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ORIGINAL ARTICLE

Common organisms in urinary tract infections and their sensitivity to pharmacological treatment in the outdoor patients of Urology Department Sheikh Zayed Hospital.

Aqib Shahzad[1], Syed Atif Hussain[2], Muhammad Shafi Ghori[3], Muhammad Sajjad[4], Muhammad Saddiq Haris[5], Muhammad Zohaib Fazal[6]

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ABSTRACT… Objective: To identify the most common organisms causing urinary tract infections (UTIs) and evaluate their sensitivity to pharmacological treatments. **Study Design:** Cross-sectional study. **Setting:** Out-patient Department of Urology, Sheikh Zayed Hospital, Rahim Yar Khan. **Period:** 1 Nov 2024 to 1 April 2025. **Methods:** on 119 patients, both male/female, aged 18-60 years, diagnosed with UTIs and no history antibiotic intake. Urine samples were collected and sent for culture and sensitivity. Data was analyzed using SPSS 25.0 with P-value < 0.05 as statistically significant. **Results:** In the study, the mean age of male participants was 43.45 ± 9.01 years, while the mean age of female participants was 44.58 ± 12.94 years. Fever was significantly more common in males (36.5%) compared to females (11.9%) ($p = 0.003$). Escherichia coli was the most prevalent (35.3%), with high susceptibility to Amikacin (83.3%) and Colistin (95.2%), but high resistance to Amoxicillin (76.2%) and Cefotaxime (47.6%). Klebsiella pneumoniae was most susceptible to Colistin (94.9%) and Meropenem (92.3%) but resistant to Amoxicillin (87.2%) and Cefotaxime (61.5%). Pseudomonas aeruginosa showed high resistance to Amoxicillin (52.4%) but was highly susceptible to Colistin (88.9%) and Teicoplanin (100%). **Conclusion:** Escherichia coli was identified as the most prevalent pathogen, particularly in females. The findings highlight the concerning resistance of common pathogens, such as Klebsiella pneumoniae and Pseudomonas aeruginosa, to frequently used antibiotics

Key words: Antibiotics, Microbial Sensitivity, Urinary Tract Infection.

INTRODUCTION

UTIs are one of the most common medical conditions in the world, and the condition significantly burdens healthcare systems. While UTIs can occur in any age group and gender, the prevalence is higher in women.[1] Nearly seven million visits to outpatient departments OPDs and up to one million visits to emergency departments are made annually due to UTIs: around 0.1 million cases require being hospitalized.[2] These statistics point out that UTIs have a massive impact on patients' quality of life as well as healthcare resources. The high recurrence rate of the condition is also a cause for concern, with an estimated 60% of women experiencing at least one episode of UTI in their lifetime.[3] If the risk factors and underlying causes of UTIs are not identified and treated promptly, the condition can progress to more severe complications. These include the spread of infection to the kidneys (pyelonephritis), which can cause intense pain, fever, and potentially permanent kidney damage. Chronic or recurrent UTIs may also lead to renal scarring, resulting in a progressive decline in kidney function and, in severe cases, to renal failure. In pregnant women, untreated UTIs are associated with adverse outcomes such as preterm labor and low birth weight, further underscoring the importance of early diagnosis and treatment.[4]

Prevention is of paramount importance since UTIs carry significant health and economic implications. Proper hydration, good personal hygiene, and control of predisposing conditions are of utmost importance. Early recognition of symptoms, including dysuria, increased frequency, and urgency of urination, and prompt

1. MBBS, PGR Urology, Sheikh Zayed, RYK.
2. MBBS, FCPS, Associate Professor Urology Dept, Sheikh Zayed, RYK.
3. MBBS, MS, FCPS (Urology), Assistant Professor Urology Dept, Sheikh Zayed, RYK.
4. MBBS, PGR Urology, Sheikh Zayed, RYK.
5. MBBS, FCPS, SR Urology, Sheikh Zayed, RYK.
6. MBBS, PGR Urology, Sheikh Zayed, RYK.

