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Research Article

Bacterial Etiology and Antibiotic Susceptibility Patterns in Urinary Tract Infection among Patients with Various Renal Conditions

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Abstract: Urinary tract infections (UTIs) are a common medical problem affecting a significant number of individuals around the world. The administration of UTIs in patients with renal abnormalities can be challenging, as these patients might require specific consideration and antibiotic regimens. The purpose of this study, which was carried out in the District Bahawalpur, was to investigate the prevalence, bacterial composition, and antimicrobial resistance pattern of UTIs in individuals with renal conditions, including renal calculi, renal cysts, and renal failure. In this descriptive cross-sectional study, 50 clinical samples from Bahawal Victoria Hospital, Bahawalpur, were subjected to microbiologic analysis using urine culture and drug susceptibility testing, and statistical analysis using descriptive statistics. Mean Patient Age was 28.52 ± 2.99, and the female to male ratio was 27:23. Among 50 patients 44% had right kidney stones, and 56% of patients faced UTIs for the first time. The most common pathogen was *Escherichia coli* (*E. coli*) (50%), which was followed by *Klebsiella spp* (20%), *Pseudomonas spp* (16%), *Morganella spp* (8%), and *Staphylococcus aureus* (6%). Azetronam was effective against some bacteria, including 4.0% of *Escherichia coli* and 8.0% of *Klebsiella spp*. Amoxicillin and Polymyxin were less effective than Augmentin and Amikacin, which were the most often used antibiotics. Our study demonstrates that antibiotic selection based on bacterial etiology is crucial for effective UTI treatment in patients with renal abnormalities. These findings improve patient outcomes and address the challenge of antibiotic resistance in patients with renal conditions.

Keywords: Antibiotic Susceptibility; Bacterial Etiology; Renal Conditions; Urinary Tract Infection.

1. INTRODUCTION

Urinary tract infections (UTIs) are a typical medical problem affecting a huge number of individuals around the world. However, people with renal conditions, like those with ongoing specific renal conditions (SRC) such as Bilateral kidney stone, right kidney stone, left kidney stone, bladder stone, renal cyst and renal failure, are at an increased risk of developing UTIs. These patients frequently have altered immune systems, which leads to intermittent or more extreme UTIs. Moreover, the utilization of immunosuppressive prescriptions in patients with SRC can additionally increase the risk of UTIs. The administration of UTIs in patients with renal abnormalities can be challenging, as these patients might require specific consideration and antibiotic regimens. Kidney stones influence many individuals, and up to 10% of all people will have a kidney stone in the course of their life [1]. Patients with renal diseases frequently had polymicrobial infections, with different microbes in their urine samples. Alternately, those with ordinary renal function had isolated bacterial infections, normally caused by *Escherichia coli* [2]. *Klebsiella pneumoniae is* the most prevalent intestinal pathogen, followed by *Pseudomonas aeruginosa* and several *Enterococci species* [3]. *E. coli* is the most prevalent uropathogen. However, in patients with specific renal conditions (SRC), *P. aeruginosa*, *Enterococcus faecalis*, and other non-*Enterobacteriaceae species* were more likely to cause infections [4]. The key component of

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standard UTI therapy is the use of antibiotics. The appropriate antibiotics should be chosen by considering the antibiotic susceptibility pattern of the causative isolate, infection type (community-acquired or hospital-acquired infection), the patient's conditions, including age, gender, history of allergy, underlying diseases, prior antibiotic consumption, taking other medications, history of prior UTIs, site of infection, and other factors [5]. Various antibiotics, including Amoxicillin, Ceftriaxone, Cephalexin, Ciprofloxacin, Fosfomycin, Levofloxacin, Nitrofurantoin, and Trimethoprim/sulfamethoxazole, treat urinary infections. Little has been accomplished despite the great efforts, and more study is needed to develop an antibiotic substitute for the treatment of UTIs [5]. In our study, the prevalence, bacterial composition, and antibiotic susceptibility patterns of UTIs in individuals with SRC were examined. UTIs are frequent infection that affects the genitourinary system and may be linked to numerous structural, metabolic, or functional problems of the kidneys. To create successful prevention measures and direct suitable treatment techniques, it is essential to understand the connection between SRC and the occurrence of UTIs. Additionally, investigating the bacterial etiology and patterns of antimicrobial resistance of UTIs in this particular patient population can offer insights into the selection of antimicrobial drugs for the best patient management. This study aims to enhance clinical decision-making by contributing to the understanding of UTIs in patients with SRC and to enhance clinical decision-making in the management of UTIs in these patients.

