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PATTERN OF ANTIBIOTIC SUSCEPTIBILITY OF URINARY TRACT PATHOGENS AGAINST COMMONLY USED ANTIBIOTICS IN PATIENTS OF A TERTIARY CARE HOSPITAL OF DISTRICT SWAT

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Abstract

Background: *Urinary tract infection is a widespread health condition and most commonly caused by bacteria. It is estimated that annually about 150 million cases of UTIs occur worldwide which is one of the key public health complications.*

Objective: *To determine the pattern of antibiotic susceptibility of urinary tract pathogens against commonly used antibiotics in patients of a tertiary care hospital of district Swat*

Methodology: *The current cross-sectional research was conducted at the Department of Microbiology, Government Degree College Madyan Swat and the Saidu Group of Teaching Hospital Swat. The study duration was six months from January 2024 to June 2024. A total of 100 patients were included in our study. 100 mid-stream urine samples were collected from both males and females with a urinary tract infection by using sterile urine containers. Further laboratory procedures were performed in the Department of Microbiology, Government Degree College Madyan Swat. Culturing was done for all the samples by using CLED media. The isolates were identified by using gram staining and conventional biochemical testing. Kirby-Bauer Antibiotic Susceptibility testing was done for all the isolates. Data were entered and analyzed in IBM SPSS-24.*

Results: *In the current study Gram-negative bacteria that was most frequently identified in UTIs was E. coli, while gram- positive bacteria that was frequently identified was S. aureus in suspected patients in Swat. The highest risk age groups for UTI were16-30 years and 46-60 years. Among genders, females were more affected compared to males. Imipenem was the highly responsive drug for gram-negative and the highly responsive drug for gram-positive was Nitrofurantoin.*

Conclusion: *This study concludes that E. coli was the primary cause of UTI. The results of the antibiotic sensitivity test showed that the majority of the isolated bacteria in this investigation are resistant to routinely used antibiotics. Culture and sensitivity should be done before prescription of antibiotics.*

INTRODUCTION

The urinary tract consist of organs like kidneys, ureters, bladder,and urethra, that are responsible for gathering, storing, and releasing urine from the body (1). Cystitis refers to an infection of the bladder while urethritis refers to an infection of the urethra. Pyelonephritis is an infection of the kidneys caused by bacteria that can travel througthe ureters (2). Particularly in females with shorter and wider urethras, bacteria travel retrogradely from the fecal flora to the urinary system (3). Urinary tract infections are most commonly caused by bacteria. Bacteria from the gastrointestinal system that have colonized the pre-urethral region are the cause of UTIs. Gram-negative bacteria are typically found in recurrent infections, particularly when they are linked to nosocomial catheter- associated infections, stones, obstruction,and urologic manipulation. These species include Pseudomonas, Escherichia coli, Proteus, Klebsiella, Enterobacter, and Serratia (4-6). Enterococcus faecalis ,Staphylococcus aureus, and Staphylococcus epidermis are other bacterial pathogens that are commonly isolated (7). The primary cause of urinary tract infections (UTIs) is Escherichia coli (8).

Urinary tract infection is a widespread health condition, produced by a varied group of bacteria and impacting human population (9). The risk of UTIs is higher in women, because it is known that asymptomatic bacteriuria is common during pregnancy (10). Due to its physical proximity to the vagina, the female urethra is susceptible to harm during sexual activity, and the moisture-rich environment of the perineum renders females more likely to become contaminated in their bladders (11). Prostatic hypertrophy nearly invariably complicates UTIs in older men, while postmenopausal women may have an elevated post-void residual volume (12).

UTIs acquired in the community account for 80–85% of cases, Escherichia coli is the primary cause of UTIs, with Staphylococcus saprophyticus accounting for approximately 5–10% of cases. It is estimated that annually about 150 million cases of UTIs occur worldwide which is one of the key public health complications. More than 60% of women are affected by UTI at least one time in their life. (13, 14). In teenage girls and sexually active females, the rate of UTI is 10.57% higher than in men and the most communal contributing organism is Escherichia coli (15).