Correspondence Address:
Dr. Aqib Shahzad
Department of Urology
Sheikh Zayed, RYK.
aqibshahzad213@gmail.com

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medical intervention can reduce the risks of recurrence and complications. The gold standard for the diagnosis of a urinary tract infection (UTI) is urine culture. It also provides accurate information regarding the pathogenic organisms along with their sensitivity to antibiotics and, therefore is very important to modulate the appropriate therapeutic strategy. Other than urine culture, urine dipstick tests and urine flow cytometry are mainly used as an initial screening technique.[5]

Most of the UTIs are caused by bacterial pathogens. Gram-negative organisms are the most common causative agents. Of these, Escherichia coli is the most common cause of both complicated and uncomplicated UTIs.[6] This is because it adheres to the uroepithelium and avoids the host's immune response. Other Gram-negative bacteria are also responsible for UTIs; these include: Proteus species, Pseudomonas aeruginosa, Acinetobacter species, Klebsiella species, Enterobacter species, and Citrobacter species. Each of the organisms has differences in virulence and antibiotic resistance, which challenges the clinical management.[7] Among Gram-positive, Staphylococcus saprophyticus is an important organism causing UTI, especially among young sexually active females. Important Gram-positive pathogens include Enterococcus species and coagulase-negative Staphylococcus. These organisms, though less frequent than their Gram-negative counterparts, can also cause severe infections if not properly managed.[8]

A native case-control study analyzed urine culture and sensitivity patterns and reported a gender distribution of 17 males (37.8%) and 12 females (26.7%) in the diabetic (Group DM) and non-diabetic (Group NDM) groups with a mean participant age of 54.64 ± 9.74 years. Escherichia coli appeared as a dominant pathogen (48.67%), antibiotic susceptibility testing showed highest susceptibility to Fosfomycin (88.6%), followed by nitrofurantoin (81.8%) and meropenem (75%).[9] In similar lines, a cross-sectional study assessing 1,599 urine samples demonstrated high bacterial growth in 12.3% of the samples. The most commonly identified pathogen was Escherichia coli 58.7%, followed by Klebsiella pneumoniae at 22.5%. Most of the bacterial isolates showed resistance to ampicillin and co-trimoxazole, while resistance to amikacin and nitrofurantoin was the lowest.[10]

The review of existing literature has revealed some gaps. While global data on UTI pathogens and antimicrobial resistance exist, studies focusing on the local microbiological profile and drug sensitivity patterns specific to Pakistan, and particularly Sheikh Zayed Hospital, are scarce. Most studies concentrate on hospitalized patients, leaving a gap in understanding UTI causative organisms and treatment patterns in outpatient settings.[11] With the rapid emergence of antimicrobial resistance, existing studies may not reflect the current sensitivity and resistance trends, particularly in a dynamic healthcare setting. In addition, Common UTI pathogens like E. coli are well-documented, but atypical or less frequent pathogens in the region may be underreported or understudied.

The purpose of this study is to determine the most prevalent pathogens causing urinary tract infections and assess their susceptibility to pharmacological therapy in patients attending the Urology Department of Sheikh Zayed Hospital who are outdoor patients. This study will have high utility in enhancing clinical management by providing region-specific data on UTI pathogens and their antimicrobial resistance patterns, thereby enabling more accurate and effective empirical treatments. The findings will contribute to the development of local treatment guidelines tailored to the specific needs of the patient population, reducing reliance on generalized protocols that may not address local resistance trends.

METHODS

This is a cross-sectional study conducted at Out-patient department of Urology, Sheikh Zayed Hospital, Rahim Yar Khan after ethical approval (802/IRB/SZMC/52A). The sample size was 119 calculated by using WHO calculator by with the incidence of most common organism of urinary tract infections to be 27%, confidence level of 95% and 8% margin of error.[8] A specific criterion

of inclusion and exclusion was designed. Patients with both gender, 18-60 years of age diagnosed as cases of urinary tract infection and no history antibiotic intake were included in the study. On the other hand, patients who are terminally ill or having a history of genitourinary tuberculosis, Female patients with active menstrual cycles, diagnosed pelvic inflammatory disease or tubal ovarian pathology, active menstrual cycles, diagnosed pelvic inflammatory disease or tubal ovarian pathology were excluded from this study. Similarly, Patients with diagnosed appendicitis or colitis and male patients with diagnosed epididymitis and orchitis were also excluded. The diagnostic criteria for UTI were define as follows[12]

1) Bacteriuria with >100,000 CFU,
2) Pyuria with >10 WBCs per field
3) Symptoms like Dysuria, new urinary frequency or urgency,
4) Cloudy, bloody or odorous appearance of urine,
5) Chills and fever,
6) New onset pain in suprapubic or flank area,
7) History of urinary incontinence,
8) Dysuria or difficult micturition,
9) Urinary retention as the inability to completely empty the bladder during voiding, resulting in an increased residual volume of urine in the bladder, typically exceeding 100 milliliters, as measured by ultrasound or catheterization,
10) Presence of pus in the urine-on-urine complete examination
11) Pyelonephritis is defined as a bacterial infection of the renal pelvis and parenchyma, typically characterized by clinical symptoms such as fever, flank pain, and dysuria, in conjunction with laboratory findings such as leukocytosis, pyuria, and bacteriuria.

