International Journal of Medical Research Professionals
P-ISSN: 2454-6356; E-ISSN: 2454-6364
DOI: 10.21276/ijmrp

IJMRP

Original Research Article.

Antibiogram of the Prevalent Uropathogens Isolated at a Tertiary Care Hospital

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ABSTRACT

Introduction: Urinary tract infections (UTIs) are among the most common bacterial infection encountered. As there is emergence of resistance in the uropathogens to multiple drugs, a local study regarding the sensitivity pattern of common uropathogens is necessary.

Aims and Objectives: This study was aimed at analyzing the antimicrobial susceptibility pattern of prevalent uropathogens, isolated in UTI patients at Tertiary care hospital, RIMS, Ranchi.

Materials and Methods: This study was performed in the Department of Microbiology, RIMS, Ranchi. The pathogens in urine samples were identified by standard microbiological techniques and their antibiogram was determined by Kirby-Bauer disc diffusion method as recommended in CLSI, 2017.

Results: Out of 2571 samples, 561 were culture positive. Among all uropathogens; Escherichia coli 169 (30.17%) was found to be the commonest organism, followed by Klebsiella species 157 (28.03%) and pseudomonas species 69 (12.32%). Escherichia coli was found sensitive to imipenem (90.53%) followed by amikacin (79.28%), levofloxacin (71.59%), gentamicin (60.35%). Klebsiella species shows high sensitivity to imipenem (88.53%), cefoperazone with sulbactam (72.61%), gentamicin (70.06%) and amikacin (57.96%). Pseudomonas the third most predominant isolate gave high sensitivity to piperaciillin-tazobactam (89.85%), imipenem (84.05%) and amikacin (65.77%).

Conclusion: Overenthusiastic use of antibiotic has resulted in emergence of drug resistant bacterial strains in UTI patients. Hence, antibiotic susceptibility testing is essential and aids to diagnose and treat the drug resistant UTI cases.

Keywords: Antibiogram, Uropathogens, Escherichia Coli, Klebsiellaspps., Pseudomonas Aeroginosa, Staphylococcus Aureus, Urinary Tract Infection.

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Article History:

Received: 10-02-2018, **Revised:** 04-03-2018, **Accepted:** 30-03-2018

Access this article online	
Website: www.ijmrp.com	Quick Response code
DOI: 10.21276/ijmrp.2018.4.2.071	

INTRODUCTION

UTI is the most common bacterial infection accounting for 25% of all infections. It is one of the most important causes of morbidity and also the second most common cause of hospital visit.[1] UTIs are defined by the presence of a growth of more han 10^5 colony forming units (CFU) of bacteria per ml of urine for asymptomatic individual and much lower for symptomatic individual (~10^3 CFU/ml).[2]

In urine sample obtained by supra pubic aspiration or catheterization and in samples from a patient with an indwelling catheter, colony count of 10^2-10^4 /ml generally indicates infection.[3] Indwelling urinary catheters pose a risk for many infective complications such as perinephric, vesical, and urethral abscesses as well as epididymitis, prostatitis and orchitis. The overall incidence of these complications is unknown, although 20 to 30 percent of patients with asymptomatic catheter- induced UTIs may develop local or systemic symptoms.[4] Women are more prone to UTIs, probably because they have shorter urethras which therefore pass bacteria into the urinary tract more easily.[5]

The vast majority of uncomplicated UTIs are caused by the gram-negative bacillus i.e. Escherichia coli, along with other pathogens including Klebsiella spp, Pseudomonas, Staphylococcus saprophyticus and Proteus mirabilis. In patients with suspected UTI, antibiotic treatment is usually started empirically, before urine culture results are available. To ensure appropriate treatment, knowledge of the organisms that cause UTI and their antibiotic susceptibility is essential. The aim of the present study was to assess the changing susceptibility pattern of urinary pathogens to antimicrobial agents in UTIs of this particular region.

