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EVALUATION OF ANTIBIOTIC RESISTANCE PATTERN OF UROPATHOGENS IN PATIENTS WITH URINARY TRACT INFECTION IN A TERTIARY CARE CENTER, NORTH MAHARASHTRA

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Abstract:
Background: Urinary tract infection (UTI) is one of the most common bacterial infections worldwide affects women more than men. Recently, there has been a changing trend in the pattern of antibiotic resistance amongst uropathogens. It is necessary to create an awareness of regional antibiotic resistance pattern among prescribing doctors.
Method: A retrospective hospital based study conducted at tertiary care centre north Maharashtra between October 2021 and December 2022. Patients above 18 years of age admitted to with a diagnosis of UTI included in the study. The data regarding causative uropathogens and their antibiotic susceptibility were retrieved from patient's case record files.
Results: Culture and antibiotic sensitivity reports were analyzed. Out of 120 significant isolates, gram-negative organisms accounted for 80.5% infection. The most predominant uropathogen isolated was E.coli (72.8%) followed by *Klebsiella spp (*12.2%), Enterococcus (8.4%) and others. E.coli showed high resistance to ampicillin (86 %), ceftriaxone (76.5%), Co-Trimoxazole (45.5%) and fluoroquinolones (59.1% to 63%); Klebsiella spp, the second most common uropathogen showed high level of resistance with ampicillin (95%), cephalexin (91%), cefuroxime (71%), ceftriaxone (75%) and Nitrofuration (89.2%). Enterococcus were highly resistant to Tetracycline (92.9%) Ciprofloxacin (85.7%), Levofloxacin (81.8%). Where, E. coli were highly sensitive to Amikacin, Imipenem, Ertapenam. Klebsiellawere highly sensitive to Meropenem, Cefoperazone/Sulbactam, Amikacin. Enterococcuswas highly sensitive to Linezolid, Teicoplanin, Vancomycin
Conclusions: Different uropathogens and their antimicrobial resistance are a concern for future treatment options in UTI.

Keywords: antibiotic resistance, Culture, UTI, uropathogens

Introduction:

Any infection of the urinary tract involving either the kidneys, ureters, urinary bladder, or the urethra is termed as urinary tract infection (UTI). In both community and hospital-acquired infections,

urinary tract infection (UTI) is a prevalent health concern hospital-acquired infections[1]. It is one of the most frequent infections, especially among women[2]. There are many factors associated with the occurrence of urinary tract infection. Timely diagnosis and treatment of these predisposing factors is essential for preventing recurrences[3]. Treatment of UTI is usually initiated empirically with antibiotics without performing culture and sensitivity test, has led to improper usage of antibiotics.[4] Identification and practice rational prescription of antibiotics to reduce the emergence of resistant bacterial strains.[5] Culture sensitivity tests were also important in case of UTI to go for a specific antibiotic treatment rather than the empirical treatment for the patients.[6,7]

Antibiotic resistance has been primarily proven to occur as a result of uncontrolled and widespread antibiotic use. Bacterial strains, even from the same species, may vary widely in sensitivity to antibiotics. World Health Organization's global plan of action on AMR has stressed antimicrobial resistance surveillance across nations as an important strategy for reducing AMR.[8]

Major risk factors for the development of UTIs include female gender, chronic renal disease, advanced age, increased length of stay in the hospital, debilitating underlying illnesses, and repeated urinary catheterizations. UTIs may lead to serious complications such as sepsis, recurrences, and progressive renal damage. The most common bacterial pathogens causing UTIs include Gram-negative organisms such as Escherichia coli, Klebsiella spp., Enterobacter spp., and Proteus spp. Common Gram-positive bacteria which can cause UTIs include Enterococcus spp. and Staphylococcus aureus.[9] Therefore , it's a must to create an awareness of regional antibiotic susceptibility regarding uropathogens. However in India, there is a lack of extensive studies regarding antibiotic resistance pattern of UTI pathogens.[10] The objective of this study was to investigate the common bacteria associated with UTI cases and their antibiotic susceptibility pattern.

Material and Methods: A retrospective descriptive study was done for one year in tertiary care center north Maharashtra between October 2021 and December 2022. The study included all in-patients of either gender above 18 years of age with a diagnosis of UTI. Data was collected from the patient's case record files, which were retrieved from the medical records department of our hospital. All relevant data regarding the type of clinical presentation, demographic distribution, associated risk factors, co-morbid conditions, microbiology reports, causative uropathogens and its antibiotic resistance pattern were documented into a proforma sheet prepared beforehand. The data was entered, stored and evaluated using Microsoft excel 2016. Data was calculated according to the percentages.

Results: Culture and antibiotic sensitivity reports were analyzed. Out of 120 significant isolates, gram-negative organisms accounted for 80.5%. Fungal isolates were seen only in 1.9 % of cases. E.coli was the most predominant uropathogen isolated (72.8%) followed by Klebsiella spp (12.2%), Enterococcus fecalis (8.4%) and Acinetobacter spp(2.4%). Other uropathogens included MRSA bacteria (2.8%), Staphylococcus aureus(1.9%), Candida spp (2.6%), Citrobacter freundii (1.9%), Pseudomonas spp (1.9%) and Streptococcus spp (1.2%). (Table 1) E.coli, showed considerable resistance to ampicillin (86 %), ceftriaxone (76.5%), Co-Trimoxazole (45.5%) and fluoroquinolones (59.1% to 63%). Low level of resistance was observed with Nitrofuration (6.4 %), piperacillin+ tazobactam (7.8%), and Ticarcillin (4.5%). Klebsiella spp, the second most common uropathogen showed high level of resistance with ampicillin (95%), cephalexin (91%), cefuroxime (71%), ceftriaxone (75%) and Nitrofuration (89.2%).

