





Original Article

Epidemiological Study and Clinical Presentation of Urinary Tract Infection

Suhad Asad Mustafa¹  Raya Kh. Yashooa¹  Muhammed Ahmad Muhammad²  Karzan Abdulmuhsin Mohammad^{1,*} 

¹General Directorate of Scientific Research Center, Salahaddin University-Erbil, Erbil, 44001, Iraq

²Basrah Ishik Primary School, Basra, 61004, Iraq

*** Correspondence**

karzan.mohammad@su.edu.krd

Article Info

Received: May 18, 2023

Revised: June 12, 2023

Accepted: June 25, 2023

Abstract

A urinary tract infection (UTI) is an immune response of the urothelium to bacterial invasion, bacteriuria (presence of bacteria in urine) and pyuria (presence of white blood cells in urine) are characteristic indicators of UTI. Prompt and effective management of UTIs is crucial to prevent complications, such as kidney infections and recurrent infections, and to alleviate symptoms, improve quality of life, and minimize antibiotic resistance. The aim of this study was to investigate the incidence, antibiotic resistance, medical treatment, causative agents, diagnosis, and prevention of urinary tract infections (UTIs) in Sulaymaniah city. A total of 60 patients from Sulaymaniah Teaching Hospital were included in the study. The most commonly diagnosed conditions were acute pyelonephritis and cystitis. Various evaluations were conducted, including history taking, physical examination, and diagnostic tests. Mid-stream urine samples were collected for culture and sensitivity analysis.

The duration of symptoms such as dysuria, fever, and frequency varied, ranging from 1 to 3 days. During medical examinations, suprapubic tenderness was the most commonly observed finding. Dysuria was reported as the predominant symptom by 19 patients. The majority of patients fell within the age range of 21-40 years. The study findings indicated a higher prevalence of UTIs among females. The most frequently identified causative microorganism was *Escherichia coli* (*E. coli*), which accounted for approximately 90% of cases. Gentamycin emerged as the most commonly used antibiotic due to its effectiveness against *E. coli*. The high prevalence of antibiotic resistance among other pathogens necessitates ongoing surveillance and appropriate antibiotic stewardship to combat UTIs effectively. In conclusion, this study provides valuable insights into the incidence, antibiotic resistance, and management of UTIs in Sulaymaniah city. It emphasizes the need for tailored treatment approaches considering the prevalent causative agents and their susceptibility patterns.

Keywords: UTI, Bacteriuria, Pyuria, Acute pyelonephritis, Cystitis.

INTRODUCTION

Urinary tract infection (UTI) is a common inflammatory response of the urothelium to bacterial invasion, often accompanied by bacteriuria and pyuria¹. In the elderly, asymptomatic bacteriuria is prevalent², necessitating differentiation between colonization and infection by assessing pyuria as an indicator of host injury³. UTIs represent the most common non-intestinal infections worldwide, posing significant healthcare burdens⁴. Children with febrile UTIs face potential risks of renal scarring, making prompt antimicrobial treatment crucial⁵. Hospital

records indicate that approximately 30% of healthcare-associated infections are UTIs, highlighting their global impact⁶. Among men, *E. coli* is the primary causative agent of UTIs⁷, with historical associations to human disease, including a notable outbreak linked to contaminated hamburgers in 1982⁸. The substantial annual occurrence of UTIs, estimated at 15 million cases worldwide, necessitates substantial healthcare expenditures⁹. The urinary tract, composed of the kidney, ureter, urethra, and bladder, plays a vital role in urinary health¹⁰. Pregnant women face

increased vulnerability to UTIs, as the condition poses risks to both maternal and fetal well-being¹¹. UTI rates differ between male and female children, with boys accounting for a lower percentage compared to girls. Diagnosing UTIs in children can be challenging due to the absence of urinary symptoms and difficulties in collecting uncontaminated urine samples¹². Alternative diagnostic approaches, such as imaging and prophylaxis, can place significant burdens on parents and prove costlier¹². This present study aims to investigate the incidence of UTIs in Sulaymaniah city, assess antibiotic resistance patterns, evaluate medical treatments, identify primary causative agents, explore preventive strategies, and establish effective diagnostic approaches. By addressing these objectives, the study seeks to enhance our understanding of UTIs, inform improved management strategies, and ultimately improve patient outcomes.

