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Original Article

Frequency of Urinary Tract Infection and Bacteriological Profile in Dir Lower Khyber Pakhtunkhwa Pakistan

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ABSTRACT

Background: Urinary tract infections (UTI) are among the most common bacterial infections, with their incidence and the causative pathogens' profile exhibiting significant geographical variability. In Pakistan, data regarding UTI prevalence and pathogen profiles are limited and varied, highlighting the need for localized studies.

Objective: This study aimed to determine the prevalence and bacteriological profile of UTIs in patients attending a laboratory in Dir Lower Khyber Pakhtunkhwa, Pakistan, and to compare these with regional data.

Methods: An observational cross-sectional study was conducted on 110 urine samples collected from symptomatic patients at Al Shifa Laboratory, Samarbagh, Dir Lower, Pakistan, from November to December 2023. Samples exhibiting pyuria (>5 pus cells per high power field) underwent culture and sensitivity testing. Age and gender distributions were analyzed, and the presence of Gram-positive and Gram-negative bacteria was identified and quantified. SPSS version 25 was utilized for statistical analysis.

Results: Of the 110 patients suspected of UTI, pyuria was present in 53.63% (n=59), with a culture positivity rate of 72.88% (n=43) for those with pyuria. The prevalence of UTI was higher in females, with a 1.5 times greater occurrence than males. The most commonly isolated pathogens were Escherichia coli (34.88%), Staphylococcus saprophyticus (27.90%), and Pseudomonas spp. (13.95%). Age distribution showed the highest prevalence in the 41-50 years category (39.53%).

Conclusion: The study demonstrated a higher prevalence of pyuria and UTI culture positivity compared to some regional data, with a significant gender predisposition towards females. Escherichia coli remains the predominant pathogen. These findings underscore the necessity for proper sample collection and immediate processing, alongside tailored approaches to diagnosis and treatment based on local bacteriological profiles.

Keywords: Urinary Tract Infection, Uropathogens, Pyuria, Culture Positivity, Antimicrobial Resistance, Bacteriological Profile, Escherichia coli, Staphylococcus saprophyticus, Gender Disparity, Public Health, Pakistan.

INTRODUCTION

Urinary tract infections (UTIs) represent a significant health concern globally, with an estimated 150 million cases reported annually worldwide. These infections, caused by the presence of pathogenic bacteria in urine collected aseptically, are among the most common bacterial afflictions affecting the human population despite the urinary tract's robust host defense mechanisms (1). The prevalence of UTIs varies widely, ranging from 1.4% to 5.1%, with women being particularly more susceptible due to anatomical differences, such as a shorter urethra that is in closer proximity to the perianal region. While UTIs are less common in men, the incidence in women over the age of 65 is approximately 20%, and about 60% of adult women will experience at least one UTI in their lifetime (2, 3, 4, 5). Symptoms of UTIs are characterized by the presence of bacteria in urine, coupled with clinical manifestations such as frequent urination, urgency, painful urination, and lower abdominal discomfort (6).

UTIs are caused by a diverse array of pathogens, including both Gram-negative and Gram-positive bacteria, as well as fungi. Among these, Uropathogenic Escherichia coli is the predominant causative agent in both uncomplicated and complicated UTIs, with other Gram-negative uropathogens like Klebsiella pneumonia, Proteus mirabilis, Pseudomonas aeruginosa, and Enterobacter spp also

Journal of Health and Rehabilitation Research 2791-156X JHRR

playing significant roles (2). The gold standard for diagnosing UTIs involves urine culture and sensitivity testing, with a threshold of 10^5 colony forming units per milliliter (CFU/ml) of a single organism species in midstream urine samples from girls serving as a definitive indicator of infection (7, 8).

Research conducted across different geographic regions has highlighted variability in the bacteriological profiles of UTIs, indicating a dynamic pattern in the prevalence of bacteria responsible for these infections. Moreover, the resistance of these microorganisms to antimicrobial treatments has been evolving, particularly in developing countries where antibiotics are often overprescribed without adequate justification. This trend underscores the necessity of ongoing surveillance and adaptation of treatment strategies to address the changing landscape of UTI pathogens and their antimicrobial resistance patterns (9, 10).

To combat UTIs, international guidelines recommend a range of antibiotics, including nitrofurantoin monohydrate, trimethoprim-sulfamethoxazole, fosfomycin trometamol, pivmecillinam, fluoroquinolones, and beta-lactams. However, the rise of antimicrobial resistance, especially among bacteria producing extended-spectrum beta-lactamases (ESBLs) that show resistance to a broad spectrum of antibiotics except for the carbapenem group, poses a significant challenge to the effective management of UTIs (11, 12). Given these complexities, the aim of this study is to investigate the prevalence and bacteriological profiles of UTIs among patients attending a laboratory in Dir Lower Khyber Pakhtunkhwa, Pakistan. Understanding the causative agents and their prevalence is essential for developing targeted and effective management and treatment strategies for UTIs, thereby addressing one of the most prevalent bacterial infections affecting the global population.