2. MATERIALS AND METHODS

2.1. Study Design

This study was conducted at the Bahawal Victoria Hospital (BVH), Bahawalpur, Pakistan, from July 2022 to January 2023. Urine samples were collected from the patients of the outdoor and indoor departments using aseptic techniques in a sterile container, which was then carried to the pathology section of Quaid-E-Azam Medical College (QMC), Bahawalpur, for further processing. This study was approved by the Ethical Review Committee of the Islamia University of Bahawalpur (letter No. IUB/ERC/20/2022). Specimens were collected using a straightforward random sampling technique in accordance with international safety regulations and biosafety standards, informed consent ensuring confidentiality and anonymizing data during analysis and reporting. Patient's clinical history including age, gender (male & Female), UTI history, hygiene as well as the presence of bilateral kidney stone, right kidney stone, left kidney stone, bladder stone, renal cyst, and renal failure was collected from the patient. Patients without above given conditions were excluded from the study samples. Contaminated specimens (with three or more pathogens exceeding 100,000 colonies/mL) were also excluded from analysis.

2.2. Data Collection

Fifty urine samples were collected from patients showing positive symptoms for UTIs in sterile conditions in the morning from the outdoor patient ward. The patient's identification and the date of collection were written on the sample container before the urine analysis process started. A sterile tube was used for culture after 0.5-1.0 mL had been thoroughly mixed and aseptically transferred. Before doing biochemical analysis with a dipstick or automatic reader, the sample's physical properties, i.e., color, clarity, and odor, were recorded. To achieve a clear supernatant for turbid or discolored materials, centrifugation was performed prior to testing. A refractometer was used to analyze the sediment's specific gravity, and at 100X and 400X magnifications, microscopic analysis revealed cellular components, casts, crystals, and bacteria. Chemical analysis was performed using 9 reagent "Chemistript", which measured nitrite, leukocyte esterase, pH, protein, glucose, ketones, Urobilinogen, and bilirubin semi-quantitatively. These strips could also detect hemoglobin, erythrocytes, and myoglobin.

2.3. Isolation of Uropathogens

While urine culture remained the preferred test, positive dipstick testing was considered specific for asymptomatic bacteriuria. A sterilized platinum wire loop (0.001 mL) was used to spread the urine sample on petri dishes in UV UV-irradiated culture hood to maintain a sterilized environment to avoid environmental contamination on LAMIL PLUS. The prepared media was poured into the Petri dishes before cooling down and solidifying. Urine samples were spread on MacConkey agar and blood agar (OXOID, UK). The culture dishes were incubated at 37 °C for 18-24 hours. The catalase and oxidation tests were performed to detect oxidase and catalase-positive colonies.

2.4. Gram Staining

Samples were smeared on slides, each labeled with its sample number, forming colonies. A primary crystal violet stain was applied, followed by fixer and decolorizing steps each lasting 30 seconds. Safranin was then used for 30 seconds. Gram staining differentiates Gram-negative and Gram-positive bacteria [6].