In recent times due to misuse of antibiotics bacteria have evolved resistance to antibiotics in medical procedures (16). Uropathogens have developed antibiotic resistance and it is an increasingly common issue globally because of the widespread and excessive use of antibiotics, prior to urine culture, and the sensitivity of bacteria to antibiotics (17-21). In case of complications or if treatment does not work properly, culture of urine may be useful. In our setting, no such study has been carried out. This study was therefore carried out to determine the pattern of antibiotic susceptibility of urinary tract pathogens against commonly used antibiotics in patients of a tertiary care hospital of district Swat.

Materials and methods

The current cross-sectional research was conducted at the Department of Microbiology, Government Degree College Madyan Swat and the Saidu Group of Teaching Hospital Swat. The study duration was six months from January 2024 to June 2024. A total of 100 patients were included in our study. The criteria for inclusion were both males and females of all ages who who had urinary tract infection signs and symptoms and were referred by a physician whereas the exclusion criteria were those patients who were using antibiotics, patients who declined to take part in the study, and patients with recognized structural anomalies of the urogenital tract (based on history and medical records). 100 mid-stream urine samples were collected from both males and females with a urinary tract infection by using sterile urine containers. Further laboratory procedures were performed in the Department of Microbiology, Government Degree College Madyan Swat. Culturing was done for all the samples by using CLED media. The isolates were identified by using gram staining and conventional biochemical testing. Kirby-Bauer Antibiotic Susceptibility testing was done for all the isolates. The antibiotics that were used included Ceftazidime, Ciprofloxacin (5ug), Gentamicin (10ug), Amikacin (30ug) , Meropenem (10ug), Penicillin (10ug), Chloramphenicol (30ug),Imipenem

(10ug),Fosfomycin(200ug),Clindamycin(2ug), Tazobactam (10ug), Nitrofurantoin (300ug), (30ug), Vancomycin Teicoplanin (30ug), Linezolid (30ug), Fosfomycin (200ug),Celestine(10ug), Tazobactam (10ug), and, Doxycycline (30ug). Data were entered and analyzed in IBM SPSS-24.

Results

In the present study, we collected 100 urine samples from UTI-suspected patients. From these samples different bacterial species were isolated, which included Pseudomonas aueroginosa 5 (5%) , E. coli 63 (63.0%), S.aureus 12 (12.0%), Enterobacter species 12 (12.0%), and E. fecalis 8 (8.0%) (Figure 1). Among 100 participants 38 (38.0%) were male and 62 (62.0%) were females. E. coli was found in the 20 (31.74%) males and 43 (68.25%) females' urine samples, and S.aureus was present in 5 (41.66%) males and 7 (58.33%) in females, Similarly Enterobacter species, Pseudomonas aueroginosa and Enterococcus fecalis were found in 7 (58.33%), 5 (100%), 1 (12.5%) males, 5 (41.66%), 0 (0.0%) and 7 (87.5%) females respectively (Figure 2).

Most of the UTIs were found in the age interval 16-30 (29.0%) and 46-60 (29.0%) years. E. coli was isolated in 11(17.64%) patients of age interval 1-15 years, 18 (28.57%) in 16-30 years, 3 (4.76%) in 31-45 years, 20 (31.74%) in 46-60 years, 7 (11.11%) in 61-75 years and 4 (6.34%) were found in age interval 76-90. Similarly S.aureus was found in 4 (33.3%) of age interval 1-15 year, 3 (25%) in 16-30 years, 0 (0.0%) in 31-45 years, 4 (33.3%) in 46-60 years, 1 (8.33%) in 61- 75 years and no S.aureus was found in the age 76-90 years, whereas in Enterobacter species, P. aueroginosa and E. fecal 2 (16.6%),0 (0.0%), 0 (0.0%) of age interval 1-15 years, 3 (25.0%), 1 (20.%), 4 (50.0%) in 16-30 years, 3 (25.0%), 0 (0.0%),1 (12.5%) in age 31-45 years, 2 (16.6%), 2 (40.0%), 1 (12.5%) in 46-60 years, 1 (0.83%), 2 (40.%), 2 (25.0%) in 61-75 years and 1 (8.33%),0 (0.0%) and 0 (0.0%) were found in the age interval 76-90 years respectively as shown in figure 3.

