ORIGINAL ARTICLE

SPECTRUM OF BACTERIAL CULTURE AND DRUG SENSITIVITY VS RESISTANCE IN UNCOMPLICATED URINARY TRACT INFECTION

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Background: The growing antibiotic resistance against uropathogens has made its treatment a challenge for the physicians. This study was conducted to know the spectrum of bacteria responsible for urinary tract infection and their susceptibility and resistance to available antibiotics. **Methods:** This hospital based cross-sectional study was carried out from May to October 2017. All patients presenting with urinary tract infection signs and symptoms and were included in the study. A sample of 168 patients of both gender and age were recruited for the study using convenient sampling technique. Antimicrobial isolation and differentiation was determined by using Cystine-lactose Electrolyte Deficient (CLED) Agar. Susceptibility and resistance to 30 available antibiotics were determined. Data was collected on the pre-designed proforma. SPSS version 16 was used for data entry and analysis. **Results:** There were 62 (36.9%) males and 106 (63.1%) females. Mean age of the male patients was 55.34±21.33 years whereas the mean age of the female patients was 45.8±22.07 years and the difference was statistically significant (p=0.007). Gram negative bacteria were isolated from 141 (83.9%) of the cases. Gender wise distribution of Gram negative and positive strains was found statistically significant (p=0.032). *E. coli* was the commonest bacterium found in 70.8% of cases. It was sensitive to only seven (23%) antibiotics in over 80% of the cases. *E. faecalis, K. pneumoniae, P. aeruginosa* and *S. faecalis* were susceptible to 13%, 26.7%, 40% and 23% of antibiotics respectively in over 60% of the cases. 90% of the cultured pathogens were susceptible to Nitrofurantoin in over 80% of the cases. Among cultured pathogens, 70% showed susceptibility to Imipenem, Meropenem, Amikacin, Doxycycline, Fosfomycin and Cefoperazone/Sulbactam in over 60% of the cases. **Conclusion:** UTI is more common in women as compared men. *E. coli, E. faecalis, K. pneumoniae and P. aeruginosa* are the major pathogens responsible for UTI in this part of the country and in over 80% of the cases are still sensitive to Nitrofurantoin.

Keywords: Urinary tract infection; Gram positive and negative uropathogens; Antibiotic susceptibility

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INTRODUCTION

Urinary tract infection (UTI) is characterized by colonization of uropathogens in the urinary tract causing pyouria, dysuria and urgency. World over 150 million patients suffer from UTI, resulting in more than 6 billion US $ loss per annum.[1] It is the most common bacterial infection affecting people both at community and hospital levels. Dreadful sequels of UTI are pyelonephritis and renal scaring. The bacteria involved in the UTI have special properties of toxins production, siderophores and adhesions enabling them to invade the urinary tract and transmit infection among various individuals. The main stay of treatment of UTI is antibiotics. However, with increasing reports of bacterial resistance to antibiotics have made the treatment a challenge.[2,3]

Based on the clinical presentation, UTIs are classified as complicated and uncomplicated. UTI associated with co-morbidities like prostatic hypertrophy, chronic renal failure, renal stones, etc is complicated one. It needs longer treatment duration and has high probability of failure to response. Sexually active individuals with structurally and functionally normal urinary tracts present more commonly with uncomplicated UTI.[4]

E coli cause 70–95% UTIs. Various other organisms responsible for the remainder of the UTI are *S.saprophyticus*, *Proteus* species, *Klebsiella* sp ecies, *Enterococcus faecalis,* other *Enterobacteriaceae*, and yeast. Some species are more common in certain subgroups of population, such as *Staphylococcus saprophyticus* in young women. However, *S saprophyticus* can also produce acute cystitis in older women and in young men so it should not be regarded as a contaminant for convenience in the urine cultures of these individuals.[5] Frequent antibiotic exposure causes multidrug-resistant pathogens, such as extended-spectrum beta-lactamase (ESBL) and

carbapenemase producers. However, the prevalence of multidrug-resistant pathogens varies by locale.[6]

Urinary tract infection has become a challenge for physicians due to growing resistance to multiple antibiotics. A major contributing factor being irrational and indiscriminate use of antibiotics across the globe. In United States, the Food and Drug Administration (FDA) has started encouraging the pharmaceutical industry for the development of new antibiotics to overcome MDR organisms.[7]

This study was conducted to determine the common uropathgens and their antibiotic susceptibility in this part of Khyber Pakhtunkhwa.