2.5. Biochemical and Oxidation Test

Bacteria produce toxic superoxide and hydrogen peroxide (H_2O_2) during aerobic respiration, which can cause cell death. To counteract this, they generate superoxide dismutase for superoxide and catalase for H_2O_2. Gram-positive and gram-negative bacteria can be distinguished using the catalase test, which entails adding 3% H_2O_2 to a culture and watching for bubbles [7], [8]. A variety of sugars were added to carbohydrate fermentation broth, and fresh overnight cultures were inoculated. The color change of broth was monitored after 24 to 28 hours incubation [9]. Oxidase enzymes, which catalyze the production of H_2O or H_2O_2 during aerobic respiration, are detected by the oxidase test. Aerobic, facultative, and microaerophiles generally have oxidase activity, but obligatory anaerobes don't have oxidase activity. With the exception of Bacillaceae, the majority of Gram-positive species are oxidase negative, whereas the majority of Gram-negative organisms have oxidase activity [8].

2.6. Antimicrobial Susceptibility

After sterilizing the loop, colonies from Petri dishes were transferred to Muller-Hilton agar. Using a cotton swab stick, the sample was spread across the plate for 24 hours at 37 °C. Different types of antibiotics were used to test antibiotic sensitivity of identified bacteria, including Ceftazidim (CAZ) 30 µg, Levofloxin (LEO) 5 µg, Penicillin (P) 10 µg, Tetracycline (TGC) 30 µg, Cefoxitin (FOX) 30 µg, Erythromycin (E) 30 µg, clarithromycin (CLR) 15 µg, Moxifloxacin (MXF) 5 µg, Meropenem (MEM) 10 µg Teicoplanin (TEC) 30 µg, Imipenem (IMI) 10 µg, Sulphamethoxazole (SXT) 25 µg, Amox + Clav (AUG) 30 µg, Vancomycin (VA) 30µg, Cefotaxime (CTX) 30 µg, Fusidic acid (FD) 10 µg, linezolid (LNZ) 30 µg, Clindamycin (DA) 10 µg, and Tobramycin (TOB) 10 µg (Sensi-Discs™ Ceftazidime, CAZ-30). The Disc diffusion test was qualitative, which categorizes susceptibility derived by RIS category, including resistance, intermediate, and sensitive, following MIC standards [10]. Antibiotic discs for Gram-negative rods and Gram-positive cocci were placed on the agar, followed by 12-hour incubation. The resulting zones indicated bacterial sensitivity, intermediate, and resistance response. The zone size for each medication was interpreted using the standards established by the Clinical and Laboratory Standards Institute (CLSI) [11]. Results were recorded and used to recommend suitable treatment.

2.7. Statistical Analysis

Statistical analyses were conducted using software like SPSS V.27. Descriptive statistics, encompassing frequencies, percentages, means, and standard deviations, summarized the demographic and clinical traits of the study group. The prevalence of urinary tract infections (UTIs) in patients with renal stones and diabetes was determined by calculating case proportions within the sample. To gauge the correlation between factors and UTI occurrence, inferential tests were performed. Chi-square test examined categorical variables (e.g., gender, hygiene, previous operations). The antimicrobial resistance of uropathogens was assessed, noting proportions of resistance, intermediate, and sensitivity to antibiotics. The zones of inhibition around antibiotic discs were measured, and diameters were recorded. Comparing resistance patterns among bacterial species involved a chi-square test to ascertain statistical significance. P-values <0.05 were considered significant.

3. RESULTS

3.1. Demographic and Clinical Characteristics of Study Participants

This study explored UTIs in individuals with renal conditions, providing insights into their prevalence, bacterial etiology, and antimicrobial resistance patterns. It involved 50 participants with renal stones, with a higher female-to-male ratio. A slightly higher percentage of patients had bladder stones than bilateral kidney stones, which impact both kidneys. Only a very small fraction of subjects had kidney failure. Renal cysts were uncommon; however, left kidney stones were more prevalent. Right kidney stones were found in the largest group. Participants' mean age was 28.52 ± 2.99 years. A little over half of the participants reported experiencing their first UTI, and a lower percentage reported having a second episode. A comparable percentage reported a third episode, and only a tiny percentage experienced more than three UTI episodes (Table 1). Visually depicts UTI prevalence among participants with various renal conditions, aiding our understanding of how these conditions influence UTI rates. Chi-square tests showed no significant association between types of SRC and UTI frequency. Confidence interval with 95% confidence level is used to determine UTI frequencies in population based on the study samples.

