ANTIBIOTIC SENSITIVITY OF ESCHERICHIA COLI URINARY TRACT INFECTION IN CHRONIC KIDNEY DISEASE VERSUS NORMAL POPULATION

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ABSTRACT

Objectives: To find is there any difference between antibiotic sensitivity of Escherichia coli urinary tract infection in chronic kidney disease versus normal population.

Material and Methods: This is a prospective study done at Department of Nephrology Khyber Teaching Hospital Peshawar, from May 2012 to November 2012. Patient with urinary tract infection caused by Escherichia coli were included into the study. Patients were divided into two groups, depending on their eGFR. We evaluated the antibiotic sensitivity profile of E.coli UTI in CKD and non CKD groups.

Results: Hundred patients were included in the study and they were divided into two groups that is CKD and non CKD group, 50 patients in each group. Male to female ratio was 1:1.7 and 1:4 in CKD and non CKD groups respectively. Â-lactamase inhibitor antibiotic showed more than 90% sensitivity of E.coli in both groups, without any significant difference. Nitrofurantoin had least sensitivity.

Conclusion: According to our study CKD itself does not affect the sensitivity of antibiotics against E.coli urinary tract infection.

Key Words Chronic Kidney Disease, Antibiotic Sensitivity, Urinary Tract Infection.

INTRODUCTION

In United States more than 7 million uncomplicated urinary tract infections (UTI) per year are reported[1] but the incidence in patients in chronic kidney disease (CKD) is unclear. According to Gilbert DN the frequency of UTI in CKD patient is not different from the general population after doing adjustment for age[2]. The most common organisms causing UTI is Escherichia coli, which is responsible for more than 80% of cases[3]. Number of patient having CKD is growing day by day. Little attention has been paid to the management of UTI in CKD patient. Treatment of UTI needs adequate serum and urinary concentration of drugs against the causative organism. Drugs like sulfamethoxazole and nitrofurantoin have inadequate urinary concentration when creatinine clearance is less than 50ml/min. Lot of data is available on antibiotic sensitivity against Escherichia coli in normal population[4,5,6]. Review of literature identified only two publications on UTI in CKD[7,8]. Theoretically the risk of infection increases in CKD patients due to reasons like stones, papillary necrosis, neurogenic bladder and co-morbidities with indwelling catheters. One third of the patients having CKD are diabetics. It has been reported that diabetes itself does not influence the susceptibility pattern of antibiotics in UTI[9]. Patients with CKD have got weak community and they are prone to different types of infections[10]. The literature on the role of CKD for the development of antibiotic resistance in UTI is sparse[11]. To find out is there any difference between antibiotic sensitivity of Escherichia coli UTI in CKD and normal population, we undertook this study.

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MATERIALS AND METHODS

This prospective study was done in department of Nephrology of Khyber Teaching Hospital, Peshawar, from May 2012 to November 2012. The patients included were between ages of 07– 90 years, who attendant Out Patient Department of Nephrology and whose Urine Routine Examination showed more than10 WBC per high power field on microscopy. The patients were divided in to two groups those having normal renal functions and those having CKD. CKD was defined as estimated glomerular filtration rate (eGFR) < 60ml/min/1.73m^2. eGFR was estimated by modification of renal disease (MDRD) equation[12].

Sampling technique used was convenience (Non Probability). Each patient was instructed to carefully collect mid-stream urine sample and then urine was sent for culture and sensitivity. For this study, posi-

tive culture was defined as culture of a single bacterial species from the urine sample at a concentration of 105 CFU/ml. All patients whose Urine culture and sensitivity grew E. coli were included in the study. Positive urine culture was further processed for identification and antibacterial susceptibility of the uropathogens.

Antibiotic susceptibility pattern of E.coli was established using Kirby-Bauer disk diffusion method. E.coli isolates were tested against following different antibiotics Tazobactam / Piperacillin (100/10μg), Cefoperazone sulbactam (75/30 μg), Imipenem Cilastatin (10μg), Amikacin (30μg), Ceftazidime (30μg), Ceftriaxone (30μg), Cefotaxime (30μg), Norfloxacin (10μg), Ciprofloxacin (5μg), Clavulanic acid / Amoxicillin (20/10μg), Enoxacin (5μg), Meropenem (10μg), Moxifloxacin (5μg), Nitrofurantoin (300μg), Ofloxacin (5μg) and Nalidixic acid (30μg). Data on age, sex, result of urine culture, etiological agent, and susceptibility pattern were recorded.

RESULTS

In CKD group out of 50 patients 32 (64%) were female while 18(36%) were male, while in non CKD group 40(80%) were female and 10(20%) were male, with male to female ratio of 1:1.7 and 1:4 in CKD and non CKD group respectively. Patient age ranged from 13–90 years and 7–70 years in CKD and non CKD group, with mean age of 52.56 years and 42.78 years respectively. Cause of renal failure in CKD group is shown in table 1. Tazobactam / Piperacillin showed sensitivity of 100% and 94% in non CKD and CKD group, while least sensitivity that is 2% was observed for nitrofurantoin for both groups. Sensitivity against individual drugs is shown in table 2, while sensitivity profile of different antibiotic groups is shown in table 3.

Table 1: Cause of CKD (n=50)

S. No	Cause	Percentage
1.	Chronic GN	40% (20)
2.	Diabetic Nephropathy	40% (20)
3.	Adult polycystic kidney disease	10% (5)
4.	Obstructive nephropathy leading to CKD	10% (5)

Table 2: Sensitivity pattern of individual antibiotics against E.coli in non CKD and CKD groups.