MATERIAL AND METHODS

This hospital based cross-sectional study was carried out in a tertiary care hospital of KPK during six months period from May to October 2017. Permission from the ethical review board was sought from Institutional Review Board. All patients presenting with one or more clinical features of UTI like burning micturation, fever, hyopgastric pain, dysuria and urgency were included in the study. Patients suffering from chronic renal failure and those with a history of catheterization during last three months were excluded from the study. A sample of 168 patients of both gender and age were recruited for the study using convenient sampling technique. Verbal informed consent was obtained from all patients after explaining the objectives of the study. All patients were asked to provide mid stream urine *(clean catch)* and the method was explained to them. Antimicrobial isolation, differentiation and their susceptibility was determined by using Cystine-lactose Electrolyte Deficient (CLED) Agar. Data was collected on the pre-designed proforma. SPSS version 16 was used for data entry and analysis.

RESULTS

The study enrolled 168 patients complaining of urinary tract infection. There were 62 (36.9%) males and 106 (63.1%) females. The mean age of the patients was 49.33±22.22 years. Mean age of the male patients was 55.34±21.33 years whereas the mean age of the female patients was 45.8±22.07 years and the difference was statistically significant (p=0.007). The age distribution showed that men suffer UTI at old age as compared to women. Sex wise age group distribution (Table-1) revealed that more men (48.4%) at old age (above 60) suffer from UTI as compared to old age women (29.2%).

This study revealed that in 141 (83.9%) of the cases, the UTI was caused by Gram negative bacteria and Gram-positive bacteria were found in 27 (16.1%) cases. Gender wise distribution showed that Gram negative strains caused infection in 57 (91.9%) males and 84 (79.2%) females, whereas Gram positive strains were found in 5 (8.1%) males and 22 (20.8%) females. The difference was found statistically significant (p=0.032).

Gender wise frequency of various pathogens found on urine culture is shown in table 2. The most common (70.8%) bacterium found was *E. coli.*

Sensitivity of the cultured bacteria was determined for thirty different antibiotics. Table-3 and 4 show the antibiotic susceptibility and resistance against the cultured Gram negative and positive uropathogens.

Table-1: Sex and age group wise distribution of the patients

Sex	Up to 20 years	21–40 years	41– 60 years	Above 60 years	Total
Male	6 (9.7%)	8 (12.9%)	18 (29%)	30 (48.4%)	62
Female	15 (16.1%)	26 (24.5%)	33 (31.1%)	31 (29.2%)	106
Total	22 (13.1%)	34 (20.2%)	51 (30.4%)	61 (36.3%)	168

Table-2: Frequency of various pathogens

Bacterium	**Patient sex**		**Total**
	Male	Female	
Enterococcus faecalis	2 (3.2%)	13 (12.3%)	15 (8.9%)
Escherichia coli	49 (79%)	70 (66%)	119 (70.8%)
Klebsiella oxytoca	0	2 (1.9%)	2 (1.2%)
Klebsiella pneumoniae	3 (4.8%)	7 (6.6%)	10 (6%)
Methicillin resistant Staph aureus	0	1 (0.9%)	1 (0.6%)
Methicillin sensitive Staph aureus	1 (1.6%)	2 (1.9%)	3 (1.8%)
Proteus Mirabilis	0	1 (0.9%)	1 (0.6%)
Pseudomonas aeruginosa	5 (8.1%)	4 (3.8%)	9 (5.4%)
Streptococcus faecalis	2 (3.2%)	5 (4.7%)	7 (4.2%)
Streptococcus agalactiae	0	1 (0.9%)	1 (0.6%)
Total	62	106	168

