	11(100)	8(100)	-	2(66.7)	1(100)	-	19(100)
AC	12(100)	11(100)	8(100)	-	2(66.7)	1(100)	-	-
NX	11(91.7)	9(81.8)	7(87.5)	4(100)	1(33.3)	0	5(100)	18(94.7)
NF	4(33.3)	-	7(87.5)	2(50.0)	-	0	0	9(47.4)
COT	10(83.3)	-	7(87.5)	-	2(66.7)	0	-	-
AK	11(91.7)	8(72.7)	7(87.5)	4(100)	-	0	-	-
NA	11(91.7)	-	5(62.5)	-	-	1(100)	-	-
CU	12(100)	-	8(100)	-	2(66.7)	1(100)	-	-
CAZ	-	7(63.6)	-	3(75.0)	-	-	-	-
PIT	5(41.7)	4(36.4)	4(50.0)	4(100)	0	0	-	-
IMP	1(8.3)	0	0	2(50.0)	0	0	-	-
P	-	-	-	-	-	-	5(100)	19(100)
CX	-	-	-	-	-	-	5(100)	-
GEN	-	-	-	-	-	-	4(80.0)	15(78.9)
VA	-	-	-	-	-	-	0	8(42.1)
LZ	-	-	-	-	-	-	0	0

(AMP-Ampicillin, AC-Amoxy-Clavulanic acid, NX-Norfloxacin, NF-Nitrofurantoin, COT- Co-trimoxazole, AK-Amikacin, NA-Nalidixic acid, CU-Cefuroxime, CAZ-Ceftazidime, PIT-Piperacillin-Tazobactum, IMP-Imipenam, P- Penicillin, CX-Cefoxitin, GEN-Gentamicin, VA-Vancomycin and LZ-Linezolid)

DISCUSSION

In this study, the infection rate among ICU patients was 11.4%, which is comparable to the observation done in other studies of nosocomial UTI in ICU[6,7]. However few studies have also reported higher incidences of UTI. The most common organism isolated from the urine specimens of ICU patients was *Candida spp.*, followed by *Enterococcus spp*., *Escherichia coli, Pseudomonas aeruginosa*, *Klebsiellapneumoniae*, *Stapylococcusaureus*,

Acinetobacter spp., *Proteus mirabilis*, *Citrobacterfreundii*. The spectrum of urinary pathogens reported in this study is different from that mentioned in literature. But there are more number of recent studies which shows similar findings all over the world[8,9,10]. Majority of the previous studies from this locality have shown *Escherichia coli,* as the predominant urinary pathogen isolated from patients. However, there is increased chance of urinary catheterization in ICU patients in which case candida usually colonize the catheter and later leads to urinary infections. Considering the overall change in bacterial spectrum with gram positive bacteria causing more infections, our finding of having *Enterococcus spp*. as the most common bacterial cause for UTI in ICU patients can be explained. High antimicrobial resistance rate was noted and only few drug options were available for these ICU patients. Predominant numbers of the isolates were found to be resistant to more than one drug tested. Nitrofurantoin was the most sensitive drug next to Imipenem and colistin for all the gram negative organisms. In *E.coli*, very high resistance was noted among the second generation Cephalosporins, Ampicillin and Amoxicillin clavulanate. Carbapenam resistance was also noted among 3 (7.7%) gram negative bacteria. Above 90% resistance was seen in aminoglycosides and fluroquinolone group of drugs. In this urinary study, all the five strains of *Staphylococcus aureus* were found to be methicillin resistant whereas, no resistance to vancomycin and linezolid drug was noted. All *Enterococci spp.* were penicillin resistant and significant number of strains were also vancomycin resistant. Similar finding of having highly resistant bacteria among intensive care patients have been reported from recent studies done in North India[6,7]. The isolates showed high resistance to beta lactams and aminoglycoside (Gentamicin) thus limiting theirimportance asempirical therapy in ICUs. In both Gram-positive and Gram-negative organisms aminoglycosides and quinolones were highly resistant.

CONCLUSION

The Spectrum of urinary pathogens causing infection among ICU patients are changing. Even the antimicrobial susceptibility pattern to common antimicrobial agents have changed leading to more resistant bacteria causing infections in hospitals. It must be taken into consideration when choosing treatment. Thus the morbidity, mortality and the treatment cost escalates among hospitalized patients. In order to restrict these infections, hospital infection control team should strictly reinforce the importance of hand washing, aseptic techniques and the use of proper barrier precautions, especially in ICU environment. Active surveillance studies should be conducted on a larger scale in the developing countries like India where the increase in antimicrobial resistance is predominantly seen.

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