MATERIAL AND METHODS

In this observational cross-sectional study, a comprehensive analysis was conducted on 110 urine samples collected from patients visiting Al Shifa Laboratory, located in Samarbagh, Dir Lower, Pakistan, during the months of November to December 2023. The study aimed to investigate the bacteriological profile of urinary tract infections among individuals exhibiting symptoms indicative of such infections. Participants were included in the study based on their presentation of symptoms associated with UTIs, including fever, abdominal pain, dysuria, increased frequency of urination, malodorous urine, dribbling of urine, vomiting, and anorexia. The methodology for urine sample collection varied according to the age and condition of the patients. Infants' urine samples were collected using sterile plastic bags or wide-mouth containers to ensure aseptic collection, whereas catheterization was employed for critically ill hospitalized patients to minimize contamination risk. Meanwhile, young male and female patients were advised to provide mid-stream urine samples following appropriate genital cleansing to further reduce the likelihood of contamination.

Upon collection, urine samples underwent routine and microscopic examination to identify the presence of pus cells. Samples demonstrating a pus cell count greater than five cells per high power field (pyuria) were subsequently subjected to urine culture to determine the bacterial profile. Cases were classified as presumptive UTI cases based on the presence of pyuria, and confirmation of UTI was established upon the identification of significant growth of pathogenic organisms in the urine culture.

The study adhered to strict ethical considerations, in compliance with the Declaration of Helsinki, ensuring the protection of participants' rights and well-being. Prior to sample collection, informed consent was obtained from all participants or their guardians in the case of minors. Ethical approval for the study was granted by the Institutional Review Board (IRB) of Al Shifa Laboratory, ensuring all research activities were conducted ethically and responsibly.

Data collected from the study were meticulously analyzed using SPSS version 25 for Windows. Statistical analysis involved the application of descriptive statistics to summarize the demographic characteristics of the study population, as well as inferential statistics to examine the relationship between various factors and the occurrence of UTIs. The choice of statistical methods was predicated on the nature of the data and the objectives of the study, focusing on identifying significant bacteriological profiles prevalent among the participants. This methodological approach provided a structured framework for the investigation, facilitating a thorough understanding of the bacteriological landscape of UTIs among patients in the targeted region. The study's adherence to ethical guidelines and rigorous data analysis protocol ensured the reliability and integrity of the findings, contributing valuable insights into the prevalence and characteristics of urinary tract infections in Dir Lower, Pakistan.

RESULTS

In an analysis of urinary tract infections (UTIs) by age group across 43 cases, it was revealed that the distribution was fairly uniform across the age brackets of 10-20, 21-40, and 41-50 years (Table 1). Males within the 10-20 and 21-40 year age groups each accounted for 20.9% of the total UTI cases, while those in the 41-50 year age bracket constituted 18.6%. Females displayed a slightly different pattern, with lower occurrences in the younger age groups (6.97% for ages 10-20 and 11.6% for ages 21-40) and a peak incidence of 20.93% in the 41-50 year age group. Cumulatively, the age group of 41-50 years had the highest prevalence, accounting for 39.53% of the total cases.

Journal of Health and Rehabilitation Research 2791-156X JHRR

Regarding the microbial etiology of the UTIs, the study found a diverse range of pathogens responsible for the infections (Table 2). Gram-positive bacteria such as Staphylococcus saprophyticus were isolated in 27.90% of cases, while Enterococcus species accounted for 6.97%. Among the Gram-negative bacteria, Escherichia coli was the most prevalent, identified in 34.88% of cases. Other Gram-negative bacteria like Klebsiella and Proteus mirrored the lower frequency observed in the younger female age group, presenting in 2.32% and 13.95% of cases, respectively. Pseudomonas also accounted for 13.95% of the UTI pathogens.

Table 1: Age-wise Distribution of UTI Cases (n=43)

	10-20 years	21-40 years	41-50 years	Total
Male	9 (20.9%)	9 (20.9%)	8 (18.6%)	26
Female	3 (6.97%)	5 (11.6%)	9 (20.93%)	17
Total	12 (27.90%)	14 (32.55%)	17 (39.53%)	43

Table 2: Distribution of Various Pathogens in Urine Culture (n=43)

Pathogens	Gram Positive Bacteria	No. of Isolates	Percentage
	Staphylococcus saprophyticus	12	27.90%
	Enterococcus	3	6.97%
Pathogens	Gram Negative Bacteria	No. of Isolates	Percentage
	Escherichia coli	15	34.88%
	Klebsiella	1	2.32%
	Proteus	6	13.95%
	Pseudomonas	6	13.95%

The graphical representation of gender-wise distribution of UTI cases (Figure 1) provided a clear visualization of the gender disparity in infection rates, with females representing 60.5% of the cases and males comprising the remaining 39.5%. This visualization effectively emphasized the numerical data extracted from the bar chart, underscoring the higher incidence of UTIs in females as observed in clinical settings.