Table-3: Antibiotic susceptibility and resistance of Gram Negative Uropathogens

Drug		*E. coli*	*K. oxytoca*	*K. pneumoniae*	*P. mirabilis*	*P. aeruginosa*
Amoxicillin/clavulanic acid	S	34 (28.6%)	0	3 (30%)	0	0
	R	85 (71.4%)	2 (100%)	7 (70%)	1 (100%)	9 (100%)
Ampicillin/Sulbactam	S	34 (28.6%)	0	3 (30%)	0	0
	R	85 (71.4%)	2 (100%)	7 (70%)	1 (100%)	9 (100%)
Cefepime	S	58 (48.7%)	0	5 (50%)	0	8 (88.9%)
	R	61 (51.3%)	2 (100%)	5 (50%)	1 (100%)	1 (11.1%)
Cefoperazone	S	41 (34.5%)	0	3 (30%)	0	4 (44.4%)
	R	78 (65.5%)	2 (100%)	7 (70%)	1 (100%)	5 (55.6%)
Cefotaxime	S	42 (35.3%)	0	3 (30%)	0	3 (33.3%)
	R	77 (64.7%)	2 (100%)	7 (70%)	1 (100%)	6 (66.7%)
Cefuroxime	S	37 (31.1%)	0	3 (30%)	0	4 (44.4%)
	R	82 (68.9%)	2 (100%)	7 (70%)	1 (100%)	5 (55.6%)
Ceftazidime	S	42 (35.3%)	0	3 (30%)	0	8 (88.9%)
	R	77 (64.7%)	2 (100%)	7 (70%)	1 (100%)	1 (11.1%)
Ceftriazone	S	41 (34.5%)	0	3 (30%)	0	5 (55.6%)
	R	78 (65.5%)	2 (100%)	7 (70%)	1 (100%)	4 (44.4%)
Cephalexin	S	4 (3.4%)	0	0	0	0
	R	115 (96.4%)	2 (100%)	10 (100%)	1 (100%)	9 (100%)
Cephradine	S	4 (3.4%)	0	0	0	0
	R	115 (96.4%)	2 (100%)	10 (100%)	1 (100%)	9 (100%)
Cefaclor	S	34 (28.6%)	0	3 (30%)	0	3 (33.3%)
	R	85 (71.4%)	2 (100%)	7 (70%)	1 (100%)	6 (66.7%)
Cefixime	S	42 (35.3%)	0	3 (30%)	0	3 (33.3%)
	R	77 (64.7%)	2 (100%)	7 (70%)	1 (100%)	6 (66.7%)
Imipenem	S	113 (95%)	2 (100%)	10 (100%)	1 (100%)	6 (66.7%)
	R	6 (5%)	0	0	0	3 (33.3%)
Meropenem	S	113 (95%)	2 (100%)	10 (100%)	1 (100%)	6 (66.7%)
	R	6 (5%)	0	0	0	3 (33.3%)
Amikacin	S	107 (89.9%)	2 (100%)	10 (100%)	1 (100%)	6 (66.7%)
	R	12 (10.1%)	0	0	0	3 (33.3%)
Gentamicin	S	71 (59.6%)	1 (50%)	6 (60%)	1 (100%)	6 (66.7%)
	R	48 (40.3%)	1 (50%)	4 (40%)	0	3 (33.3%)
Tobramycin	S	55 (46.2%)	2 (100%)	5 (50%)	1 (100%)	5 (55.6%)
	R	64 (53.8%)	0	5 (50%)	0	4 (44.4%)
Doxycycline	S	53 (44.5%)	2 (100%)	5 (50%)	1 (100%)	0
	R	66 (55.5%)	0	5 (50%)	0	9 (100%)
Nalidixic acid	S	19 (16%)	2 (100%)	2 (20%)	0	0
	R	100 (84%)	0	8 (80%)	1 (100%)	9 (100%)
Ciprofloxacin	S	34 (28.6%)	2 (100%)	3 (30%)	0	6 (66.7%)
	R	85 (71.4%)	0	7 (70%)	1 (100%)	3 (33.3%)
Levofloxacin	S	35 (29.4%)	2 (100%)	3 (30%)	0	6 (66.7%)
	R	84 (70.6%)	0	7 (70%)	1 (100%)	3 (33.3%)
Norfloxacin	S	35 (29.4%)	2 (100%)	3 (30%)	0	6 (66.7%)
	R	84 (70.6%)	0	7 (70%)	1 (100%)	3 (33.3%)
Ofloxacin	S	34 (28.6%)	2 (100%)	3 (30%)	0	6 (66.7%)
	R	85 (71.4%)	0	7 (70%)	1 (100%)	3 (33.3%)
Moxifloxacin	S	35 (29.4%)	2 (100%)	3 (30%)	0	5 (55.6%)
	R	84 (70.6%)	0	7 (70%)	1 (100%)	4 (44.4%)
Trimethoprim/sulphamethoxozole	S	43 (36.1%)	0	2 (20%)	1 (100%)	3 (33.3%)
	R	76 (63.9%)	2 (100%)	8 (80%)	0	6 (66.7%)
Nitrofurantion	S	105 (82.2%)	2 (100%)	10 (100%)	1 (100%)	4 (44.4%)
	R	14 (11.8%)	0	0	0	5 (55.6%)
Fosfomycin	S	113 (95%)	2 (100%)	10 (100%)	0	6 (66.7%)
	R	6 (5%)	0	0	1 (100%)	3 (33.3%)
Pipemedic acid	S	20 (16.8%)	2 (100%)	2 (20%)	0	2 (22.2%)
	R	99 (83.2%)	0	8 (80%)	1 (100%)	7 (77.8%)
Cefoperazone/Sulbactam	S	106 (89.1%)	2 (100%)	10 (100%)	1 (100%)	5 (55.6%)
	R	13 (10.9%)	0	0	0	4 (44.4%)
Piperacillin/Tazobactam	S	108 (90.8%)	2 (100%)	9 (90%)	1 (100%)	7 (77.8%)
	R	11 (9.2%)	0	1 (10%)	0	2 (22.2%)