S. aureus was sensitive to Doxycycline in 66.6% of cases and resistant in 33.3% of cases. 41.66% of cases were sensitive, 50.0% intermediate and 8.33% were resistant to Fucidic acid. Similarly, S. aureus was sensitive to Rifampicin in 83.33% of cases and resistant in 16.66% of cases. In the case of Penicillin, G S.aureus was not sensitive, 66.66% showed an intermediate response and 33.33% of cases were resistant. S. aureus was not sensitive to Teicoplanin whereas, in 41.66%, it showed intermediate response and resistance in 58.33% cases. In the case of Chloramphenicol S.aureus was sensitive in 83.3% of cases and intermediate in 16.66% of cases. In NitrofurontoinS.aureus was sensitive in 83.33% of cases, in 8.33% of cases intermediate, and in 8.33% of cases resistant. In the case of Vancomycin, it was sensitive to 66.66% of cases and resistant to 33.33% of cases, whereas it was sensitive to 91.66% of cases and resistant to 8.33% cases to Erythromycin.41.66% of cases were sensitive, 8.33% of intermediate and 50% cases were resistant to Fosfomycin. S. aureus was sensitive to 66.66% of cases and resistant to Ciprofloxacin in 33.33% of cases.

E. fecalis was sensitive to Doxycycline in 100.0% of cases and resistant in 0.0% of cases. 25% of cases were sensitive and 75% were resistant to Fucidic acid. Similarly, E. fecalis was sensitive to Rifampicin in 25% of cases, intermediate in 25%, and resistant in 50.0% of cases. In the case of Penicillin G E. fecalis was sensitive 100.0%. E. fecalis was sensitive to Teicoplanin in 100.0% of cases. In the case of Chloramphenicol, E. fecalis was sensitive in 33.5% of cases and resistant in 62.5% of cases. In Nitrofurontoin E. fecalis was sensitive in 100.0% of cases. In the case of Vancomycin, it was resistant to 100.0% of the cases, whereas it was not sensitive in any case, 25.0% were intermediate and resistant to 75.0% cases in the case of Erythromycin. No case was seen as sensitive, 12.5% intermediate, and 87.5% cases were resistant to Fosfomycin. S. aureus was sensitive in 12.5% of cases and resistant to Ciprofloxacin in 87.5% of cases.

E. coli was sensitive to Cefotaxime in 19.04% of cases, intermediate in 7.9%, and resistant in 73.0% of cases. 76.1% of cases were sensitive, 11.11% intermediate and 12.6% were resistant to Tazobactam. Similarly, E. coli was sensitive to Ceftazidime in 19.0%% cases and resistant in 80.9% of cases. In the case of Gentamycin, E. coli was sensitive in 33.33% and resistant in 66.66% of cases. E. coli was sensitive in 80.9% of cases to Sulbactam whereas in 12.6% it showed intermediate response and resistance in 6.3% cases. In the case of

Polymyxin B, E. coli was sensitive in 34.9% of cases, intermediate in 49.2% of cases, and 14.28% of cases were resistant. In Imipenem E. coli was sensitive in 85.7%% cases, 7.9% cases intermediate, and 6.3% cases were resistant. In the case of Nitrofurantoin it was sensitive to 82.5% of cases, 12.6% of cases were intermediate, and 7.76% cases were resistant, whereas it was sensitive to 23.8% cases, intermediate to 12.6% and resistant to 63.4%% cases in the case of Ciprofloxacin.76.1%% cases were sensitive, 11.11% intermediate and 12.69% cases were resistant to Amikacin. E. coli was sensitive in 47.6% of cases, intermediate in 22.22%, and resistant in 30.15% of cases to Colastine Sulphate. Enterobacter species were sensitive to Cefotaxime in 25% of cases and resistant in 75.0% of cases. 91.6% of cases were sensitive and 8.3% of cases were intermediate to Tazobactam. Similarly, Enterobacter species were sensitive to Ceftazidime in 50.0% of cases and resistant in 50.0% of cases. In the case of Gentamycin Enterobacter species were sensitive in 58.33% and resistant in 41.66% of cases. Enterobacter species were sensitive in 91.66% of cases to Sulbactam whereas in 8.33% it showed an intermediate response. In the case of Polymyxin Enterobacter species were sensitive in 75% of cases, intermediate in 8.33% of cases, and 16.66% of cases were resistant. In the case of Imipenem Enterobacter species were sensitive in 100.0% of cases. In the case of Nitrofurantoin, it was sensitive to 91.66% of cases and intermediate to 8.33% of cases, whereas it was sensitive to 33.33% of cases and resistant to 66.66% of cases in the case of Ciprofloxacin. 100.0% of cases were sensitive to Amikacin. Enterobacter species were sensitive in 66.66 % of cases, intermediate in 8.33%, and resistant in 25.0% of cases to Colastine Sulphate.