MATERIALS and METHODS

Samples Collection

This study recruited 60 participants with urinary tract infection (UTI) from Sulaymaniah Teaching and Casualty Hospital between May 20th, 2022, and November 20th, 2022. The age range of the participants was 3 to 85 years, with an average age of 41 years. Among the participants, 35 were female and 25 were male. The patients sought medical attention within 1 to 3 days of symptom onset. A comprehensive assessment was conducted, including medical history, physical examination, and various diagnostic tests such as urine analysis, complete blood count, renal function tests, and imaging studies. Treatment for the patients included antibiotics, analgesics, and intravenous fluids. Face-to-face interviews were conducted to evaluate the reported symptoms, including pain, dysuria, fever, and other associated symptoms. Further diagnostic and clinical tests, including laboratory reports and imaging studies, were utilized to establish a definitive diagnosis. The majority of cases were identified as acute pyelonephritis, acute cystitis, urethritis, acute prostatitis, and UTI. This study aimed to improve our understanding of UTIs and enhance clinical

decision-making for the management of these conditions.

Isolation of UTI Bacteria and Antibiotic Sensitivity

Mid-stream urine samples were collected from the patients and cultured on specific media such as MacConkey agar, blood agar, or mannitol salt agar. Following incubation at 37°C for 18 to 24 hours, the growth of microorganisms was observed. Selective cultivation was performed to isolate the specific microorganisms. To determine antibiotic sensitivity, the disk diffusion method was employed, where paper disks containing antibiotics were placed on the agar plates and incubated. The resulting areas of inhibition zones were measured and used to assess antibiotic effectiveness. The findings were then reported to the referring physician, providing valuable information for selecting appropriate antibiotic treatment.

Statistical Analysis

The data collected for this study were stored digitally in MS Excel and organized into relevant tables. Analysis included calculating the incidence of the disease, gender prevalence, common symptoms, infection duration, patient age ranges, and prescribed treatments. Correlation analysis was conducted to explore the relationships between factors and determine their significance. Multifactorial analysis was performed to identify the most influential factor in UTI patients.

RESULTS

Patient's Characteristics

The gender distribution of UTI patients, revealing that 35 female patients were more affected compared to 25 male patients (Figure 1).

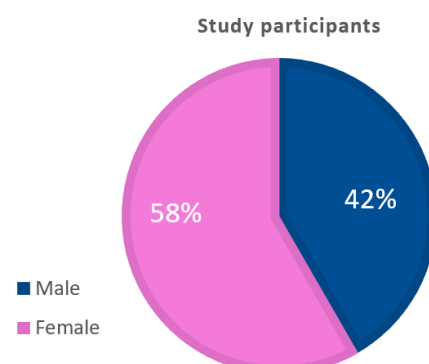


Figure 1. Gender distribution of urinary tract infections (UTIs) in the study participants

Antibiotic Sensitivity

Gentamycin emerged as the most frequently used antibiotic due to its effectiveness against E. coli, which accounts for approximately 90% of causative microorganisms and is sensitive to Gentamycin. Ciprofloxacin was the second choice, followed by commonly used antibiotics such as Ceftriaxone and Bactrim. However, a smaller number of cases (five) involved the use of Claforan and Imipenem for treatment Figure 2.