Table-4: Antibiotic susceptibility and resistance of Gram Positive Uropathogens.

Drug		*E. faecalis*	MRSA	MSSA	*S. faecalis*	*S. agalactiae*
Amoxicillin/clavulanic acid	S	13 (86.7%)	0	2 (66.7%)	7 (100%)	1 (100%)
	R	2 (13.3%)	1 (100%)	1 (33.3%)	0	0
Ampicillin/Sulbactam	S	13 (86.7%)	0	2 (66.7%)	7 (100%)	1 (100%)
	R	2 (13.3%)	1 (100%)	1 (33.3%)	0	0
Cefepime	S	4 (26.7%)	0	2 (66.7%)	0	1 (100%)
	R	11 (73.3%)	1 (100%)	1 (33.3%)	7 (100%)	0
Cefoperazone	S	2 (13.3%)	0	2 (66.7%)	2 (28.6%)	1 (100%)
	R	13 (86.7%)	1 (100%)	1 (33.3%)	5 (71.4%)	0
Cefotaxime	S	3 (20%)	0	2 (66.7%)	2 (28.6%)	1 (100%)
	R	12 (80%)	1 (100%)	1 (33.3%)	5 (71.4%)	0
Cefuroxime	S	5 (33.3%)	0	2 (66.7%)	2 (28.6%)	0
	R	10 (66.7%)	1 (100%)	1 (33.3%)	5 (71.4%)	1 (100%)
Ceftazidime	S	4 (26.7%)	0	2 (66.7%)	1 (14.3%)	1 (100%)
	R	11 (73.3%)	1 (100%)	1 (33.3%)	6 (85.7%)	0
Ceftriazone	S	4 (26.7%)	0	2 (66.7%)	2 (28.6%)	1 (100%)
	R	11 (73.3%)	1 (100%)	1 (33.3%)	5 (71.4%)	0
Cephalexin	S	1 (6.7%)	0	2 (66.7%)	0	0
	R	14 (93.3%)	1 (100%)	1 (33.3%)	7 (100%)	1 (100%)
Cephradine	S	0	0	2 (66.7%)	0	0
	R	15 (100%)	1 (100%)	1 (33.3%)	7 (100%)	1 (100%)
Cefaclor	S	0	0	2 (66.7%)	0	0
	R	15 (100%)	1 (100%)	1 (33.3%)	7 (100%)	1 (100%)
Cefixime	S	1 (6.7%)	0	2 (66.7%)	2 (28.6%)	1 (100%)
	R	14 (93.3%)	1 (100%)	1 (33.3%)	5 (71.4%)	0
Imipenem	S	5 (33.3%)	0	2 (66.7%)	2 (28.6%)	0
	R	10 (66.7%)	1 (100%)	1 (33.3%)	5 (71.4%)	1 (100%)
Meropenem	S	5 (33.3%)	0	2 (66.7%)	2 (28.6%)	1 (100%)
	R	10 (66.7%)	1 (100%)	1 (33.3%)	5 (71.4%)	0
Amikacin	S	5 (33.3%)	1 (100%)	3 (100%)	1 (14.3%)	0