Pseudomonas aueroginosa was sensitive to Cefotaxime in 20% of cases and resistant in 80.0% of cases. 80.0% of cases were sensitive and 20.0% of cases were resistant to Tazobactam. Similarly, Pseudomonas aueroginosa was resistant in 100.0% of cases to Ceftazidime. In the case of Gentamycin, Pseudomonas aueroginosa was sensitive in 60.0% and resistant in 40.0% of cases. Pseudomonas aueroginosa was sensitive in 60.0% of cases to Sulbactam whereas in 20.0% it showed an intermediate response and 20.0% showed a resistant response. In the case of Polymyxin B Pseudomonas aueroginosa was sensitive in 80% of cases, intermediate in 20.0% of cases, and 0.0% cases were resistant. In the case of Imipenem, Pseudomonas aueroginosa was sensitive in 80.0% of cases and 20.0% showed a resistant response. In the case of Nitrofurantoin, it was sensitive to 60.0% of cases and intermediate to 40.0% of cases, whereas it was sensitive to 60.0% of cases and resistant to 40.0% of cases in the case of Ciprofloxacin. 40.0% of cases were sensitive and 60.0% were resistant to Amikacin. Pseudomonas aueroginosa was sensitive in 40.0 % cases and resistant in 60.0% cases to Colastine Sulphate. (Table 1 and 2)