AIMS AND OBJECIVES

1. This study was aimed at identifying the microorganisms and analyzing the antimicrobial susceptibility pattern of prevalent uropathogens isolated in UTI patients at tertiary care hospital, RIMS, RANCHI.
2. To help clinicians as well as patients who have developed resistant UTI in diagnosis and treatment.

MATERIALS AND METHODS

A total of 2571 urine culture sensitivity were pefomed and analyzed of patients who were suspected to be having urinary tract infection, from December 2016 to July 2017 with prior Clean-catch midstream urine specimens from patients diagnosed clinically to be having UTI on the basis of symptoms (fever, dysuria and increased frequency of urination) were inoculated on Blood agar and MacConkey agar plates, which were incubated aerobically at 37°C overnight. Plates showing growth suggestive of significant bacteriuria, with colony counts exceeding 105cfu/ml were subjected to standard biochemical tests for identification and antimicrobial sensitivity testing by Kirby- Bauer disc diffusion method. Interpretation as 'Sensitive' or 'Resistant' was done on the basis of the diameters of zones of inhibition of bacterial growth as recommended by the CLSI guidelines. Antibiotics against which sensitivity was tested in the present study included Imipenem, amikacin, gentamicin, levofloxacin, norfloxacin, ciprofloxacin, nitrofurantoin, cefotaxime, piperacillin+tazobactam, amoxicillin, cefoperazone + sulbactam and cefixime.

Table 1: Species isolated, their number and percentage from urine culture.

Species isolated	No.	%
E. Coli	169	30.12
Klebsiella	157	27.99
Pseudomonas	69	12.30
Staphylococcus	24	04.28

Table 2: Susceptibility pattern of E. coli.

Isolates	Sensitivity (%)	Resistance (%)
Nitrofurantoin	93.49	6.51
Imipenem	90.53	9.47
Amikacin	79.28	20.72
Piperacillin + Tazobactam	77.51	22.49
Levofloxacin	71.59	28.41
Cefotaxime	70.41	29.59
Norfloxacin	66.86	33.14
Ciprofloxacin	63.31	36.69
Gentamicin	60.35	39.65
Cefoperazone + Sulbactam	54.44	45.56
Amoxi-Clav	44.97	55.03

Table 3: Susceptibility pattern of Klebsiella.

Isolates	Sensitivity (%)	Resistance (%)
Imipenem	88.53	11.47
Amikacin	82.80	17.20
Nitrofurantoin	75.16	24.84
Cefoperazone + Sulbactam	72.61	27.39
Levofloxacin	71.33	28.67
Norfloxacin	69.43	30.57
Cefotaxime	63.06	36.94
Ciprofloxacin	61.78	38.22
Gentamicin	60.51	39.49
Piperacillin + Tazobactam	57.96	42.04
Amoxiclav	54.77	45.23
Amoxicillin	29.97	70.03

Table 4: Susceptibility pattern of Pseudomonas aeruginosa

Isolates	Sensitivity (%)	Resistance (%)
Piperacillin + Tazobactam	89.85	10.15
Imipenem	84.05	15.95
Amikacin	65.21	34.79
Ciprofloxacin	63.77	36.23
Levofloxacin	59.42	40.58
Norfloxacin	56.52	43.48
Gentamicin	53.62	46.38
Nitrofurantoin	50.72	49.28
Cefotaxim	50.72	49.28
Amoxicillin	11.59	88.41

Table 5: Susceptibility pattern of Staphylococcus aureus

Isolates	Sensitivity (%)	Resistance (%)
Cefixime	79.17	20.83
Nitrofurantoin	70.83	29.17
Ciprofloxacin	66.67	33.33
Levofloxacin	62.50	37.50
Norfloxacin	58.33	41.67
Gentamicin	54.17	45.83
Amoxiclav	54.17	45.83
Vanc60ycin	41.67	58.33
Amoxicillin	37.50	62.50

RESULTS

A total of 2571 sample were studied. Among them; 561 came out culture positive. Among these 561, 243 (43.31%) samples belonged to male and 318 (56.69%) belonged to female patients. The most common isolates in this study have been the Gram-negative bacilli which accounts for 76.78% of the total positive isolates. In the gram-negative bacilli, the predominant isolate was the Escherichia coli. (n=169, 30.12%) followed by Klebsiella spp. (n=157, 27.99%), and Pseudomonas (n=69, 12.30%) among the major isolates. In the gram-positive bacteria, the main organism identified was Staphylococcus aureus (n=24, 4.28%). Table 1 shows the detailed frequency of all the isolates identified.

