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RESISTANCE IN THE SHADOWS: UROPATHOGENIC PROFILES IN CHRONIC KIDNEY DISEASE PATIENTS AND IMPLICATIONS FOR ANTIMICROBIAL STEWARDSHIP

Nephrology

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ABSTRACT

Introduction: Urinary tract infection (UTI) is one of the few most frequently reported bacterial infections in general population only second to respiratory tract infections. It accounts for approximately 1 million hospitalizations annually. This study aims to determine the antibiogram of uropathogenic bacteria isolated from chronic kidney disease patients admitted in the department of nephrology and to determine the susceptibility of the isolated bacterial uropathogens to commonly used antibiotics. **Material And Methods:** It is a retrospective study, conducted at inpatient departments of medicine and nephrology at Goa Medical College. 50 patients with Chronic Kidney Disease (CKD) having Urinary tract infection (UTI) were included in the present study. Patients having UTI without CKD and patients having fungal UTI were excluded from study. Patients satisfying the inclusion criteria were randomly selected and their antibiogram was studied, with antibiotics grouped into Group A (Commonly used antibiotics) and Group B (Reserved antibiotics) drugs. **Results:** Of the total 50 CKD patients with UTI, majority presented with E.coli 14 (28%), followed by Klebsiella 10(20%), Pseudomonas aeruginosa 7(14%) and Staphylococcus species 7(14%) and Enterococcus 5(10%). The most effective antibiotics were those in group B for treating the infections. **Conclusion:** The pattern of antimicrobial resistance of bacteria producing UTI varies in different regions. A continuous review and monitoring of antimicrobial susceptibility can aid the clinician for prescribing the appropriate medication and prevent the development of drug resistance. Amikacin and Meropenem still show a good response compared to many of the bacterial spectrum in group A antibiotics in study. The Group B antibiotics show an over all better sensitivity to many of the organisms in present study.

KEYWORDS

Antibiogram, bacteria, Urinary Tract Infection, CKD.

INTRODUCTION:

Urinary tract infection (UTI) is one of the most frequently reported bacterial infections in general population second to respiratory tract infections. It accounts for approximately 1 million hospitalization annually.(1) UTI are defined by the presence of a growth of more than 10^5 colony forming units (CFU) of bacteria per ml of urine for asymptomatic individuals and much lower for symptomatic individuals (10^3 CFU/ml).

UTI is one of the most commonly occurring community acquired infections in developing countries owing to lack of sanitation and minimal hygienic practices after the use of toilets. UTIs are caused by pathogenic invasion of the urinary tract which leads to inflammatory changes of uroepithelium. Proliferation of the pathogenic bacteria in urinary tract causes the urinary tract infection.(2)

Antibiotic resistance is a serious public health problem resulting in increased morbidity and mortality. In urinary tract infections, resistance rates against commonly prescribed antibiotics are constantly rising. Quinolones are one of the most widely used antibiotics in the community for the treatment of UTI, and it is this unfortunate excessive use of the agent that has led to a considerable and worrying increase in the rate of E. coli resistant isolates in many countries. Studies concerning culture sensitivity profiles of urine have been performed over decades.(3) There have been changes in the sensitivity profiles over time and more so due to indiscriminate as well as illogical use of antibiotics.

Thus, knowledge of most common uropathogens and their susceptibility to routinely used antibiotics is the need of the hour. The appropriate use of empirical treatment of UTI requires a good knowledge of epidemiological data.

Aims And Objective:

To determine the antibiogram of uropathogenic bacteria isolated from chronic kidney disease patients admitted in nephrology and medicine and to determine the susceptibility of the isolated bacterial uropathogens to commonly used antibiotics.

MATERIAL AND METHOD:

It is a retrospective study, conducted at inpatient department of medicine and nephrology at Goa medical college. Minimum of 50 patients with Chronic Kidney Disease (CKD) with Urinary tract infection (UTI) were included in the present study. Patients of CKD with UTI admitted in wards with growth of bacterial organism were included in study. Patients with UTI without CKD and patients having fungal UTI were excluded from study. Patients satisfying the inclusion criteria were randomly selected and their antibiogram was studied.

Antibiotics Were Classified Into Two Groups.

Table 1: Showing Grouping Of Antibiotics

Group A- Commonly used antibiotics	Group B- Reserved antibiotics
Ampicillin	Piperacillin – tazobactum
Amoxy-Clav	Cefoperazone
Cefuroxime	Ceftazidime
Ceftriaxone	Aztreonam
Ciprofloxacin	Meropenem
Cotrimoxazole	Amikacin
Nitofurantoin	Vancomycin
	Teicoplanin
	Colistin
	Tigecycline

The sensitivity of uropathogenic bacteria from patients of UTI was compared between two groups. Ethical approval was **obtained** from the institutional Ethical Committee prior to commencement of the study.