On the basis of detailed history of clinical features and previous history, clinical examination and laboratory investigations patients were diagnosis with urinary tract infection as per the designed criteria. A written informed consent was taken. Data was collected on a predesigned Performa. Urine samples were collected from each participant after giving clear instructions to the patients using aseptic technique obtaining a midstream urine sample. The samples were sent to pathology laboratory for culture and sensitivity.

Data was entered and analyzed using SPSS software (version 25.0). Data was be stratified for age, gender, previous UTI and poststratification Chi-square test will be applied. P-value < 0.05 was considered as statistically significant.

RESULTS

In the study, the mean age of male participants was 43.45 ± 9.01 years, while the mean age of female participants was 44.58 ± 12.94 years ($p = 0.592$). Regarding symptoms, fever was significantly more common in males (36.5%) compared to females (11.9%) ($p = 0.003$). Dysuria was experienced by 44.2% of males and 38.8% of females ($p = 0.683$). Urinary retention occurred in 19.2% of males and 10.4% of females ($p = 0.274$). Urgency was reported by 50% of males and 32.8% of females ($p = 0.088$). Increased frequency of urination was more common in females (73.1%) compared to males (61.5%) ($p = 0.251$). Pyelonephritis was present in 7.7% of males and 14.9% of females ($p = 0.353$). Previous urinary tract infections (UTIs) were reported by 25% of males and 32.8% of females ($p = 0.467$). Lastly, previous catheterization was experienced by 21.2% of males and 14.9% of females ($p = 0.521$) (Table-I).

The organisms isolated from urine cultures in the study were as follows: Escherichia coli was the most prevalent, accounting for 35.3% of isolates, with 12 cases in males and 30 cases in females. Enterococcus was isolated in 16.0% of cases, with 3 male and 16 female cases. Klebsiella pneumoniae was found in 29.4% of cases, with 15 males and 20 females. Pseudomonas aeruginosa accounted for 15.1% of the isolates, with a higher prevalence in males (15 cases) compared to females (3 cases). Enterobacter cloacae was the least common, present in 4.2% of cases, with 1 male and 4 female cases. The significant p-value (0.00018) indicates a notable difference in the prevalence of urinary pathogens between male and female participants (Table-II, Figure-1).

The susceptibility of various organisms to

different antibiotics was assessed, with the results as follows: Escherichia coli showed high susceptibility to Amikacin (83.3%) and Colistin (95.2%), but high resistance to Amoxicillin (76.2%) and Cefotaxime (47.6%). Enterococcus demonstrated full susceptibility to most antibiotics, including Amikacin, Ceftazidime, and Teicoplanin. Klebsiella pneumoniae was most susceptible to Colistin (94.9%) and Meropenem (92.3%) but resistant to Amoxicillin (87.2%) and Cefotaxime (61.5%). Pseudomonas aeruginosa showed high resistance to Amoxicillin (52.4%) but was highly susceptible to Colistin (88.9%) and Teicoplanin (100%). Enterobacter cloacae was fully susceptible to Penicillin and Teicoplanin but showed resistance to several antibiotics, including Cefotaxime (80%) and Ceftriaxone (60%) (Table-III).

Variable	Male (n=52)	Female (n=67)	P-Value
Age (Mean + S.D)	(43.45 ± 9.01)	(44.58 ± 12.94)	0.592
Fever (%)	19 (36.5%)	8 (11.9%)	0.003
Dysuria (%)	23 (44.2%)	26 (38.8%)	0.683
Urinary retention (%)	10 (19.2%)	7 (10.4%)	0.274
Urgency (%)	26 (50.0%)	22 (32.8%)	0.088
Increased frequency (%)	32 (61.5%)	49 (73.1%)	0.251
Pyelonephritis (%)	4 (7.7%)	10 (14.9%)	0.353
Previous UTI (%)	13 (25.0%)	22 (32.8%)	0.467
Previous catheterization (%)	11 (21.2%)	10 (14.9%)	0.521

Table-I. Comparison of clinical symptoms and history between male and female participants with urinary tract infections