The most common isolates were E. coli (30.12%) showed high sensitivity to nitrofurantoin imipenem (90.80%), followed by meropenem (85.40%), amikacin (79.24%) levofloxacin (77.21%), gentamycin (62.26%) and ampicillin (59.92%). It was found to be resistant to cotrimoxazole (96.14%), norfloxacin (88%), nalidixic acid (86.76%), cefotaxime (69.88%), ciprofloxacin (55.07%) and nitrofurantoin (40.65%) as shown in Table 2.

DISCUSSION

Urinary tract infections are common conditions worldwide and the pattern of antimicrobial resistance varies in different regions. The present study describes the relationships between isolated bacterial agents and antibiotic resistance of UTIs. The sex distribution of patients in our study is consistent with those of other reported studies, showing a statistically predominance of females with UTI (56.69% of the positive cultures). This result is similar to those reported from many other centers.[6] The elevated incidence of infection among females is related to difference between the male and female genitourinary systems in anatomy and microflora.[7]

Escherichia coli (37.41%) is the most common organism causing urinary tract infection in this study followed by Klebsiella species. This is in accordance with earlier study Ranjbar et al, and Amin et al.[8,9] The highest percentages of resistance of Escherichia coli causing urinary tract infections were found for Amoxicillin (80.47%), Amoxi-clav (55.03%), gentamicin (39.65%), norfloxacin (33.14%), cefotaxim (29.59%), whereas the highest percentages of sensitivity were seen for nitrofurantoin (93.49%), imipenem (90.53%), amikacin (79.28%), levofloxacin (71.59%). Despite these finding resistances to floroquinolone is on rise as evident from different study done worldwide. More than 30 resistant variants of trimethoprim resistant DFR genes and three variants of sulfonamide resistant SUL genes have been described so far.[10] In the North American Urinary Tract Infection Collaboration Alliance surveillance study, 5.5% and 5.1% of urinary E. coli isolates from outpatients in the United States and Canada were resistant to ciprofloxacin and levofloxacin, respectively.[11] In Escherichia coli, mutational alterations in the Fluoroquinolones target enzymes, namely, DNA topoisomerase II (DNA gyrase) and topoisomerase IV, are recognized to be the major mechanisms through which resistance develops.[12] Khotaii et al, reported resistance rates of 87.5% to ampicillin, 67.5% to trimethoprim-sulfamethoxazole.[13] A study done in King Fahd Hospital, Saudi Arabia showed that meropenem was 95.8% sensitive followed by amikacin (93.7%) and imipenem (91.71%) against extended spectrum ß lactamase producing E. coli.[14]

Athough the percentage of E. coli isolated from urine culture is lower in our study due to emergence of increasing trends of other etiological agent as causative organism for UTI, it still supports the previous findings indicating that E. coli is the principal etiological agent of UTI, accounting for 30.12% of the culture positive cases.[15]

The prevalence and antibiotic sensitivity of Klebsiella strains varied among published literatures, as study from Kuwait University, showed that Klebsiella was accounting for 12.2% of the organism isolated.[16] In a study done in Aligarh, India, Klebsiella was isolated in 22% of cultures of 920 patients with UTI.[17] In our study the Klebsiella was second most common isolated bacteria (28.03%) and showed a low degree of sensitivity to most antibiotics tested except 88.53% to imipenem, 82.80% to amikacin, 72.61% to cefoperazone with sulbactam, 71.33% to levofloxacin. Among resistant drugs, resistance to amoxicillin was 70.03%, amoxiclav 45.23%, piperacillin with tazobactam 42.04% and gentamicin 39.49%.GetanetBeyene et al reported very high number of K. pneumoniae isolates resistant to amoxicillin and ampicillin which is similar to our study.[18]