3.2. Frequency Distribution of Urinary Tract Infections among Renal Condition Categories

The study explored UTI frequency distribution among SRC categories (Table 2). Notably, UTI frequencies significantly varied. Bilateral kidney stone, kidney failure, left kidney stone (LKS), and right kidney stone (RKS) spanned the 1st to "More" frequency categories, signifying broader UTI ranges. Conversely, bladder stones and renal cysts mostly appeared in the 1st category. Urinary tract infections were present in a significant percentage of patients with bilateral renal abnormalities at variable frequencies, suggesting persistent infections. Right kidney stones were present in a substantial number of cases, indicating a greater vulnerability to UTIs. The most prevalent kidney stones were on the left, suggesting a higher risk of infection. Urinary tract infections linked to renal cysts and bladder stones were very uncommon.

3.3. Severity and Clinical Presentation of Ultrasound Injuries in Renal Calculi, Cyst and Failure

This study investigated the severity and clinical presentation of UTIs in people with renal calculi, cysts, and failure. Despite the fact that several of the 37 patients lacked microbiological data, doctors

Table 1. Mean, standard deviation, and percentage of variables.

Variables		
Age (Mean ± SD, Median (IQR))	28.52 ± 2.99, 24.50(40)	
Gender Frequency		
Female	27(54%)	
Male	23(46%)	
Renal Abnormalities		
Mean ± SD	8.33±8.641	
Bilateral Kidney stone	2(4%)	
Bladder Stone	3(6%)	
Kidney failure	6(12%)	
Left kidney stone	16(32%)	
Renal cyst	1(2%)	
Right kidney stone	22(44%)	
UTI Frequency		
Mean ± SD, Median (IQR)	1.68 ± 0.86, 1.00(1.00)	95% confidence interval
1st time	28(56%)	0.0097, 0.3203
2nd time	11(22%)	0.0063, 0.1537
3rd time	10(20%)	0.0048, 0.1452
More	1(2%)	-0.0448, 0.1298

Note: Demographic and Clinical Characteristics of Study Participants.

Table 2. Distribution of UTI frequencies among patients with various renal abnormalities.

Renal abnormalities	UTI frequency (%)				Total (%)
	1st	2nd	3rd	More	
Bilateral	4	0	0	0	4
Bladder Stone	6	0	0	0	6
Kidney failure	2	2	8	0	12
Left Kidney Stone	18	10	4	0	32
Renal cyst	0	2	0	0	2
Right Kidney Stone	26	8	8	2	44
P-value	0.224	0.263	0.285	0.306	

treated their symptoms. Notably, pus cell counts, indicating considerable inflammation or infection, while yeast presence, indicating compromised immunity. While epithelial cells, white and red blood cell casts, indicating hemorrhage, Inflammation, trauma, and neoplasia infection. The data distribution was revealed by percentiles, with the 25th percentile indicating that at least 25% of patients had values that were at or below 1.00. The 75th percentile showed that at least 75% of patients had values at or below 1.00 for several parameters, whereas medians showed that around 50% of patients had values between 1.00 and 2.00 (Table 3).