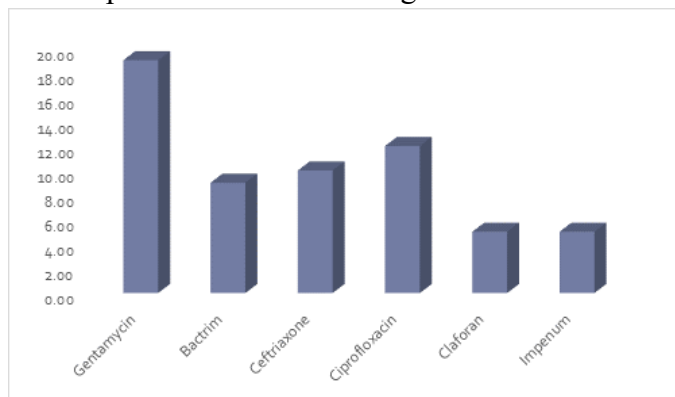


Figure 2. Distribution of antibiotic usage among patients with urinary tract infections (UTIs)

Symptom analysis and clinical characteristics

In the study population (Figure 3), the prevalence of different types of urinary tract infections (UTIs) was observed. Acute pyelonephritis was diagnosed in 23 patients, along with an equal number of 23 patients diagnosed with cystitis. Furthermore, 9 patients were diagnosed with UTIs, 1 patient with urethritis, and 1 patient with prostatitis. These findings emphasize the diverse spectrum of UTIs encountered within the study cohort.

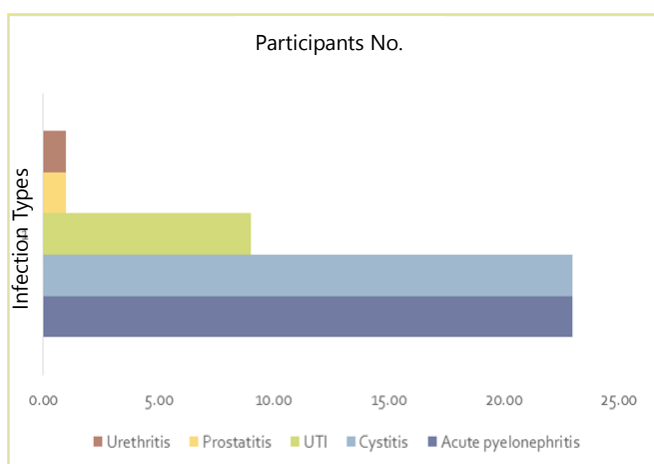


Figure 3. Prevalence of different types of urinary tract infections

Our study findings (Figure 4A) revealed various symptom presentations among patients

with urinary tract infections (UTIs). The most common symptoms reported were dysuria, fever, and frequency, observed in 30 patients. Additionally, 11 patients presented with loin pain, dysuria, and fever, while 5 patients experienced left loin pain, fever, and generalized body ache. Other symptom combinations, such as frequency, urgency, dysuria, and fever, or right loin pain, fever, and dysuria, were observed in 4 patients each. Four patients exhibited symptoms of generalized body ache, fever, and loin pain. Regarding symptom duration (Figure 4B), our findings indicated that 32 patients reported symptoms lasting for 1 day, followed by 20 patients with symptoms persisting for 2 days, and 7 patients experiencing symptoms for 3 days. These insights shed light on the duration of symptoms in individuals affected by urinary tract infections (UTIs).