K. pneumoniae produce various enzymes that target specific parts of drugs and deactivate them. The enzymes produced usually target beta lactam type drugs. These enzymes include extended spectrum beta lactamases, metallo-beta-lactamases, oxacillinases, K. pneumonia carbapenemases, and various others. These enzymes are encoded on plasmids which K. pneumoniae seems to readily uptake by conjugation process. Extended spectrum beta-lactamases (ESBLs) are so named due to their ability to hydrolyze a wide spectrum of beta-lactam drugs. Their action occurs through the hydrolyzation of the beta-lactam ring in beta-lactam drugs by nucleophilic attack.[19] Plasmids encoding Temoniera (TEM) and Sulfhydryl variable (SVH) ESBLs are the most common to be found in isolated K. pneumoniae, which are active against cephaloporins. The plasmids that encode the ESBL genes also have been found to carry genes that express resistance for drugs other than beta-lactams, such as aminoglycosides. Because carbapenems are not degraded by ESBLs, they are used for treatment when ESBL producing K. pneumoniae are isolated from patient samples.

Pseudomonas aeruginosa is the third most common pathogen associated with hospital-acquired or catheter associated UTIs.[20] Here, Pseudomonas showed the highest sensitivity to piperacillin + tazobactam (89.85%), imipenem (84.05%), amikacin (65.21%), ciprofloxacin (63.77%) and significant resistance to amoxicillin (88.41%), cefotaxim (49.28%) and nitrofurantoin (49.28%).

Prior studies suggest that isolation of S. aureus from the urine is often secondary to staphylococcal bacteremia originating at another site (e.g., in cases of endocarditis).[21] In our study Staphylococcus was found sensitive to cefixime (79.17%), nitrofurantoin (70.83%), ciprofloxacin (66.67%), levofloxacin (62.50%) whereas resistance towards amoxicillin was (62.50%), vancomycin (58.33%), amoxiclav (45.83%) and gentamicin (45.83%). A study conducted by Adebola Onanuga et al, reported of higher resistance of Staph. aureus to gentamicin (73.9%), and (69%) to vancomycin.[22] Whereas in our study, the resistance to gentamicin is low (45.83%) but the resistance vancomycin is quite similar. It is similar to the findings of Olayinka et al who reported 57.7% resistance in vancomycin in hospital associated S. aureus isolates in Zaria, Nigeria.[23]

CONCLUSION

High level of antimicrobial resistance percentage in this study indicates the appearance of resistance towards commonly used antimicrobials agent such as first line drugs (amoxicillin, ampicillin and cefotaxime), this may be due to the widespread and prolonged use of these drugs for empirical therapy that may have an impact on the antibiotic treatment of UTI patients. These data may be used to determine trends in antimicrobial susceptibilities, to formulate local antibiotic policies, to compare local with national data and overall to assist clinicians in the rational choice of antibiotic therapy to prevent misuse or overuse of antibiotics. As there is derth of new molecules of antibiotics for the management of UTI we need to be concerned for this in future. There is need for wide range and periodical study to know the changing sensitivity pattern of microorganisms. Health education should be provided to the public on the dangers of unnecessary use of antibiotics.

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Source of Support: Nil. **Conflict of Interest:** None Declared.

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Cite this article as: Manoj Kumar, Manish Kumar Sinha, Ashok Kumar Sharma, Amber Prasad, Ashwini Verma. Antibiogram of the Prevalent Uropathogens Isolated at a Tertiary Care Hospital. Int J Med Res Prof. 2018 Mar; 4(2):314-17.
DOI:10.21276/ijmrp.2018.4.2.071