3.4. Antibiotic Sensitivity and Resistance

The antibiotic sensitivity and resistance among microorganisms. Azetronam and tazobactam had inconsistent efficacy, while Imipenem and cotrimoxazole showed high sensitivity to various bacteria. Cephalexin consistently demonstrated sensitivity, indicating its safety for treatment. Nitrofurantoin and ciprofloxacin exhibited clear resistance, underscoring the need for cautious use. Azetronam was effective against some bacteria, including 4.0% of *E. coli* and 8.0% of *Klebsiella species*. Imipenem generally showed sensitivity, especially against S. aureus. Cotrimoxazole displayed high sensitivity across all bacteria. Sensitivity rates varied for ciprofloxacin and nitrofurantoin. Notably, *S. aureus* was 100.0% sensitive to vancomycin, offering valuable insights into UTI antibiotic resistance and sensitivity patterns (Table 4). The p-value indicates Antibiotic susceptibility significance in contrast with bacterial etiology.

3.5. Bacterial Etiology and Antibiotic Resistance in UTI Patients with Renal Conditions

The study investigated UTI bacterial etiology and antibiotic resistance in patients with bilateral kidney stones, right kidney stones, left kidney stones, bladder stones, renal cyst and renal failure (Table 5). *Escherichia coli* (*E. coli*) was the most common pathogen (50%), followed by *Klebsiella spp* (20%), *Pseudomonas spp* (16%), *Morganella spp* (8%), and *Staphylococcus aureus* (6%). Antibiotic prescriptions varied based on the bacteria. Ciprofloxacin and Imipenem were common for *E. coli*. Moxifloxacin was preferred for *Klebsiella spp* and *Morganella spp*. *Pseudomonas spp* showed resistance to many antibiotics. Moxifloxacin was primary for *Staphylococcus aureus*.

Table 3. Mean and standard deviation for the urine analysis test.

		Yeast	Pus cell	WBC cast	RBC cast	Granule	Epithelial cell
Mean		1.16	1.81	1.30	1.16	1.03	1.51
Std. Deviation		0.374	0.397	0.463	0.374	0.164	0.507
Percentiles (IQR)	Q1 = 25	1.00	2.00	1.00	1.00	1.00	1.00
	Q2 = 50	1.00	2.00	1.00	1.00	1.00	2.00
	Q3 = 75	1.00	2.00	2.00	1.00	1.00	2.00

Note: Summary of urine analysis statistical analysis and percentiles for measured parameters.

Table 4. Percentage of antibiotic susceptibility.

Antibiotics	Sensitivity (%)	Intermediate (%)	Resistant (%)	Bacterial Etiology (%)					p-value
				E. coli	*Klebsiella spp*	*Morganella spp*	*Pseudomonas spp*	*S. aureus*	
Azetronam	4.0	88	8	52	20	4	15	6	0.220
Imipenem	94	6	0	0	0	0	0	100	0.287
Tazobactam	44	56	0	42	25	10	10	10	0.265
Cotrimoxazole	6	88	6	47	9	18	9	6	0.241
Cephalexin	16	84	0	59	21	7	4	7	0.241
Ceftazidime	32	54	14	48	12	11	7	11	0.241
Amikacin	56	22	22	36	36	9	0	18	0.241
Sulbactam	38	58	4	46	20	10	13	10	0.241
Ceftriaxone	20	74	6	40	27	5	18	8	0.220
Ciprofloxacin	36	16	48	53	15	0	7	23	0.220
Levofloxacin	32	24	44	50	16	16	0	16	0.265
Cefepime	24	66	10	54	21	9	6	9	0.241
Sulphamethoxazole	4	92	4	52	21	8	15	2	0.220
Gentamycin	26	60	14	53	13	0	23	10	0.220
Amox+clav	28	44	28	54	27	0	9	9	0.241
Cefotaxime	18	62	20	41	22	12	16	6	0.220
Nitrofurantoin	44	48	8	33	20	12	25	8	0.220
Cephalexin	4	96	0	52	20	8	16	2	0.220
Fosfomycin	16	80	4	52	20	0	20	7	0.241
Vancomycin	4	94	2	53	21	8	17	0	0.220
Linezolid	4	96	0	52	20	8	16	2	0.220
Clindamycin	2	94	4	51	21	8	17	2	0.220
Teicoplanin	4	92	4	52	21	6	17	2	0.220
Azithromycin	0	96	4	50	20	8	16	4	0.220
Clarithromycin	2	94	4	53	21	8	14	2	0.220
Erythromycin	0	98	2	51	20	8	16	4	0.220
Moxifloxacin	2	94	4	51	21	8	17	4	0.220
Cefadroxil	2	88	10	54	15	6	15	6	0.265
Ampicillin	2	76	22	60	13	0	18	7	0.220
Cefixime	2	80	18	55	12	7	17	7	0.241
Total				50	20	8	16	6	