	R	10 (66.7%)	0	0	6 (85.7%)	1 (100%)
Gentamicin	S	3 (20%)	0	1 (33.3%)	7 (100%)	0
	R	12 (80%)	1 (100%)	2 (66.7%)	0	1 (100%)
Tobramycin	S	5 (33.3%)	0	1 (33.3%)	2 (28.6%)	0
	R	10 (66.7%)	1 (100%)	2 (66.7%)	5 (71.4%)	1 (100%)
Doxycycline	S	14 (93.3%)	1 (100%)	3 (100%)	5 (71.4%)	1 (100%)
	R	1 (6.7%)	0	0	2 (28.6%)	0
Nalidixic acid	S	5 (33.3%)	0	2 (66.7%)	1 (14.3%)	0
	R	10 (66.7%)	1 (100%)	1 (33.3%)	6 (85.7%)	1 (100%)
Ciprofloxacin	S	3 (20%)	0	1 (33.3%)	1 (14.3%)	1 (100%)
	R	12 (80%)	1 (100%)	2 (66.7%)	6 (85.7%)	0
Levofloxacin	S	3 (20%)	0	1 (33.3%)	1 (14.3%)	1 (100%)
	R	12 (80%)	1 (100%)	2 (66.7%)	6 (85.7%)	0
Norfloxacin	S	3 (20%)	0	1 (33.3%)	1 (14.3%)	1 (100%)
	R	12 (80%)	1 (100%)	2 (66.7%)	6 (85.7%)	0
Ofloxacin	S	3 (20%)	0	1 (33.3%)	1 (14.3%)	1 (100%)
	R	12 (80%)	1 (100%)	2 (66.7%)	6 (85.7%)	0
Moxifloxacin	S	5 (33.3%)	0	1 (33.3%)	0	0
	R	10 (66.7%)	1 (100%)	2 (66.7%)	7 (100%)	1 (100%)
Trimethoprim/sulphamethoxozole	S	1 (6.7%)	1 (100%)	2 (66.7%)	0	0
	R	14 (93.3%)	0	1 (33.3%)	7 (100%)	1 (100%)
Nitrofurantion	S	13 (86.7%)	1 (100%)	3 (100%)	7 (100%)	1 (100%)
	R	2 (13.3%)	0	0	0	0
Fosfomycin	S	5 (33.3%)	1 (100%)	3 (100%)	5 (71.4%)	0
	R	10 (66.7%)	0	0	2 (28.6%)	1 (100%)
Pipemedic acid	S	4 (26.7%)	0	1 (33.3%)	2 (28.6%)	0
	R	11 (73.3%)	1 (100%)	2 (66.7%)	5 (71.4%)	1 (100%)
Cefoperazone/Sulbactam	S	5 (33.3%)	1 (100%)	2 (66.7%)	1 (14.3%)	1 (100%)
	R	10 (66.7%)	0	1 (33.3%)	6 (85.7%)	0
Piperacillin/Tazobactam	S	3 (20%)	0	1 (33.3%)	2 (28.6%)	1 (100%)
	R	12 (80%)	1 (100%)	2 (66.7%)	5 (71.4%)	0