Statistics: Data was entered in Microsoft excel and analysis was done with SPSS version22. The data is presented as frequency and percentage. Rate, ratios, proportions are presented in the results.

RESULTS:

The urine of a total of 50 patients with CKD having UTI in our hospital was screened for the antibiogram. Among them, 29 were males and 21 were females, with male to female ratio of 1.38.

Table 2. Showing Gender distribution.	
Gender	N (%)

Female	21 (42)
Male	29 (58)

Table 3. Showing Pathogens isolated from Urine specimen.

Organism	N (%)
Citrobacter diversus	3 (6)
Citrobacter freundii	2 (4)
Coagulase negative staphylococcus	3 (6)
E.coli	14 (28)
Enterobacter	2 (4)
Enterococcus	5 (10)
Group D streptococcus	2 (4)
Klebsiella	10 (20)
Methicillin resistant staphylococcus aureus	2 (4)
Pseudomonas aeruginosa	7 (14)

Organisms isolated from various urine samples of CKD patients with UTI were E.coli, Citrobacter Freundii, Coagulase negative staphylococcus, Enterbacter, Enterococcus, Group D streptococcus, Klebsilla, methicillin resistant staphylococcus aureus, pseudomonas aeruginosa.

E. coli was the most common organism isolated with total of 14 (28%) out of the 50 samples, followed by Klebsiella 10(20%).

Table 4. Showing the antibiogram of the organism resistant to the commonly used antibiotics.

Group A - Antibiotic	Citrobacter diversus	Citro bacter freundii	Coagulase negative staphylococcus	E.coli	Enterobacter	Enterococcus	Group D streptococcus	klebsiella	Methicillin resistant staphylococcus aureus	Pseudomonas aeruginosa
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
AMPICILLIN	3*	2*	3*	12 (85.7%)	2*	5*	2*	10*	2*	7*
AMOXYCLAV	3*	2*	3*	14*	2*	4 (80)	2*	10*	2*	7*
CEFUROXIME	3*	2*	3*	13*	2*	4 (80)	2*	10*	2*	7*
CEFTRIAXONE	2 (66.7)	2*	3*	13 (92.9)	2*	4 (80)	2*	10*	2*	5 (71.4)
CIPROFLOXACIN	2 (66.7)	2*	3*	12 (85.7)	2*	4 (80)	2*	10*	2*	5 (71.4)
COTRIMOXAZOLE	3*	2*	2*	13 (92.9)	2*	5*	2*	10*	2*	7*
NITROFURANTOIN	2 (66.7)	2*	0*	7 (50)	2*	0*	2*	9 (90)	0*	7*
Group B – Antibiotics										
PIPERACILLIN/TAZOBACTUM	2 (66.7)	2*	2 (66.7)	10 (71.4)	2*	4 (80)	2*	9 (90)	2*	4 (57.1)
CEFPERAZONE	2 (66.7)	2*	2 (66.7)	11 (78.6)	2*	4 (80)	2*	9 (90)	2*	4 (57.1)
CEFTAZIDIME	2 (66.7)	2*	2 (66.7)	12 (85.7)	2*	4 (80)	2*	10*	2*	4 (57.1)
AZTREONAM	2 (66.7)	2*	3*	12 (85.7)	2*	4 (80)	2*	10*	2*	4 (57.1)
MEROPENEM	2 (66.7)	2*	2 (66.7)	8 (57.1)	1(50)	3 (60)	2*	8 (80)	2*	4 (57.1)
AMIKACIN	1 (33.3)	2*	1 (33.3)	7 (50)	1 (50)	5*	2*	8 (80)	1(50)	4 (57.1)
VANCOMYCIN	3*	2*	0*	14*	2*	1 (20)	2*	10*	0*	6 (85.7)
TEICHOPLANIN	3	2*	1*	14*	2*	1(20)	2*	10*	0*	6 (85.7)
COLISTIN	1 (33.3)	0*	1*	9 (64.3)	2*	5*	2*	8 (80)	2*	0
TIGECYCLINE	1 (33.3)	1*	2*	6 (42.9)	2*	5*	2*	6 (60)	2*	5 (71.4)

*organism is 100% resistant to the said antibiotic in table presented above.