Note: Microbial profile of urine culture and antibiotic resistance/sensitivity patterns.

4. DISCUSSION

The study provides insights into UTIs in patients with renal conditions, specifically renal stones and diabetes. The gender distribution showed more females (54%) than males (46%), consistent with previous research [12-14]. Prevalence of Bilateral kidney stone, right kidney stone, left kidney stone, bladder stone and renal cyst among participants: bilateral kidney stones (4%), bladder stones (6%), kidney failure (12%), left kidney stones (32%), renal cysts (2%), and right kidney stones (44%). Sample characteristics and geographic factors can influence variation in prevalence rates [15-17]. These findings highlight the diverse renal conditions present in the study population, which may contribute to the susceptibility and recurrence of UTIs.

This study's insights into UTI distribution among renal calculi, cysts, and failure categories offer valuable perspectives. Comparing them with other studies helps identify commonalities and disparities, shedding light on underlying factors. In participants with bilateral renal stones, 11.5% had recurring UTIs, aligning with prior research [18]. In this study, the highest number of UTI cases (50 cases) occurred in the age group of 1-9 years, indicating a higher prevalence among younger individuals. This aligns with previous research showing increased UTI incidence in pediatric populations [19]. Factors like anatomical differences, incomplete bladder emptying, and lower hygiene awareness contribute to the higher susceptibility in young children [20, 21]. As age increased, UTI frequency generally decreased, with the 10-19 and 20-29 age groups having 12 and 11 UTI cases, respectively. Age-related urinary tract changes, hormonal factors, and comorbidities likely contribute to this trend. In the 60-69, 70-79, and 80-89 age groups, UTI frequencies were even lower, with 6, 5, and 2 cases, respectively, consistent with previous studies noting reduced UTI incidence in the elderly [22]. Factors such as immune function changes, bladder dysfunction, and comorbidities may underlie the decreased susceptibility to UTIs in older individuals. In this study, UTI prevalence and severity were assessed using various parameters. Yeast presence in urine was relatively low (mean value: 1.16), aligning with previous studies reporting lower fungal UTIs compared to bacterial UTIs [23]. Mean values for WBC cast and RBC cast confirmed a mild to moderate presence of white and red blood cells, further supporting UTI occurrence [24].

Table 5 presents insights into microbial profiles of UTIs and antibiotic resistance/sensitivity patterns. Variations in sensitivity and resistance rates for each antibiotic-bacteria combination were observed. Azetronam showed 4.0% to 8.0% sensitivity against *E. coli* and *Klebsiella spp*., consistent with previous studies [24]. Beta-lactam drug imipenem demonstrated high overall sensitivity except for *S. aureus*, which displayed above 90% resistance, in line with its effectiveness against most bacteria but not MRSA strains [25] *S. aureus* develops resistance to β-lactam antibiotics through two main mechanisms: the production of β-lactamase enzymes, which render the antibiotic inactive, and the use of an alternative penicillin-binding protein (PBP2a), which has a low affinity for these antibiotics and allows the bacteria to survive despite their presence [26, 27]. It also highlights the role of BlaR1 receptor senses β-lactams and initiates β-lactamase production [28-30].

Table 5. Antibiotic prescriptions tailored to microbial profiles in study participants.