DISCUSSION

Indiscriminate use of antibiotics has made the UTI a public health problem. The resistance to antibiotics, not only escalates treatment cost[8], but also affects the quality of life with restricted daily activities and abstention from works.[9] Effective management of UTIs requires essential knowledge regarding common causative microorganisms and their susceptibility to antibiotics particularly in developing countries.[10]

The results of this study revealed that frequency of UTI is more in females (63%) as compared to males (37%). UTI affects both the genders but its incidence is more in women as compared to men. It is reported that one in three women do suffers from UTI during her life time period as compared to men where the risk is one in twenty.[11] The high frequency in women is attributed to the anatomy and physiology of reproductive and genitourinary system.[12] Moreover, post-menopausal women are at higher risk due to age related factors like uterine prolapse, decrease in oestrogen levels, associated co-morbidities etc.[13,14] The results of this study are at par with other studies.[10,14]

Our study found that 83.9% of the cases were infected with Gram negative bacteria. Richa *et al*[15] reported that 84.6% of UTI cases were caused by Gram negative bacteria. Other studies around the world also found that majority of the urinary tract infections are caused by gram negative bacteria.[4,6,10]

Uropathogens show variability in their species, susceptibility and resistance to antibiotics from place to place.[8] This study found ten different uropathgens responsible for UTI; *E coli* being the major pathogen responsible for UTI in 70.8% of the patients. Other bacteria in order of frequency were *E. faecalis* (8.9%), *k. pneumoniae* (6%), *P. aureginosa* (5.4%) and *S. faecalis* (4.2%).

Several studies found *E. coli* as a major uropathogen.[4,10–15] The findings of our study confirm that the major uropathogen is still *E.coli.* Different studies across the world have also found *E. faecalis* as an important pathogen for urinary tract infections. Flores-Mireles *et al*[16] in their study found *E. faecalis* as major pathogen responsible for UTI in 8.9% of the cases. Similar proportion of UTI cases were found in a study conducted in Mexico.[17] A study from Pakistan and Nepal found 15% and 18% of the urinary tract infections caused by *E. faecalis.*[18,19] Results from a study in Vietnam found *E. faecalis* responsible for UTI in 55.1% of the cases.[20] *E. faecalis* is one of the common pathogen isolated from urinary tract infection, infected surgical sites, blood-stream and vagina.[21]

Our study found *K. pneumoniae* in 6% of the urine samples. Different studies found the pathogen in different proportions. Richa *et al*[15] found the pathogen in 2.6% of the samples, Kidwai *et al*[22] reported 11% cases, 3.4% cases were reported by Lagunas-Rangel[17], 19% by Beyene *et al*.[10]

We found *P. aureginosa* in 5.4% of the samples. Richa *et al*[15] found the pathogen in 7.7% of the samples, Flores-Mireles *et al*[16] reported it as a major pathogen in their study. Few other studies also reported *P. aureginosa* as a causative organism of UTI in 3%[22], 7.2%[4] and 2.8% cases.[17]