Antibiogram pattern showed, many of these organisms were resistant to most commonly used antibiotics in the clinical setting. Among all, meropenem, colistin, tigecycline, ceftriaxone, nitrofurantoin, piperacillin+tazobactum showed a good sensitivity for varied organisms isolated from the urine samples.

DISCUSSION:

World Health Organization (WHO, 2003) defined health as not just freedom from disability or the absence of morbidity, but as complete physical, mental and social well being. Symptoms of lower urinary tract infection include bothersome sensations such as urinary urgency, frequency, painful urination, hesitancy, and the sense of incomplete bladder emptying. Although urinary tract infection is not a significant cause of mortality, it still represents an important cause of morbidity since UTI have the potential for serious and life- threatening consequences if appropriate treatment is not given. Likely complications include pyelonephritis which can lead to renal scaring and sepsis

However, because of the serious and life-threatening consequences of this disease together with the increasing prevalence of antimicrobial resistance (Nerurkar et al.,(4); Sood and Gupta,(5)) this study was carried out to determine the incidence of bacteriuria in CKD patients.

UTI accounts for huge burden on health care system, because of high prevalence of infection in both nosocomial and community settings. As the CKD patients are already in a compromised state of health, the UTI will have high prevalence rate. In our study, we found that UTI was caused by variety of pathogens including E. Coli, Klebsiella, Pseudomonas aeruginosa, Enterococcus, Enterobacter, Citrobacter species, Coagulase negative staphylococcus and Methicillin resistant Staph Aureus, the pattern was similar to previous researchers in India.(6)

In present study, gram negative bacilli were the predominant bacterial isolates from the urine specimen followed by gram positive cocci which was consistent with other studies.(6,7) overall most common bacterial isolates were Escherichia coli 14(28%) followed by Klebsiella species 10(20%), Pseudomonas aeruginosa 7(14%) and Staphylococcus species 7(14%), Enterococcus with 5(10%), these findings were in relation with previous studies.(6) In our study, Klebsiella species was the second most frequently isolated organism after E.coli in UTI, which was similar to other studies.(6,8,9)

In the present study, among the gram negative bacilli isolated from UTI, E.coli was sensitive to many of the group B antibiotics compared to the group A drugs. Among them E.coli was tested sensitive for the Nitrofurantoin, Meropenem, Amikacin, Colistin and Tigecycline line of drugs. High level of resistance was found with Amoxyclav and Cefuroxime in group A, Vancomycin and Teichoplanin in group B drugs. Studies conducted by Mangaiarkkarasi et.al., and Shalini et.al., reported similar pattern of antibiotic resistance. (6,10,11)

Klebsiella species was found to be resistant to all the drugs in group A, and little sensitivity was found with group B drugs which included piperacillin+tazobactum, Meropenem, Amikacin, Colistin and Tigecycline. (6,12)

Many of the organisms isolated from the urine specimen of UTI patients with CKD was found to be resistant to both the group of antibiotics such as Citrobacter freundii, Coagulase negative staphylococcus, Enterobacter, group-D Streotococcus, Methicillin resistant staphylococcus (only found sensitive to Amikacin) (table 3).(6,7)

Our study points out emerging high resistance rate among the CKD patients with UTI; this was in agreement with various other studies done in India.(5,6,13) The present study gives an idea about the most common trend of increasing antibiotic resistance of uropathogens in the region which could be due to indiscriminate or under dose use of antibiotics. This data would help the treating physicians from avoiding the use of resistant antibiotics in CKD patients presenting with UTI.

CONCLUSION:

The pattern of antimicrobial resistance among bacteria causing urinary tract infections in chronic kidney disease patients demonstrates

significant regional variation and presents a growing clinical challenge. This study reveals that continuous surveillance and monitoring of antimicrobial susceptibility patterns are essential tools for clinicians to make informed prescribing decisions and prevent the further development of drug resistance. The findings underscore the critical importance of judicious antibiotic use, as the overuse and inappropriate application of higher-tier antibiotics appears to be the primary driver behind the expansion of drug resistance and the emergence of multidrug-resistant organisms.

Among the therapeutic options evaluated, Amikacin and Meropenem continue to demonstrate favourable efficacy against a broad spectrum of bacterial pathogens, particularly when compared to many Group A antibiotics that showed diminished effectiveness. The Group B antibiotics consistently exhibited superior sensitivity profiles across multiple organisms isolated in this study, suggesting their potential value as more reliable therapeutic options for this vulnerable patient population. However, the concerning trend toward widespread resistance even among reserved antibiotics highlights the urgent need for antimicrobial stewardship programs and the development of institutional guidelines for empirical therapy in chronic kidney disease patients with urinary tract infections.

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