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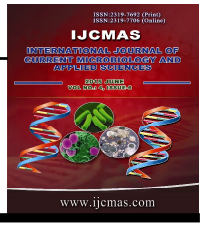

Original Research Article

Antibiotic Susceptibility Pattern of Uropathogens Isolated in a Rural Teaching Hospital in South India

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A B S T R A C T

Urinary tract infection is one of the most common infections encountered and is of major public health importance. Because of development of antibiotic resistance, the susceptibility pattern of uropathogens to commonly prescribing drugs varying from time to time. The present study was conducted to know the current susceptibility pattern of uropathogens from both community acquired and hospital acquired urinary tract infections. Out of 1350 urine samples from hospitalized patients and 742 samples from out patients 322(23.85%), and 148 (19.94%) showed significant growth respectively. *Escherichia coli* was the predominant uropathogen isolated from both hospitalized patients (66.45%) and out patients (70.27%). Otherorganisms isolated were *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Acinetobacter* species, *Citrobacter* species, *Proteus mirabilis*, *Enterobacter* species, *Enterococcus* species and *Staphylococcus aureus*. Predominant uropathogens like *E. coli* and *Klebsiella pneumoniae* were resistant to commonly used antibiotics like Norfloxacin, Ampicillin and Cotrimoxazole. 74%, 52%, 88% of *E. coli* from hospitalized patients and 62%, 39%, 80% from out patients showed resistance to Norfloxacin, Cotrimoxazole and Ampicillin respectively. Common uropathogen *E. coli* had shown good susceptibility pattern to drugs like Nitrofurantoin (78%, 81%), Amikacin (79%, 100%) and to Imipenem (91%, 100%) in hospitalized and out patients respectively. Extended spectrum β lactamase production by Gram negative bacilli and increased empirical use of Quinolones for treatment of UTI is mainly responsible for development of drug resistance to β lactam antibiotics and Quinolones.

Keywords

Uropathogens, Current antibiotic susceptibility pattern, Drug resistance

Introduction

Urinary tract infection is one of the most common infections observed in clinical practice among community and hospitalized patients (Gatermann, 2007). 25 to 35% of all

females suffer from urinary tract infection (UTI) at some stage in their lives. UTI forms 40–50% of the total nosocomial infections. Urinary tract infection often results in serious complications like secondary bacteremia and sepsis leading to a rise in mortality. Extremities of age, female gender, pregnancy, instrumentation, neurological dysfunction, renal disease, expression of A, B and H blood group oligosaccharides on the surface of epithelial cells are the predisposing factors for the development of UTI. Treatment of UTI depends on etiological agents and their antibiotic susceptibility pattern. As susceptibility pattern is varying because of development of drug resistance in uropathogens, it became necessary for physicians to have current knowledge about antibiotic susceptibility pattern (Manjunath *et al.,* 2011; Kumar *et al.,* 2006). This study was conducted to know the current antibiotic susceptibility pattern in common uropathogens isolated in a rural teaching hospital in south India.

Material and Methods

This study was conducted in department of Microbiology, in a rural teaching hospital in south India from May 2014 to March 2015.Clean catch midstream urine (CCMU) were collected from ambulatory patients and from Foley's catheter in catheterized patients. All samples were inoculated on blood agar and Mac Conkeys medium by using calibrated loop technique. Urine microscopy was done to see pus cells. In mid-stream urine samples, $>10^5$ colony forming units per ml (CFU/ml) of urine was considered as significant bacteriruria. Identification of growth was done by standard biochemical methods (Collee *et al.,* 1999). The antibiotic susceptibility testing was carried out by using Kirby-Bauer disc diffusion method following guidelines of Clinical Laboratory Standard Institute (CLSI). Extended spectrum β lactamase production in Gram negative bacilli and Methicillin resistance in Staphylococcus aureus was detected by using CLSI guide lines (CLSI, 2014).

Results and Discussion

A total of 1350 urine samples from hospitalized patients and 742 from out patients were collected. Among hospitalized patients 322 (23.85%) showed significant growth. 810(60%) samples were sterile. 35(2.59%) samples showed insignificant growth and 183 (13.55%) were polymicrobial. Among out patients 148 (19.94%) showed significant growth, 497(66.98%) samples were sterile.18 (2.4%) showed insignificant growth and 79(10.64%) were contaminated.