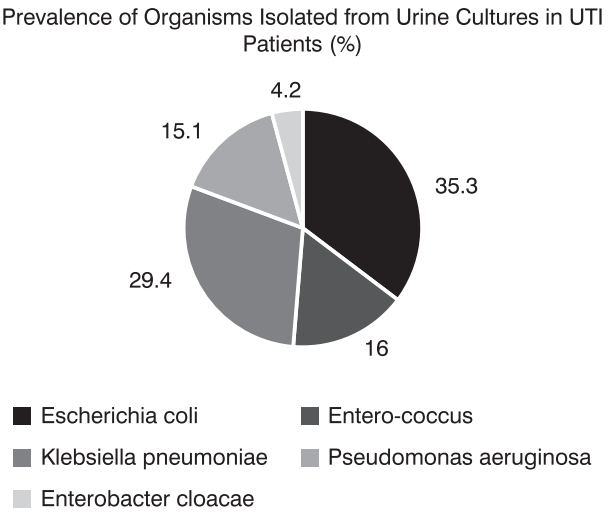

Figure-1. Prevalence of organisms isolated from urine cultures in UTI patients (%)

DISCUSSION

The findings from this study highlight important patterns in the clinical presentation, microbial profile, and antibiotic susceptibility of urinary tract infections (UTIs) in male and female patients. The clinical characteristics of UTI were evaluated in a cohort of 119 patients, and significant differences were observed in the prevalence of certain symptoms. Common symptoms of urinary tract infections (UTIs) typically include dysuria (painful urination), increased urinary frequency, urgency, lower abdominal pain, and fever. In more severe cases, symptoms may progress to include pyelonephritis, which is characterized by flank pain, nausea, and vomiting.[13] In this study, while dysuria, urinary urgency, and increased frequency were observed in both male and female participants, fever was more prevalent in males (36.5%) compared to females (11.9%), showing a significant gender difference ($p = 0.003$).

Organisms Isolated from Urine Culture	N (Total)	N (Male)	N (Female)	P-Value	Prevalence (%)
Escherichia coli	42	12	30	0.00018	35.3
Entero-coccus	19	3	16		16.0
Klebsiella pneumoniae	35	15	20		29.4
Pseudomonas aeruginosa	18	15	3		15.1
Enterobacter cloacae	5	1	4		4.2

Table-II. Distribution and prevalence of organisms isolated from urine cultures in male and female UTI patients

	Susceptibility	Escherichia Coli (%)	Entero-coccus (%)	Klebsiella Pneumoniae (%)	Pseudomonas Aeruginosa (%)	Enterobacter Cloacae (%)
Amikacin	S	83.3	100	76.9	66.7	80
	R	16.7		23.1	33.33	20
Amoxicillin	S	23.8	31.6	12.8	47.6	100
	R	76.2	68.4	87.2	52.4	
Ceftaxamine	S	59.5	100	51.3	100	60
	R	40.5		48.7		40
Cefotaxime	S	52.4	100	38.5	100	20
	R	47.6		61.5		80
Cephalexin	S	42.9	100	25.6	100	100
	R	57.1		74.4		40
Cotrimoxazole	S	47.6	26.3	20.5	100	60
	R	52.4	73.7	79.5		60
Ceftriaxone	S	59.5	100	56.4	100	40
	R	40.5		43.6		100
Ciprofloxacin	S	66.7	15.8	51.3	61.1	80
	R	33.3	84.2	48.7	38.9	20
Colistin	S	95.2	100	94.9	88.9	100
	R	4.8		5.1	11.1	
Gentamicin	S	71.4	89.1	64.1	72.2	80
	R	28.6	10.9	35.9	27.8	20
Levofloxacin	S	64.3	10.5	46.2	55.6	40
	R	35.7	89.5	53.8	44.4	60
Meropenem	S	95.2	100	92.3	87.4	100
	R	4.8		7.7	12.6	
Netilmicin	S	76.2	100	71.8	76.9	80
	R	23.8		28.2	23.1	20
Norfloxacin	S	52.4	31.6	30.8	100	20
	R	47.6	68.4	69.2		80
Nitrofurantoin	S	71.4	36.8	64.1	100	60
	R	28.6	63.2	35.9		40
Piperacillin-Tazobactum	S	88.1	100	89.7	74.1	80
	R	11.9		10.3	25.9	20
Penicillin	S					
	R	100	100	100	100	100
Tigecycline	S	95.2	94.7	89.7	71.4	100
	R	4.8	5.3	10.3	28.6	
Teicoplanin	S	100	89.5	100	100	100
	R		10.5			
Vancomycin	S	100	84.2	100	100	100
	R		15.8			

