

Pattern of UTI in Chronic Kidney Disease: Experience from A Tertiary Care Hospital, Bangladesh

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Abstract

Background: Urinary Tract Infection (UTI) is common and higher in prevalence in patients with Chronic Kidney Disease (CKD). To find out the frequency and clinico-bacteriological pattern of UTI in CKD patients.

Materials and methods: A cross-sectional study was done on 1000 of CKD patients attending Nephrology Department of Chattogram Medical College Hospital (CMCH) a tertiary level hospital in Bangladesh during January to December, 2017. Clean-catch midstream urine samples were collected from study populations irrespective of symptoms. Macroscopic and microscopic examinations were done. Urine samples were then inoculated in Blood agar and MacConkey agar and incubated aerobically at 37 °C for 18-24 hours. Microscopic observations and conventional biochemical tests were done to identify the isolated organisms. Significant growth of organisms in urine was defined as UTI. The isolated organisms were tested for antimicrobial susceptibility by using modified Kirby Bauer technique.

Results: The prevalence of UTI was 61.8%. with significant asymptomatic UTI for 28%. Gram-negative organisms were most frequent 564 (93%) with predominant *Escherichia coli* 399 (64%) followed by *Klebsiella* 113(18%) and *Pseudomonas* 39(6%). Among Gram positive isolates, *Staphylococcus* (6%) was the dominant organism isolated. Regarding antibiotic susceptibility, Gram-negative microorganisms were found to be most sensitive to carbapenem and amikacin whereas Gram-positive microorganisms were most sensitive towards carbapenem, colistin and linezolid.

Conclusion: In CKD patients, asymptomatic UTI was detected significantly. *E.coli* was found to be predominant organisms and resistant towards most of the studied common antibiotics.

Key words: Bacteriuria; Asymptomatic UTI; Chronic kidney disease; Antibiotic susceptibility.

INTRODUCTION

Chronic Kidney Disease (CKD) is now a global problem¹. Infection is one of the detrimental factors for greater morbidity and mortality in these patients². UTIs are one of the most common infections in CKD, accounting to 35% of nosocomial infections^{3,4}. A deterioration in renal function correlates with disturbed specific and non-specific host defenses⁵. A change in the composition of urine, oliguria, anuria and the resultant changes in pH, osmolality and urinary urea have effect on UTIs. Various uraemic toxins inhibit antimicrobial activity of granulocytes, macrophages and other defense reactions. These may contribute to develop UTI in patients with renal diseases^{6,7}. Due to structural and functional defect, the incidence of UTI in CKD is higher compared to others⁸. The risk might be increased by disease factors and management of comorbidities⁹. In the patients with the chronic renal insufficiency, urine drug concentration may be too low to eradicate organisms completely. Resultant treatment failure and compromised host immune system increases the vulnerability to infections¹⁰.

The patients with renal insufficiency, UTI may be asymptomatic or with non-specific symptoms and early accurate diagnosis is not always easy. Delayed treatment may contribute to further loss of renal function. So surveillance of urinary pathogens in a hospital is important for both clinical and microbiological. The data of UTI in CKD patients yet demands more informations. This study is aimed to find out the prevalence of UTI in CKD irrespective of symptoms and to identify the bacterial pathogens from urine samples and their sensitivity pattern.

MATERIALS AND METHODS

This cross-sectional study was conducted on patients of CKD admitted to Nephrology Department of CMCH during January to December 2017. CKD patients of both sex aged ≥18 years with or without dialysis were included consecutively irrespective of symptoms of UTI. CKD patients with pyuria getting antibiotic for more than 48 hours before admission or with anuria and who did not provide written consent were excluded. A preformed standard case record form was used for data collection. A midstream clean-catch urine sample at least >20 ml was collected in the clean, sterile, dry container by standard procedure.

Examination and culture of urine: Urine samples were tested by using multiple reagent strips and microscopic urinalysis. A urine dipstick consists of chemically treated paper, which displays different colors indicating the presence of sugar, protein, specific gravity and pH. The cut-off value for pyuria was determined >10pus cell/HPF by cell count method. All samples were inoculated on Blood agar and Mac-Conkey agar by the semi-quantitative culture technique using a standard wire loop and incubated at 37°C for 24-48 hours in an incubator. The approximate number of colonies and the number of bacteria was counted. Bacteriuria was defined as any micro-organisms growth of ≥10⁵ CFU/ml or ≥10³ CFU/ml in symptomatic patients. Asymptomatic Bacteriuria (ASBU) was defined as the presence of at least 10⁵ colony-forming units (CFU/ml) of bacterial species in clean-voided midstream urine sample without symptoms of a UTI^{11,12}. The isolated organisms were identified by standard biochemical method which involves morphological appearance of the colonies, staining reactions and biochemical properties¹³. Antimicrobial susceptibility of isolates was tested by Kirby-Bauer disk diffusion method using Mueller-Hinton agar. Results were read according to the National Committee for Clinical Laboratory Standards guidelines (NCCLS)^{14,15}. Ethical Committee approval (Memo No. CMC/PG/2017/315) was duly obtained from the Institutional Review Board of Chittagong Medical College Hospital, Chattogram prior commencement of the study.