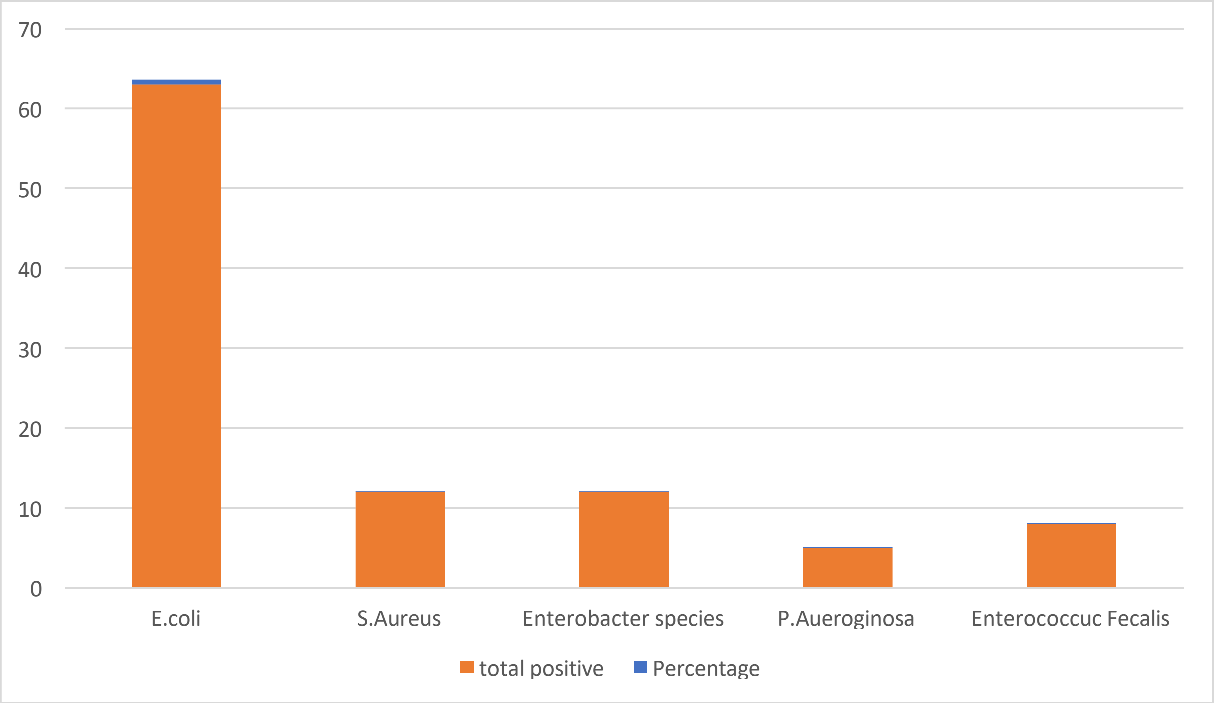

Figure 1: distribution of bacteria isolated from patients with UTI

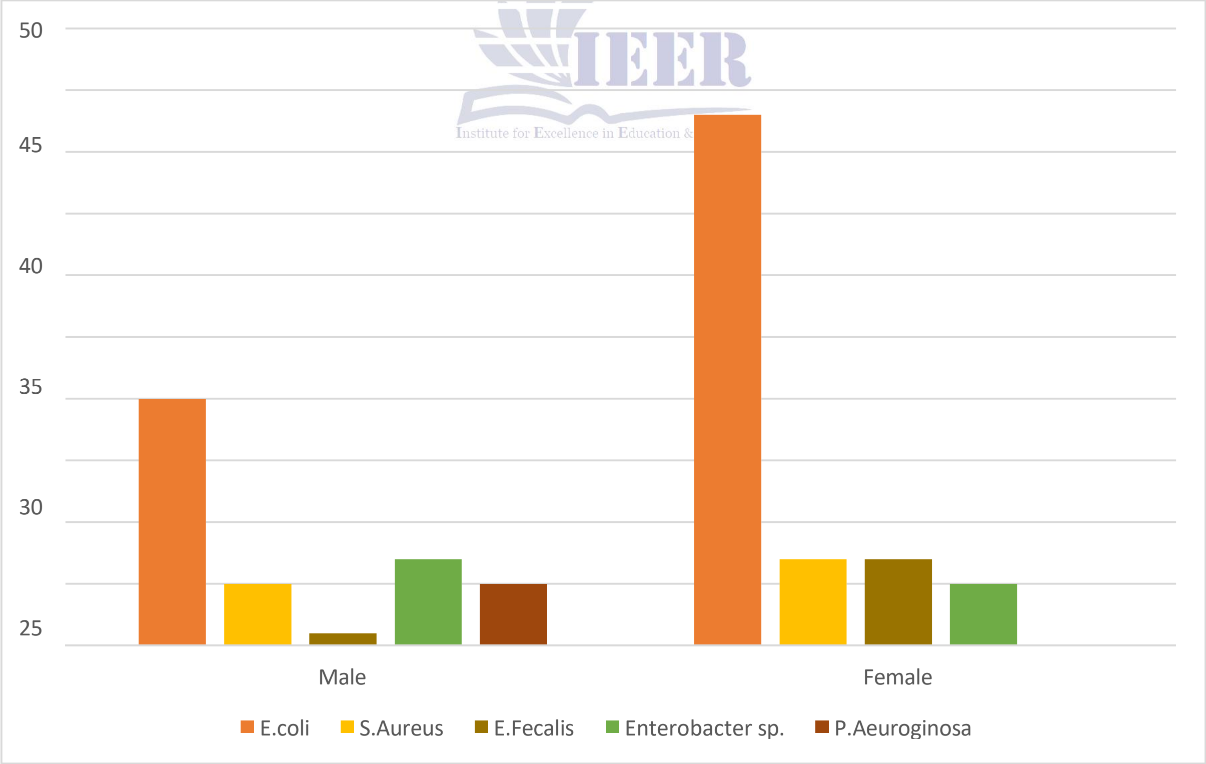

Figure 2: Distribution of bacteria isolated from patients with UTI W.R.T to gender