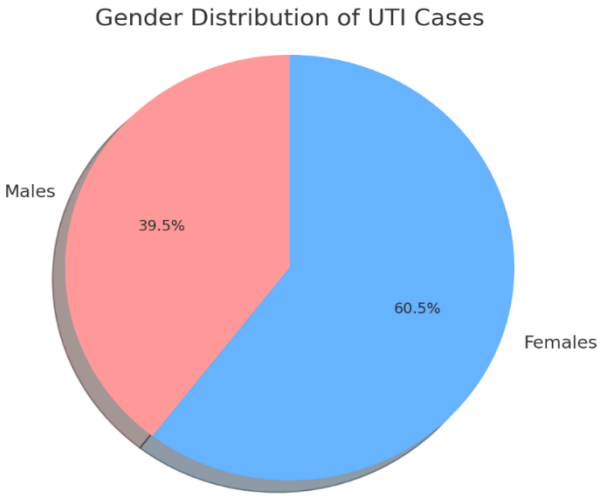

Figure 1 Gender.

DISCUSSION

In the retrospective evaluation of urinary tract infection (UTI) prevalence, routine urine microscopy conducted on 110 suspected cases revealed pyuria in 53.63% of individuals, an incidence significantly higher than that reported in previous regional studies such as Kohat, where pyuria was observed in only 11.6% of cases (13). Among the specimens demonstrating pyuria, culture positivity was recorded in 72.88%, a finding remarkably similar to the 73.1% positivity rate observed in a parallel study conducted in Lahore (14). These findings underscore the variability of UTI indicators across different demographics and localities.

The methodology for urine sample collection proved to be a critical factor in the accuracy of UTI diagnosis. In this study, adolescents and adults were instructed to collect midstream urine after meticulous cleansing, a step that is crucial for reducing contamination and ensuring the reliability of results (15). Indeed, the prompt transportation of samples to the laboratory within a narrow timeframe—or their preservation at 4°C—was emphasized to maintain sample integrity for subsequent diagnostic tests such as dipstick analysis, microscopy, and culture. Non-adherence to aseptic collection methods, particularly in outpatient settings, could lead to false negatives in culture results, thus highlighting an area for improvement in diagnostic practices (16).

The demographic analysis revealed a higher occurrence of UTIs in females, with the incidence being 1.5 times greater than that in males (Figure 1). This gender disparity is not unexpected; anatomical differences, such as the proximity of the female urethra to the anus, increase susceptibility to bacterial transfer and subsequent infection (17). Moreover, the adherence of bacteria to the urothelial mucosa, exacerbated by mucopolysaccharide lining alterations, contributes to this increased vulnerability in females (18).

Pathogen profiling in this study identified a diverse bacteriological landscape, with Staphylococcus saprophyticus emerging as the predominant Gram-positive pathogen, corroborating its notable role in UTI pathogenesis. In contrast, Enterococcus species, although less frequent, remained significant. Gram-negative bacteria showed a varied representation; Escherichia coli was the most commonly isolated, consistent with its established association with UTIs, while Klebsiella species were identified less frequently. The presence of Proteus and Pseudomonas species mirrored findings from other studies, indicating a multifaceted microbial profile in UTIs (Table 2) (18, 19).

This study is not without its limitations. The sample size, though adequate for preliminary analysis, could be expanded in future research to enhance the generalizability of the findings. Additionally, the study was conducted in a single laboratory setting, which may introduce bias reflective of the specific population served by the facility. Future studies might include multiple centers to mitigate this limitation. Recommendations for clinical practice include stringent adherence to aseptic urine collection methods, coupled with educational initiatives to inform patients of the importance of these practices (20). Moreover, regular surveillance of pathogen profiles is essential to monitor emerging trends in antimicrobial resistance, guiding more effective treatment regimens.

CONCLUSION

In conclusion, the study affirmed the significant prevalence of pyuria and culture positivity in UTIs, with rates comparable to other regional research. The gender-based predisposition to UTIs, predominantly affecting females, and the diverse array of contributing pathogens, underscore the necessity for tailored diagnostic and therapeutic approaches. Recognizing the microbial spectrum of UTIs is pivotal for enhancing the accuracy of diagnoses and the efficacy of treatments, ultimately improving patient outcomes.

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Journal of Health and Rehabilitation Research 2791-156X JHRR

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