Antibiotics	**Bacterial etiology (%)**					**Total (%)**	**p-value**
	E. coli	***Klebsiella spp***	***Morganella spp***	***Pseudomonas spp***	***S. aureus***		
Amikacin	0	2	0	0	0	2	0.287
Amoxicillin	4	0	0	0	0	4	0.287
Augmentin	4	2	2	0	2	10	0.265
Ciprofloxacin	22	2	2	2	2	30	0.287
Imipenem	18	2	0	4	0	24	0.241
Moxifloxacin	2	10	4	6	0	22	0.220
Polymyxin	0	2	0	4	2	8	0.265

Cotrimoxazole showed high sensitivity rates (80.0% to 100.0%) for all bacteria, supporting its use as a first-line treatment for complicated UTIs [31]. However, resistance to antibiotics like ciprofloxacin and nitrofurantoin was evident, highlighting the global concern about increasing antibiotic resistance in UTIs [32]. Consistent with previous research, this study identified *E. coli* as the most common pathogen, accounting for 50% of cases [33] because *E. coli* uses a variety of CUP pili to attach to and invade urinary tract cells, particularly those in the bladder [34]. By establishing quiescent intracellular reservoirs (QIRs) and intracellular bacterial communities (IBCs) [35]. It evades the host's immune system through an aggressive immune response, particularly a strong inflammatory reaction involving lymphocytes causes significant damage to the urinary tract's protective lining (the mucosal uroepithelium) [36]. Ciprofloxacin is frequently prescribed for *E. coli* infections (22%), along with Imipenem (18%), which is effective against Gram-negative bacteria [37]. Proper antibiotic selection is crucial to effectively target this prevalent pathogen. *Klebsiella spp* exhibited varying susceptibility patterns. Moxifloxacin was the preferred choice in 10% of cases, supported by studies [38]. Less common antibiotics included Augmentin, Amikacin, Amoxicillin, and Polymyxin, suggesting the need for additional treatment options for diverse *Klebsiella spp*. infections. *Pseudomonas spp* infections displayed widespread drug resistance, with only 2% responding to the antibiotic. Imipenem and Polymyxin were used in 4% of cases, indicating the demand for broad-spectrum antibiotics against *Pseudomonas spp* [39].

The study offers new insight into healthcare that may affect clinical practice and existing treatment recommendations for urinary tract infections (UTIs) in individuals with SRC. The continued use of cotrimoxazole and imipenem as first-line therapies for complex UTIs and highlighting the alarming resistance patterns, especially for ciprofloxacin and nitrofurantoin, and the proven efficacy of these medications against different bacterial strains. Furthermore, the particular patterns of susceptibility in Pseudomonas and Klebsiella species emphasize the need for individualized antibiotic treatment based on regional resistance profiles especially in patients with SRC to improve patient's outcome and treatment effectiveness.

5. CONCLUSIONS

Our research focused on UTIs in patients with renal calculi, cyst and failure. The key data indicate that *E. coli* is the most prevalent pathogen. For a successful course of treatment, specific antibiotic selection based on bacterial etiology was essential. For *E. coli* infections, Ciprofloxacin and Imipenem are routinely recommended, whereas Moxifloxacin was effective against *Klebsiella spp*. Antibiotic resistance seen in *Pseudomonas species*. Due to different resistance patterns, culture, and sensitivity testing is crucial for assisting treatment decisions. Antibiotic resistance must be combatted with cautious prescribing techniques, particularly for *Pseudomonas species*. These findings improve patient outcomes and address the challenge of antibiotic resistance in UTIs with renal conditions.

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7. ETHICAL STATEMENT AND PARTICIPATION CONSENT

The study has been approved by the Ethical Review Committee of "The Islamia University of Bahawalpur, Pakistan" under the letter number IUB/ERC/20/2022. Written informed consent was obtained from all participants before their inclusion in the study.

8. CONFLICT OF INTEREST

The authors declare no conflict of interest.

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