Data were collected by interview & recording reports of laboratory investigations. All the collected data were checked and compiled and then tabulated. The data were entered into SPSS for windows 20(SPSS in C Chicago, IL,USA). All data were evaluated by using Chi-square test for categorical variables and t-test for continuous variables. The results were presented in Tables and Figures. Mean for numerical variables and percentage for categorical variables was used as statistical term in this

study. AOR and multiple regression analysis was done for prediction of risk factors. Statistical significance was set at p<0.05 and confidence interval was set at 95% level.

RESULTS

This cross-sectional study found 618 subjects (62%) with UTI among study population (n=1000). Distribution of the socio-demographic characteristics showed prevalence of UTI was more in female, poor economic status and in illiterate group with highest (23%) in the age group of (51-60) years. Significant UTI was in CKD patients with DM, Stone disease, with Indwelling catheter and on Dialysis (Not shown). The prevalence of UTI was about two third of total patients (61.8%) and about one fourth of UTI (28%) was asymptomatic (Table I). The major organism was gram negative organism and E. coli was the predominant organism followed by klebsiella (Figure 1). E.coli growth is similar in both group but Pseudomonas caused asymptomatic UTI more compared to symptomatic whereas Staphylococcus was more in symptomatic UTI (Table II). Association between type of organism and symptoms was significant in Chi-square test. The study showed highest sensitivity of E.coli and Klebsiella towards both Meropenem (90%) and Amikacin (63%,71%). Pseudomonas to Ceftriaxone (72%), Meropenem (65%) (Figure 2 & 3). Gram positive organism showed most susceptibility towards Piperacillin-Tazobactam and Colistin (100%), Linezolid (97%), Clindamycin (93%) and Carbapenem (90%).

Table I : Prevalence of UTI and their distribution according to symptoms.

Symptom status	UTI status				p-value
	Present-n (%)		Absent-n (%)		
Symptomatic	458	72%	297	68%	.001*
Asymptomatic	160	28%	85	32%	
Total	618	62%	382	38%	

Table I shows that prevalence of UTI was about two third of total patients and about one fourth of UTI was asymptomatic.

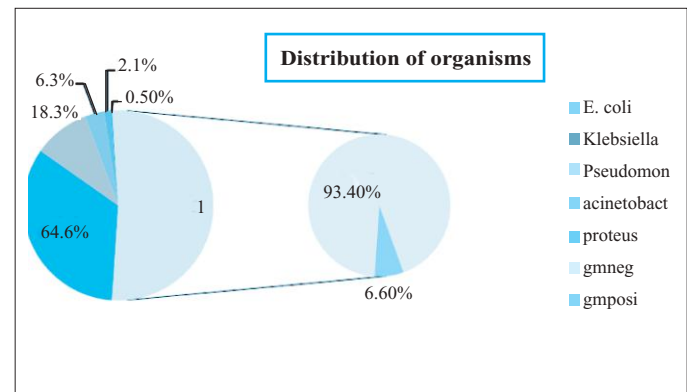


Figure 1: Distribution of uropathogens among the positive UTI samples (n=618).

Figure 1 showed that majority is gram negative organisms and predominant isolate is E.Coli followed by klebsiella and pseudomonas. Staphylococcus is dominant among gram positive organism.

Table II : Association of bacteriological pattern in symptomatic vs asymptomatic UTI patients.

UTI patient	E. Coli	Klebsiella	Pseudomonas	Staphylococcus	Others	p Value
Symptomatic	296(65%)	87 (19%)	22(5%)	35 (8%)	17(4%)	<0.001*
Asymptomatic	103(64%)	26 (16%)	17 (11%)	3 (2%)	9(6%)	

Table II showed that Pseudomonas causes asymptomatic UTI more compared to symptomatic whereas Staphylococcus is more frequent in symptomatic UTI.

*Association between type of organism and symptoms is significant in Chi-square test.

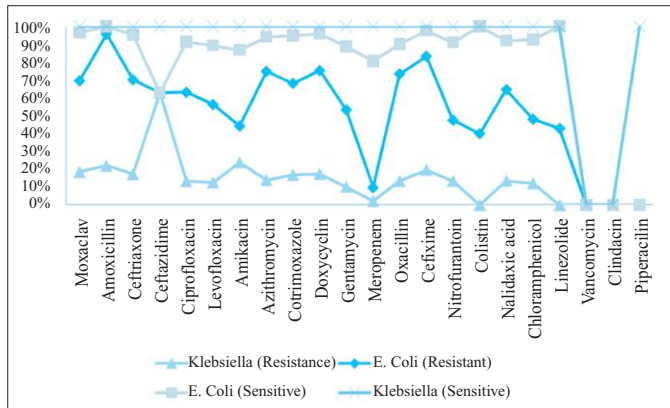


Figure 2 : Susceptibility pattern of E. coli and Klebsiella to different antibiotics.

Figure 2 showed highest sensitivity of E.coli and Klebsiella towards both Meropenem (90%) and Amikacin (63%,71%).