In hospitalized patients, out of 322 culture positive samples, Gram negative bacilli (94.40%) were predominate over Gram positive (5.99%). *Escherichia coli* (66.45%) was the predominant etiological agent isolated. Other Gram negative bacilli isolated were *Klebsiella* species 51(15.84%), *Pseudomonas aeruginosa* 16(4.96%), *Acinetobacter* species 9(2.79%), *Citrobacter* species 8(2.48%), *Proteus mirabilis* 5(1.55%), *Enterobacter* species 1(0.31%). Among Gram positive isolates *Enterococcus* species 12(3.72%) was predominant followed by *Staphylococcus aureus* 6(1.86%).

In outpatients also *E. coli* was the predominant organism 104(70.27%) followed by *Klebsiella pneumoniae* 44(29.72%).

In hospitalized patients, females 256 (79.50%) were infected more commonly compared to males 66 (20.49%). Among females, reproductive age group 21–30 years women (42.57%) were predominantly infected compared to other age groups.

Among men age group above 60 years were infected more 16(24.24%) compared to other age groups. In outpatients also females were infected more 105(71%) compared to males 43(29%).

In hospitalized patients eighty eight percent of *E. coli* isolates were resistant to Ampicillin. The rates of resistance among Gram negative bacilli to cephalosporins including 3rd generation were increasingly high. Ceftazidime resistance in *E. coli* was 80% and in *Klebsiella* species it was 82%. Among non-fermenters 58% of *Pseudomonas aeruginosa*, 58% of *Acinetobacter* species, 75% of *Proteus* species were resistant to ceftazidime. In outpatients also *E. coli* showed 80% resistance to Ampicillin. 57% of *E. coli* isolates and 50% of *Klebsiella pneumoniae* were resistant to Ceftazidime.

Resistance to quinolones was increased among Gram negative bacilli isolated from hospitalized patients and outpatients also. 74% of *E. coli*, 50% *Klebsiella* species, 59% *Pseudomonas aeruginosa*, 72% *Acinetobacter* species isolated from hospitalized patients showed resistance to Norfloxacin. In outpatients 62% of *E. coli* and only 10% of *Klebsiella pneumoniae* were resistant to Norfloxacin.

Coming to the aminoglycoside susceptibility pattern in Gram negative bacilli isolated from hospitalized patients, 42% and 21% of *E. coli* were resistant to Gentamicin and Amikacin respectively.40% and 27% of *Klebsiellae* species isolates were resistant to Gentamicin and Amikacin. Among nonfermentors 10% of *Pseudomonas aeruginosa* strains were resistant Amikacin and 27% were resistant to Gentamicin.25% of *Acinetobacter* species strains were resistant to both Gentamicin and Amikacin.

In outpatients 80% of *E. coli* and 82% of *Klebsiella pneumoniae* were susceptible to Gentamicin. All isolates were sensitive to Amikacin.

In hospitalized patients 78% strains of *E. coli* were sensitive (22% resistant) to Nitrofurantoin. But only 33% strains of *Klebsiella* species were sensitive to Nitrofurantoin. In outpatients 81% of *E. coli* and 36% of *Klebsiella pneumoniae* were sensitive to Nitrofurantoin.

Resistance to cotrimoxazole was varied in out patients and inpatients.52% and 56% of *E. coli* and *Klebsiella pneumoniae* strains from hospitalized patients showed resistance. But in out patients 39% of *E.coli* and 40% *Klebsiella pneumoniae* strains were resistant. 33% resistance was observed in Acinetobacter species.

From hospitalzed patients ESBL production in Gram negative bacilli was 238 (68.32%). 80% of *E. coli*, 82% of *Klebsiella* species,58% of *P. aeruginosa* & Acinetobacter species each were ESBL producers. In outpatients ESBL production among *E. coli* and *Klebsiella pneumoniae* was 57% and 50% respectively.

Resistance to Imipenem was observed in 9% of *E. coli* &11% of *Klebsiella pneumoniae* from hospitalized patients. In outpatients all isolates of *E. coli* and *Klebsiella pneumoniae* were sensitive to Imipenem.

Among Gram positive isolates 75% Staphylococcus aureus isolates were Methicillin resistant (MRSA). But all isolates were sensitive to Cotrmoxazole, Nitrofurantoin and Vancomycin. 80% of strains were resistant to Norfloxacin. Among *Enterococcus* species 40%, 65%, 80% strains were resistant to Nitrofurantoin,

Ampicillin and Norfloxacin respectively. But all were sensitive to Vancomycin.