The results of the study revealed sensitivity of E. coli to Imipenem, Meropenem and Fosfomycin (95%), Piperacillin/Tazobactam, Amikacin, Cefoparazone/Sulbactam and Nitrofurantoin 90.8%, 89.9%, 89.1% and 82.2% respectively. *E. coli* was resistant to Amoxicillin/clavulanic acid (71.4%), Cefotaxime, Ceftazidime, Ceftriazone in 65.5%, Flouroquinolones (70%), Cephalexin, Cephradine (96.4%), Nalidixic acid (84%) and Pipemidic acid (83.2%). Results of a study from Punjab, Pakistan are comparable except Amikacin which showed 91% resistance.[18] Another study from Karachi[22], observed similar susceptibility to Imipenem. However, amikacin, tazobactam, fosfomycine and nitofurantoin were less sensitive.[22] *E. coli* resistance to Nitrofurantoin is still low (<5%)[13] in developed countries.

E. faecalis had susceptibility only to amoxicillin/clavulanic acid, ampicillin/sulbactam, doxycycline and nitrofurantoin in over 87% of the cases. However, the organism showed 100% resistant to cephradine and cefaclor and to 3rd generation cephalosporins in 66–93% of the cases. Aminoglycosides and flouroquinolones were also found ineffective in 66% to 80% of the cases.

Similar resistance patterns of *E. faecalis* to flouroquinolones and gentamicin were also published in one study.[18] Another study found beta lactams ineffective in almost all of the organisms isolated from urine samples. The author attributed the high resistance to irrational use of antibiotics and a high trend of self-medication in the area. On scientific grounds the resistance was attributed to the issue of permeability and absorption of the drug molecules as the combination of amoxicillin and clavulanic acid results is large size of the molecule.[8]

K. pneumoniae showed susceptibility to imipenem, meropenem, amikacin, nitrofurantoin, fosfomycin, cefoperazone/sulbactam in 100%

cases, and Piperacillin/Tazobactam in 90% of the cases. The bacterium was resistant to Beta lactams, Cephalosporins and flouroquinolones from 70–100% of the cases.

Kidwai *et al*[22] reported 85% sensitivity to imipenem and 70% to amikacin and Tazobactam. However, the sensitivity of Nitofurantoin and Fosfomycin was observed in 25% and 53% of the cases respectively. The resistance against *K. pneumoniae was* almost similar as in our study. However, another study showed 100% sensitivity to Nitrofurantoin thus supporting the findings of this study.[18]

P. aeruginosa was susceptible to Cefepime, Ceftazidime, Ceftriazone, Tobramycin, Moxifloxacin Cefaperazone/Sulbactam, Piperacillin/Tazobactam in 77-90% and Imipenem, Meropenem, Amikacin, Gentamycin, Ciprofloxacin, Levofloxacin, Norfloxacin, Ofloxacin and Fosfomycin in 66.7% of the cases. This uropathogen was resistant to wide range of antibiotics including Beta lactams, cephalexin, cephradine, doxcycline, nalidixic acid and fair sensitivity to Nitrofurantoin and Trimethoprim/sulphamethoxozole. In a Caucasian study the relative susceptibility of *P. aeruginosa* was ceftazidime (81.0%), meropenem (86.2%), piperacillin-tazobactam (85.4%) and amikacin (98%) [24]

CONCLUSION

UTI is more common in women as compared men. *E. coli, E. faecalis, K. pneumoniae and P. aeruginosa* are the major pathogens responsible for UTI in this part of the country and in over 80% of the cases are still sensitive to Nitrofurantoin.

RECOMMENDATIONS

The management of UTI should be based on antimicrobial culture and sensitivity when available. Where culture is not available, common uropthogens with their antibiotic susceptibility should be considered to avoid resistance. Surveillance studies regarding common pathogens and their antibiotic susceptibility is also advised.

AUTHORS' CONTRIBUTION

SAJ: Data collection and writing introduction and discussion. AA, RI: Data entry, analysis and result writing.

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