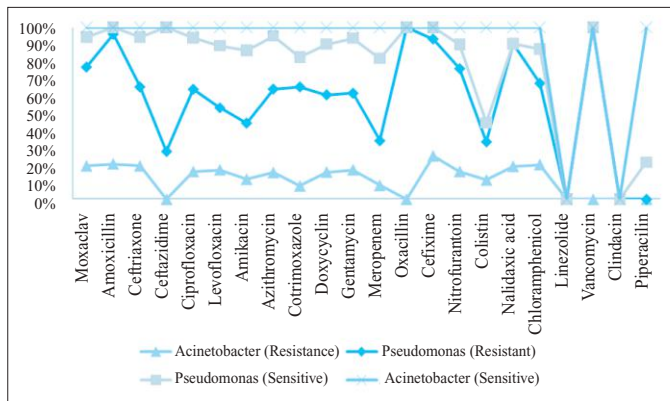


Figure 3 : Susceptibility of antibiotics for Pseudomonas and acinetobacter.

Figure 3 Pseudomonas is mostly sensitive to Ceftazidime (72%), Meropenem (65%).

DISCUSSION

In this study, after adjusting effect sex, DM, dialysis were found significant clinical predictor of UTI in CKD. Maconald et al stated age as risk in CKD which was discrepant with our study¹⁶. James et al observed a weaker association with age for infection supporting our study¹⁷. Gatenet et al found no statistical significance for age, sex in evaluation of risk except catheterization¹⁸. Saitoh et al revealed association of UTI with primary

cause with higher frequency in PKD followed by DN and Chronic GN¹⁹. Jadav et al found Indwelling Catheter and Richa et al reported stone disease as a predictor of UTI^{6,20}. Dissimilarity of our study may be due small number of sub-group population. Dialysis was found a predictor of UTI in our study which is supported by all other previous studies. Regarding diabetes findings of studies are variable²¹.

In this study, 618(62%) of participants were found with UTI Similar to Golebiewska et al with 65%²². But the recent study conducted by Jaiswal et al Siddiqui KM and chowdhury Richa et al showed report of 30%, 36%, 26% of growth positivity^{11,13,20}. The variation may be due to inclusion of specific CKD sub-groups .

As CKD stages advances, blunted immune response results in asymptomatic UTI. This was evident in our study with significant asymptomatic UTI (28%). Prevalence of asymptomatic UTI varies from 9-27% in various studies²³. Jaiswal et al also Renko et al suggested that significantly^{11,24}. Dysautonomia and defective chemotaxis in diabetic nephropathy and uremic toxins in Hemodialysis (HD) or ESRD patients may cause this^{7,25,26}. This was supported with study by Richa et al, Falah et al on HD patients with p value < 0.001^{20,26}.

In this study, gram negative (gm -ve) bacteria were found more frequent for UTI (93%) which was similar to study done by Richa et al reported 85%, Yadav et al 97% and other recent reports^{11,20,23,26,27}. Among 7 different isolates E.coli 64.6% was found to be more predominant and followed by klebsiella 18%, pseudomonas 6.3%, Staphylococcus 6.4%, acinetobacter 2.1%, Proteus 0.5%, Streptococcus 0.2%. This was similar to studies done by Falah et al Yadav et al Ranjana et al HSAIO et al²⁶⁻²⁹.

But some author found staphylococcus one of the commonest organism specially in HD & transplant patients whereas our study reported 6.6%³⁰. Studies by Suresh found 26.6% , Richa et al 15.4%, venkatesh et al 9.4%, Jamal haider 24.2%, mostly included patients with HD^{11,20,23,31}.

Our study found E.coli growth equally responsible for both symptomatic and asymptomatic UTI and Pseudomonas and other Gm -ve bacteria causes asymptomatic UTI more whereas staphylococcus causes symptomatic infection more. This pattern of asymptomatic UTI is similar to other studies but findings by Richa et al and Suresh et al who found staphylococcus next to E.coli in asymptomatic patients does not support our findings^{23,24,27,11,20}.

Our study showed highest sensitivity of gram negative organisms towards Meropenem, Amikacin , Colistin, Ceftazidime. Gram positive organism showed most susceptibility towards Piperacillin-Tazobactam, Linezolid and Clindamycin. This sensitivity pattern of our study more or less similar to other studies done in CKD on broad spectrum antibiotics except susceptibility of NFN for gram negative and Oxacilin for gram positive which are almost not a highly active agent in our study^{26,31,32}.

This may explain their prophylactic and over the counter usage in our setup. Most frequently used antibiotics like amoxicillin, cefixime, ciprofloxacin, NFN, ceftriaxone revealed low level of sensitivity to all organisms as a whole. Continuous use of broad spectrum antibiotic during HD period, ESRD and DM patients for any complication resulted these scenario.

CONCLUSION

In our study female were more prone to UTI and the frequency of asymptomatic UTI was significant in CKD patients. E. coli was the commonest organism which is resistant to most of common antibiotics. As predictor of UTI in CKD patients Sex, DM, and Dialysis were significant after adjustment.

DISCLOSURE

All the authors declared no conflict of interest.

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