No.	Antibiotic	Sensitivity (%) in non CKD (n=50	Sensitivity (%) in CKD (n=50)
1.	Tazobactam / Piperacillin	100% (50)	94 % (47)
2.	Cefoperazone sulbactam	96% (48)	92 % (46)
3.	Imipenem Cilastatin	76% (38)	88 % (44)
4.	Amikacin	82% (41)	86 % (43)
5.	Ceftazidime	30% (15)	18 % (09)
6.	Ceftriaxone	30% (15)	16 % (08)
7.	Cefotaxime	30% (15)	18 % (09)
8.	Norfloxacin	28% (14)	18 % (09)
9.	Ciprofloxacin	26% (13)	16% (08)
10.	Clavulanic acid / Amoxicillin	22% (11)	06% (03)
11.	Enoxacin	16% (08)	10% (05)
12.	Meropenem	18% (09)	08% (04)
13.	Moxifloxacin	08% (04)	04% (02)
14.	Nitrofurantoin	02% (01)	02% (01)
15.	Levofloxacin	02% (01)	02% (01)
16.	Nalidixic acid	0% (0)	02% (01)

Table 3: Sensitivity pattern of antibiotics groups against E.coli in non CKD and CKD group

No.	Antibiotic	Sensitivity (%) in non CKD (n=50)	Sensitivity (%) in CKD (n=50)
1.	Tazobactam / Piperacillin	100% (50)	94 % (47)
2.	Cefoperazone sulbactam	96% (48)	92 % (46)
3.	Carbapenem	94% (47)	96 % (48)
4.	Amikacin	82% (41)	86 % (43)
5.	Cephalosporins	30% (15)	18 % (09)
6.	Quinolones	28% (14)	20 % (10)
7.	Clavulanic acid / Amoxicillin	22% (11)	06 % (03)
8.	Nitrofurantoin	02% (01)	02 % (01)

DISCUSSION

In this study we have tried to find weather there is any difference between CKD and non CKD patient regarding antibiotic sensitivity of E.coli causing UTI. We know that patient with CKD due to weakened immunity are prone to infections. The role of CKD in the development of antimicrobial resistance has not been clarified. To sterilize urine we need high urinary drug concentration and at the same time we need effective tissue concentration of antibiotic. The drug concentration in the renal tissue depends upon serum concentration of antibiotic[13]. Urine concentration of an antibiotic depends upon glomerular filtration and tubular secretion. For patients with renal insufficiency with therapeutic drug levels and normal arterial perfusion to the kidneys, therapeutic antibiotic concentration in tissues and urine should not be a problem. In case of chronic renal insufficiency the urinary drug concentration may be too low to eliminate infection[3].

In our study infection rate were more in females than males in both groups. This is similar to the studies done by Gupta P and Manjunath GN et al[14,15]. Mean age was 52.56 years in CKD group as compare to 42.78 years in non CKD group. Our study showed that antibiotic sensitivity against E.coli in CKD group was 94% to Tazobactam / Piperacillin, 96% to Carbapenem group, 92% to Cefoperazone sulbactam, 86% to Amikacin, 20% to fluoroquinolones and 18% to third generation cephalosporin. While in non CKD patients it was 100% to Tazobactam / Piperacillin, 96% to Cefoperazone sulbactam, 94% to Carbapenem group, 82% to Amikacin, 30% to third generation cephalosporin and 28% to fluoroquinolones. This shows that there was no significant difference between antibiotics that represents state of art â-lactamase inhibition. Commonly used antibiotics like cephalosporin and quinolones showed low sensitivity for both groups. For these two drugs the sensitivity was more in non CKD patients as compare to CKD patients. Jung YS et al showed sensitivity of 100% to Imipenem, 90% to Amikacin, 75% to third generation cephalosporin and 66% to quinolones in CKD patients[8]. If we compare our study to this study it shows that sensitivity to less commonly use antibiotics is about same, but for antibiotics like third generation cephalosporin and quinolones which are over and miss used by general practitioners and quakes has got low sensitivity as compared to international levels.

The sensitivity of E.coli against third generation cephalosporin was 30% in non CKD group as compare to 18% in CKD group. Previous antimicrobial treatment especially with third cephalosporin has been reported with high level multi drug resistance. Twenty eight percent in non CKD group in 20% in CKD group showed sensitivity to E.coli for quinolones. Resistance to ciprofloxacin has been reported at 69% in India and 89.9% in Brazil[16,17]. According to Acar GF resistance to quinolone is higher and developing countries than develop nation, reason being use of less active quinolones and use of potent quinolones in low dose[18]. It is recommended that only those fluoroquinolones should be used who achieve both good urine and serum concentration. Therefore Moxifloxacin should not be used because of their low urinary concentration. In case of renal failure the dose of drug should be adjusted according to the degree of renal insufficiency as guided by standard reference sources[19]. In patients with infected cysts and adult polycystic kidney disease drugs like cephalosporin, amino glycosides and penicillin are not use because they do not achieve adequate concentration in the cysts[20]. Ciprofloxacin is indicated for the treatment of infected renal cysts because it achieves effective concentration in the cysts[21]. Therefore CKD itself makes the treatment of UTI difficult, because even if there is no difference between sensitivity profile in CKD and non CKD patient, option are limited for CKD patient because either some drug are Nephrotoxic like amino glycosides are other cannot achieve therapeutic concentration due to renal failure.

CONCLUSION

Based on our study there is no significant difference between CKD and non CKD groups regarding sensitivity of β-lactamase inhibiting antibiotics and Amikacin in E.coli UTI. Third generation cephalosporin and quinolones showed low level of sensitivity for both groups.

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