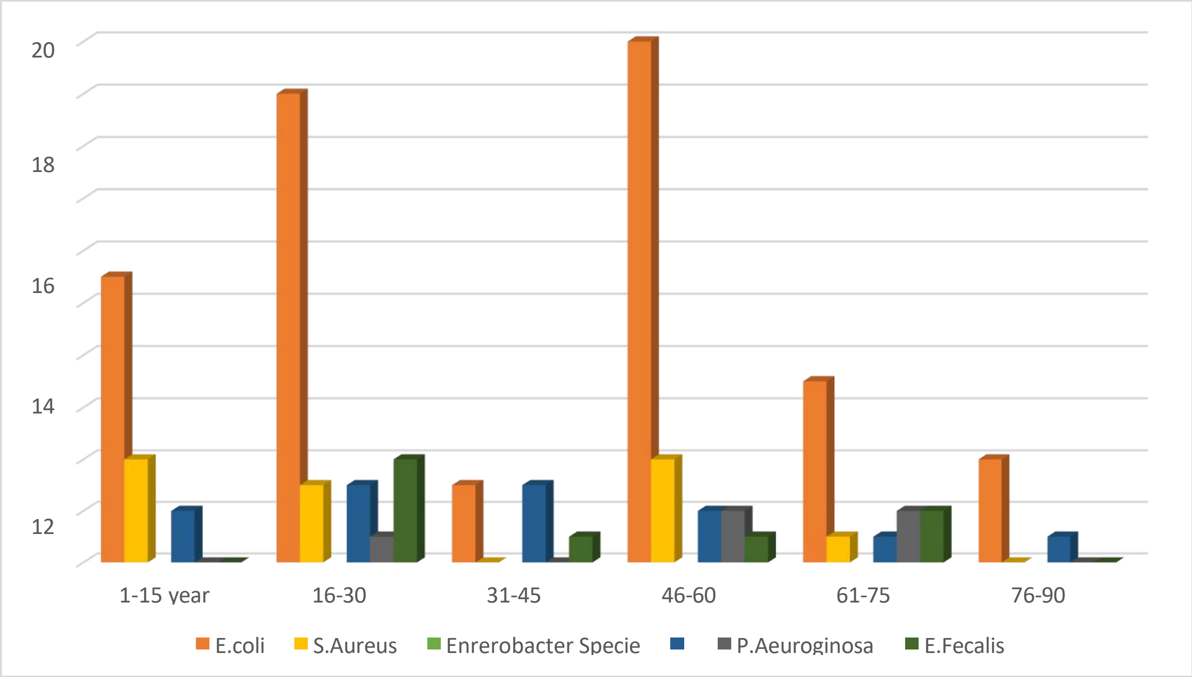

Figure 3: Distribution of bacteria isolated from patients with UTI W.R.T to age

Table 1: Antibiotic susceptibility pattern of Gram Positive Bacteria in urine samples

Antibiotics	S. *aureus*			E. *fecalis*		
Pattern	S	I	R	S	I	R
Doxycycline	8	0	4	8	0	0
Fucidic Acid	5	6	1	2	0	6
Rifampicin	10	0	2	2	2	4
Penicillin G	0	8	4	8	0	0
Teicoplanin	0	5	7	8	0	0
Chloramphenicol	10	2	0	3	0	5
Nitrofurontoin	10	1	1	8	0	0
Vancomycin	8	0	4	0	0	8
Erythromycin	11	0	1	0	2	6
Fosfomycin	5	1	6	0	1	7
Ciprofloxacin	4	3	4	1	4	4

Table 2: Antibiotic susceptibility pattern of Gram Negative Bacteria in urine samples

Antibiotics	E. *coli*			Enterobacter species			P. *aueroginosa*		
Pattern	S	I	R	S	I	R	S	I	R
Cefotaxime	12	5	46	3	0	9	1	0	4
Tazobactam	48	7	8	11	1	0	4	0	1
Ceftazidime	12	0	51	6	0	6	0	0	5
Gentamycin	21	0	42	7	0	5	3	0	2
Sulbactam	51	8	4	11	1	0	3	1	1
Polymyxin B	22	31	9	9	1	2	4	1	0
Imipenem	54	5	4	12	0	0	4	0	1

Nitrofurontoin	52	8	3	11	1	0	3	2	0
Ciprofloxacin	15	8	40	4	0	8	3	0	2
Amikacin	48	7	8	12	o	o	2	0	3
Colastine Sulphate	30	14	19	8	1	3	2	0	3

Discussion

This research was conducted in order to find the causative pathogens of infection of the urinary tract in local people of Swat Considering the pattern of antibiotic sensitivity against them. The urine samples were taken from both male and female patients. Males were 44 years old on average, while females were 35 years old. In the current study the frequency of UTI was greater in females (62%) compared to males (38%). This research is in accordance with the findings of the previous study (22). The increased frequency of UTI in women is in accordance with the previous study who reported more UTI cases as compared to male (23). Whereas in Hazara division it is more frequent in male may be due to their environmental conditions or male dominancy (23). Five different types of pathogens were isolated including , S. aureus, E. coli, P.aeuroginosa, Enterobacter species and E.fecalis.