Table-III. Antibiotic susceptibility profiles of urinary pathogens isolated from UTI patients

Pyelonephritis was found in 7.7% of males and 14.9% of females, though this difference was not statistically significant ($p = 0.353$). These findings align with the typical UTI symptom profile, but also highlight a gender-based variation in symptom severity, particularly with fever. This could suggest a gender-based difference in the immune response or severity of infection. Various studies have labelled UTI with strong gender biases as incidence of the disease is 40 times more in female as compare to male.[14]

The microbiological data revealed Escherichia coli as the most prevalent pathogen, accounting for 35.3% of the isolates, with a significantly higher prevalence in females (30 cases vs. 12 cases in males, $p = 0.00018$). It correlates with the findings of a retrospective cohort analysis that reveals higher frequency of E.coli in females (53%) than in males (27%, $p < 0.001$).[15] Other organisms, such as Klebsiella pneumoniae and Pseudomonas aeruginosa, were also isolated in significant numbers. Klebsiella pneumoniae was found in 29.4% cultural that coincides with existing literature revealing 35.73% prevalence of klebsiella in UTIs.[16] P. aeruginosa was more commonly isolated from male patients. The distribution of organisms aligns with findings from other studies, which have identified Klebsiella pneumoniae and Pseudomonas aeruginosa as significant pathogens in complicated UTIs. The antibiotic susceptibility patterns indicated considerable variation in the effectiveness of different antibiotics against the isolated organisms. Among the pathogens, Escherichia coli and Klebsiella pneumoniae showed high resistance to commonly used antibiotics like Amoxicillin and Cefotaxime, with resistance rates of 76.2% and 87.2% for Amoxicillin, and 47.6% and 61.5% for Cefotaxime, respectively. This reflects the growing issue of antibiotic resistance in urinary pathogens, which is becoming an increasing concern in clinical practice. Conversely, E. coli and K. pneumoniae showed high susceptibility to Amikacin, Colistin, Meropenem, and Tigecycline, which could be considered as treatment options for infections caused by these organisms an correlates with existing literature.[17]

The findings from this study can be effectively utilized to enhance the management and treatment of urinary tract infections (UTIs) in the outpatient setting of the urology department at Sheikh Zayed Hospital. By providing data on the prevalence of specific pathogens and their susceptibility to antibiotics, the study can guide clinicians in selecting the most effective, targeted treatments, thereby minimizing the overuse of broad-spectrum antibiotics and reducing the risk of antibiotic resistance. The observed gender-based differences in UTI symptoms and microbial distribution can inform more personalized treatment strategies, ensuring that both male and female patients receive optimal care. However, this study has certain limitations. The study was conducted on a relatively small sample size (119 patients), which may limit the generalizability of the findings to the broader population of UTI patients. The study was cross-sectional in nature, which means it only provides a snapshot of the microbial and clinical data at one point in time. Long-term data on recurrence, resistance patterns, and treatment outcomes would offer a more comprehensive understanding of UTIs in this population.

CONCLUSION

This study provides valuable insights into the clinical presentation, microbial profile, and antibiotic susceptibility patterns of urinary tract infections (UTIs) in patients at Sheikh Zayed Hospital's urology department. Escherichia coli was identified as the most prevalent pathogen, particularly in females, with significant gender-based differences observed in symptom severity and microbial distribution. The findings highlight the concerning resistance of common pathogens, such as Klebsiella pneumoniae and Pseudomonas aeruginosa, to frequently used antibiotics like Amoxicillin and Cefotaxime, emphasizing the growing issue of antibiotic resistance. However, the study also identified certain antibiotics, such as Amikacin, Colistin, and Meropenem, that remain highly effective against these pathogens. The data underscore the importance of personalized treatment strategies, gender-specific management, and ongoing monitoring of antibiotic resistance patterns to

optimize patient outcomes and combat the rise of antimicrobial resistance. Overall, this research supports the need for targeted, evidence-based approaches in UTI management, and highlights the importance of continued surveillance and adaptation of treatment protocols to address the evolving landscape of UTI pathogens.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORSHIP AND CONTRIBUTION DECLARATION	
1	**Aqib Shahzad:** Data analysis, data collection, composition.
2	**Syed Atif Hussain:** Composition, data analysis, review.
3	**Muhammad Shafi Ghori:** Composition review.
4	**Muhammad Sajjad:** Data collection.
5	**Muhammad Saddiq Haris:** Composition.
6	**Muhammad Zohaib Fazal:** Data collection.