Present study showed that females were more commonly infected with urinary tract infections compared to males both in hospitalized (79.50%) and outpatients (71%). Male to female ratio was 3.8:1in hospitalized patients and in outpatients it was 2.44:1. This was in correlation with other studies (Akram *et al.,* 2007; Ram *et al.,* 2000). Among females 21–30 years age group predominantly was infected (42.57%). But in males age group above 60 years were infected more 16 (24.24%). The predominance of UTI in female population is because of short urethra and proximity of anal opening to urethra.

In the present study Gram negative bacilli were the common agents to cause UTI compared to Gram positive organisms and *E. coli* was the predominant organism in both hospitalized patients (66.45%) and out patients (70.27%). This was also observed in other studies also (Manjunath *et al.,* 2011; Ram *et al.,* 2000; Dalela *et al.,* 2012). Other Gram negative bacilli isolated from hospitalized patients were *Klebsiella pneumoniae*, *Pseudomonas aeruginosa, Acinetobacter* species, *Citrobacter* species, *Proteus mirabilis* and *Enterobacter* species (Bhargavi *et al.,* 2010). Other organism isolated from out patients was *Klebsiella pneumonia* (29.72%).

Our study shows predominant Gram negative bacilli to cause UTI in both hospitalized and outpatients like *E. coli* and *Klebsiella pneumoniae* were resistant to commonly used antibiotics like Norfloxacin, Cotrimoxazole and Ampicillin. This was observed in other studies (Manjunath *et al.,* 2011; Arjunan *et al.,* 2010; Mohanty *et al.,* 2013). Resistance to these antibiotics in hospitalized patients was high compared to out patients. 74%, 52 & 88% of *E. coli* from hospitalized patients and 62%, 39%, 80% from outpatients showed resistance to norfloxacin, cotrimoxazole & ampicillin. Cephalosporins including 3rd generation showed high resistance pattern in both hospitalized patients and outpatients. Extended spectrum β lactamase production by *E. coli* & *Klebsiella pneumoniae* and other Gram negative bacilli is responsible for resistance to cephalosporins. Wide spread use of quinolones in treatment of UTI may be responsible for increasing resistance to quinolones in Gram negative bacilli. This was observed in other studies (Zervos *et al.,* 2003; Ena *et al.,* 1995). In our study ESBL producing Gram negative bacilli were 68.32%. 80% of *E. coli* &82% of *Klebsiella pneumoniae* from hospitalized patients were ESBL producers. Decreased sensitivity to Cotrimoxazole was observed in the present study. *E. coli* and *Klesiealla pneumoniae* isolated from out patients had showed 61% and 60% sensitivity but from hospitalized patients shown only 48% and 44% sensitivity to Cotrimoxazole.

Toour surprise 78% of strains of *E. coli* from hospitalized patients and 81% of *E. coli* from out patients were sensitive to Nitrofurantoin which was not prescribed that much frequently by clinical practitioners. This was also observed in some studies (Mandal *et al.,* 2012). But resistance to Nitrofurantoin was high in *Klebsiella pneumoniae*, only 33% and 36% of strains were sensitive from hospitalized and out patients respectively.

Resistance to aminoglycosides is comparatively less in Gram negative bacilli and 79% of strains of *E. coli*,73% of *Klebsiella peumoniae*, 90% of *Pseudomonas aeruginosa* and 75% of *Acinetobacter* species from hospitalized patients and 100% of *E. coli* and *Klebsiella pneumoniae* from

out patients were sensitive to Amikacin. Even sensitivity to Gentamicin was also significant in *E. coli* and *Klebsiella pneumoniae* isolated from out patients i.e. 80% and 82%. This was in correlation with other studies (Mandal *et al.*, 2012). But only 58% of *E. coli* and 60% of *Klebsiella pneumoniae* from inpatients were sensitive to Gentamicin.