The most prevalent urinary tract bacterium was E. coli, identified in 63.0% cases. coli was shown to be the most frequent bacteria in both the 2010 and 2013 studies carried out at the Department of Microbiology, Armed Forces Institute of Pathology, Rawalpindi, and the Mayo Hospital, Lahore. These studies accounted for 63% and 80% of all the culture-positive strains (24, 25). A comparable work carried out in Peshawar (KP) has reported comparable findings that indicate E. coli (77%) as the main uropathogens (26).

However, in two related investigations conducted in Canada and Ethiopia recently, the prevelance of E. coli as the causative agent of UTIs was shown to be 80–90% (27, 28). Conversely to this research, one research from Aurangabad showed Klebsiella as the most common isolate followed by Staphylococcus aureus, Escherichia coli, and Pseudomonas aueroginosa (1). This difference could be due to environmental factors, socioeconomic status and host immunity and Klebsiella might be prevalent in these areas. In this research, 85% isolates of E. coli were Imipenem sensitive, the outcome being in line with a comparable study done at AFIP two years prior and the study carried out in Peshawar (25, 26). These findings coincide with previous research conducted in India, which found that 96% of E. Coli isolates were imipenem-susceptible (29). Ciprofloxacin sensitivity of E. coli was 23.80% similar to research carried out in other Indian and Pakistani cities (25,26,29). But a study conducted in London shown that 94% of the E. coli strains were susceptible to ciprofloxacin, indicating a significant difference in the condition (30). These different outcomes obviously indicate the unnecessary ciprofloxacin utilization has resulted in declining sensitivity to these essential. The sensitivity of E. coli to Nitrofurontoin in this investigation was observed in 82.53%, but in a study conducted in London, it reached 94% (30). Nitrofurontoin sensitivity was seen in every isolate of enterococcus that we had. The profile of antibacterial sensitivity of P.aueroginosa showed that a high number of isolates were susceptible to Nitrofurontoin, Tazobactum,and Imipenem. Whereas in this study P.aeuroginosa was resistant to Ceftazidime. These results of our study in this case are Varying from a previous study conducted at the AFIP laboratory (2010), where86% of the strains showed susceptibility to Ceftazidime , Imipenem and Antipseudomonal penicillin's (76%) (25). The resistance of Ceftazidime could be due to its misuse which would have made p. aueroginosa more resistant. According to our research, which is similar with other local investigations, Enterobacteriaceae, including E. coli have higher antimicrobial sensitivity to Imipenem (26). S. aureus with a prevalence rate of 12.0 percent was shown to be the second most prevalent pathogen associated with UTIs.

This finding confirms the outcomes of Akerele et al (31). The research of Okonko et al (32) in Nigeria ,Ibadan, and Manikandan et al (33) in India, who described the organism as the second most prevalent pathogen in UTIs, were also published, along with a 35.6% recovery rate for S. aureus in

Benin-city, Nigeria. These latest results thus validate S. aureus as a significant etiologic agent in UTIs. S.aureus susceptibility test results in the research demonstrated resistance 100% to penicillin and Teicoplanin, 41.6% to Fucidic acid and Fosfomycin. But S.aureus was sensitive to 83.3% chloramphenicol, Rifampicin and vancomycin, 66.6% to doxycycline, clindamycin and ciprofloxacin. As a result, it can be concluded that every S. aureus isolate linked to this UTI was Methicillin-resistant S. aureus (MRSA) and that their level of resistance to widely used medications was extremely high. This finding has been extensively reported in the majority of MRSA infections (34, 35).

Conclusion

This study concludes that E. coli was the primary cause of UTI. The results of the antibiotic sensitivity test showed that the majority of the isolated bacteria in this investigation are resistant to routinely used antibiotics. Culture and sensitivity should be done before prescription of antibiotics. Antibiotic assay results may influence the physician's recommendation of antibiotics.

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