Discussion: Antibiotic resistance can be exacerbated by the usage of antibiotics. Antimicrobial resistance is caused by a combination of antibiotic-exposed bacteria and the spread of those bacteria and the resistance mechanisms. The advantages of using antibiotics often exceed the hazards of antibiotic resistance. However, too many antibiotics are unnecessarily used or misused to undermine the usefulness of this important medicines[11,12] E.coli is the commonest uropathogen causing both complicated and uncomplicated UTI.[13] In this study , the most predominant uropathogen isolated was *E.coli* and this finding was similar to results of studies by Basnyat KB et al,[14]and

Khameneh ZR[15]. Second most common uropathogen isolated in our study was *Klebsiella spp* which is similar to studies conducted by Beyene *et al.*[14] and Khameneh *et al.*[15] where in contrast result reported by Khatri B et al observed Enterococcus fecalis as second most prevalent uropathogen isolated. Our study showed the resistance among the isolated uropathogens to some of the commonly prescribed antimicrobials. *E.coli*, which was the predominant uropathogen isolated showed considerable resistance to ampicillin. A resistance rate comparable to our study was observed in a study conducted by Mandal *et al.* in South India.[16] In contrast to our observations, in a study conducted by Das RN[17] in West Nepal, *E.coli* isolates showed high susceptibility to ampicillin and cotrimoxazole. High level of resistance was observed with ampicillin in similar with In a retrospective study conducted by Bahadin *et al*[18]., klebsiella was found to be the second most prevalent isolate and a hundred percent resistance was observed with ampicillin. However, in contrary to our observations, their study noted higher sensitivity to gentamicin. Another study by Bhargavi PS et al[19] conducted in Southeast part of India showed a higher resistance to gentamicin (83.3%) and cotrimoxazole (82.4%) compared to our study results, which were 54.5% and 45.5% respectively. Our study showed resistance to Nitrofuration (6.4 %), piperacillin+ tazobactam (7.8%), and Ticarcillin (4.5%). Klebsiella spp. On the contrary ,showed a lower susceptibility rate against cotrimoxazole and ceftriaxone in a study conducted by Beyene *et al*[13]. In our study, MRSA accounted for 2.8% of total isolates found to be highly susceptible to vancomycin (100%) Similar susceptibility rates with vancomycin and linezolid among MRSA isolates was observed by Dalela *et al*[20].
In our study, we observed higher sensitivity to vancomycin and Carbapenems among isolated uropathogens. Henceforth, their future use should be restricted to prevent the development of antibiotic resistance.

Conclusion:
Most of the identified bacteria were resistant to several of the popular antibiotics used in clinical settings. Consequently, it is vital to prescribe antibiotics rationally both before and after culture reports. Pattern needs to be studied further and the outcome should be communicated to the prescribing physicians in that area.

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Table 1: antibiotic resistance pattern of gram-negative

Antimicrobial Agents	***E.coli***	***Klebsiella spp***	***Acinetobacter spp***	***Citrobacter freundii***	***Pseudomonas spp***
	R (%)	**R (%)**	**R (%)**	**R (%)**	**R (%)**
Ampicillin	86.0	95	92	94	100
Amoxicillin-Clavulanic Acid	66.7	45.5	75	92	94
Ampicillin/Salbactum					
Cefalexin	84.1	91	100	100	100
Cefuroxime	77.8	71	100	50	100
Ceftriaxone	76.5	75	100	50	100
Ciprofloxacin	83.0	50	100	50	100
Levofloxacin	79.1	33.3	100	50	100
Cotrimoxazole	45.5	45.5	100	100	100
Gentamicin	50.6	54.5	100	50	50
Amikacin	6.0	16.7	100	50	100
Nitrofurantoin	6.4	89.2	100	0.0	100
Piperacillin + Tazobactam	7.8	30	50	50	0.0
Meropenam	6.5	9.1	75	0.0	0.0

Table 2: antibiotic resistance pattern of gram-Positive

ANTIMICROBIAL AGENTS	***Enterococcus fecalis***	***Staphylococcus aureus***	**MRSA**	***Streptococcus spp***
	R (%)	**R (%)**	**R (%)**	**R (%)**
Ampicillin	24	33.3	100	0.0
Amoxicillin-clavulanic acid	18.3	0.0	100	0.0
Cephalexin	100	-	100	0.0
Cefuroxime	100	0.0	100	0.0
Ceftriaxone	100	0.0	100	0.0
Ciprofloxacin	28.6	100	100	0.0
Levofloxacin	28.6	0.0	66.7	0.0
Cotrimoxazole	57.1	0.0	66.7	0.0
Gentamicin	71.4	0.0	0.0	100
Amikacin	62.5	0.0	66.7	100
Nitrofurantoin	12.5	-	0.0	0.0
Piperacillin+Tazobactam	0.0	-	-	-
Imipenem	14.7	-	-	-
Meropenem	33.3	-	-	-
Vancomycin	0.0	0.0	0.0	-
Linezolid	0.0	0.0	0.0	-
Teicoplanin	0.0	0.0	0.0	-
Azithromycin	-	-	100	0.0