Table.1 Age and sex wise distribution of inpatients

	Sex distribution		
Age group	Male	female	**Total**
0-10	11 (3.42%)	10(3.10%)	21 (6.52%)
11-20	6(1.86%)	55(17.08%)	61(18.94%)
21-30	11(3.42%)	109(33.85%)	120(37.27%)
31-40	7(2.17%)	29(9.00%)	36(11.17%)
41-50	6(1.86%)	28(8.69%)	34(10.55%)
51-60	9(2.79%)	18(5.59%)	27(8.38%)
61-70	16(4.96%)	7(2.17%)	23(7.14%)
Total	66(20.49%)	256 (79.50%)	322(100%)

Table.2 Etiological agents isolated from hospitalized patients

Bacterial species	**Total number**
E.coli	214(66.45%)
Klebsiella pneumoniae	51(15.84%)
Pseudomonas aeruginosa	16(4.96%)
Citrobacter species	8 (2.48%)
Acinetobacter species	9 (2.79%)
Proteus mirabilis	5 (1.55%)
Enterobacter species	1 (0.31%)
Staphylococcus aureus	6 (1.86%)
Enterococcus species	12(3.72%)
Total	322(100%)

Table.3 Etiological agents isolated from out patients

Bacterial species	**Total number**
E.coli	104(70.27%)
Klebsiella	44(29.72%)

pneumoniae	
Total	148(100%)

Table.4 Susceptibility pattern of Gram negative isolates from hospitalized patients

Antibiotic susceptibility (% sensitive)								
Organism	Amp	Gen	AK	NIT	NX	CAZ	COT	I
E.coli	12	58	79	78	26	20	48	91
Klebsiella pneumoniae	-	60	73	33	50	18	44	89
Pseudomonas aeruginosa	-	63	90	-	41	42	-	100
Acinetobacter species	33	75	75	28	28	42	-	50
Proteus mirabilis	100	0	100	-	50	100	-	-
Citrobacter species	0	42	57	28	42	16	42	100

Amp –Ampicillin, Gen – Gentamicin,AK-Amikacin, NIT- Nitrofurantoin,NX –Norfloxacin, CAZ- Ceftazidime, COT-Cotrimoxazole,I-Imipenem.

Table.5 Susceptibility pattern of Gram negative isolates from outpatients

	Antibiotic susceptibility (% sensitive)							
Organism	Amp	Gen	AK	NIT	NX	CAZ	COT	I
E.coli	20	80	100	81	38	43	61	100
Klebsiella pneumoniae	-	82	100	36	90	50	60	100

Amp –Ampicillin, Gen – Gentamicin,AK-Amikacin, NIT- Nitrofurantoin,NX –Norfloxacin, CAZ- Ceftazidime, COT-Cotrimoxazole, I-Imipenem.

Table.6 Susceptibility pattern of Gram positive isolates from hospitalized patients

Organism	**Amp**	**Gen**	**NIT**	**NX**	**COT**	**VA**
Enterococcus species	35	33	60	20	-	100
Staphylococcus aureus	25	50	100	50	100	100

Amp –Ampicillin, Gen – Gentamicin,AK-Amikaci NIT- Nitrofurantoin,NX –Norfloxacin, CAZ- Ceftazidime, COT-Cotrimoxazole, I-Imipenem.

Common etiological agent like *E.coli* had shown good susceptibility pattern to drugs like Nitrofurantoin (78%,81%),Amikacin (79%,100%) and to Imipenem (91%,100%)

in hospitalized patients and out patients respectively.

Even etiological agents mainly implicated to cause only hospital acquired UTI like Pseudomonas aeruginosa,Acinetobacter species were more susceptible to Amikacin (90% &75%), Imipenem (100% &50%).

Among Gram positive isolates 75% of Staphylococcus aureus were MRSA and Beta lactam agents except 5th generation cephalosporins were of no use in treating these infections. In our study all isolates were sensitive to cotrimoxazole, Nitrofurantoin and Vancomycin.

The number of strains of S.aureus isolated in the present study was only six;more number of isolates needs to be tested in order to come to conclusion of susceptibility pattern of this species. Enterococcus strains showed 60% sensitivity to Nitrofurantoin, 35% sensitivity to ampicillin and 100% sensitive to Vancomycin.

As drug resistance among Gram negative bacilli and Gram positive cocci is increasing, most Gram negative uropathogens are resistant to commonly prescribed antibiotics by general practitioners likeNorfloxacin (quinolones), beta lactams. Gram negative uropathogens are more susceptible to Nitrofurantoin, aminoglycosides like Amikacin, Cotrimoxazole (out patients) and Imipenem.

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