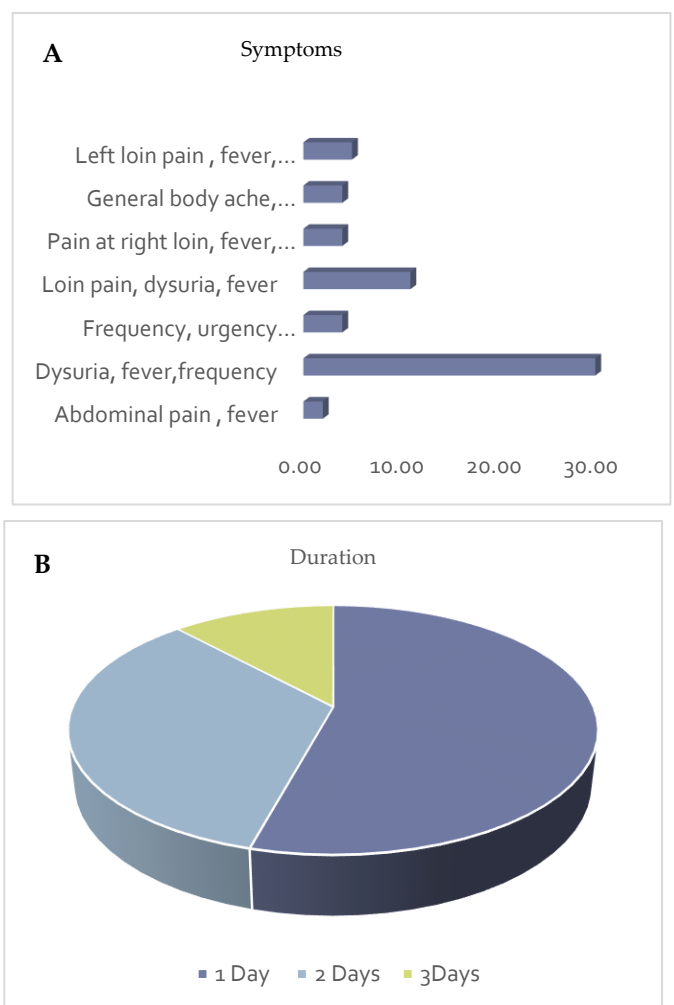


Figure 4. Distribution of various symptom presentations and duration among patients with urinary tract infections

Based on our revised study findings (Figure 5), specific physical examination findings were observed among patients with urinary tract infections (UTIs). Suprapubic tenderness during palpation was detected in 24 patients, while 12 patients exhibited left loin tenderness. Interestingly, 10 patients did not show any specific findings (signs). Four patients displayed right loin tenderness, and an additional four patients presented with bilateral loin tenderness. Notably, three patients had a palpable urinary bladder. These findings contribute valuable insights into the physical examination manifestations associated with urinary tract infections.

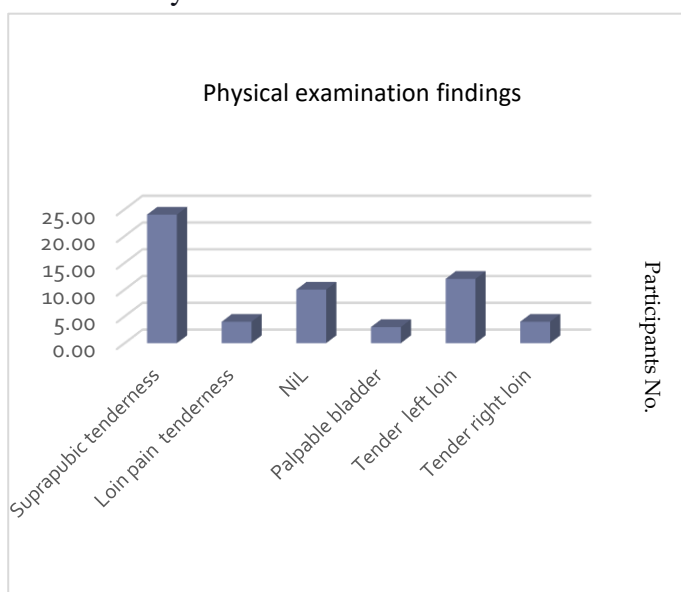


Figure 5. Overview of physical examination findings among patients with urinary tract infections

According to Figure (6A), our study findings indicate that various symptoms were experienced by patients with UTIs. Painful urination (dysuria) was reported by 19 patients, while 12 patients had right loin pain, 11 patients had left loin pain, and 7 patients faced difficulty in urination. Additionally, 5 patients reported suprapubic pain, 2 patients experienced a burning sensation during urination, and 1 patient had urinary retention. These observations highlight the diverse range of symptoms encountered in UTI cases. Furthermore, Figure (6B) illustrates the distribution of UTI cases across different age groups. Although UTIs can affect individuals of all ages, the age group of 21-40 years exhibited a higher prevalence compared to other age groups. This may be attributed to

increased sexual activity within this age range, which can contribute to the transmission of infections causing UTIs. Among the other age groups, 18 patients were in the 41-60 years age group, 11 patients were in the 60-80 years age group, a few patients were in the 1-20 years age group, and only 2 patients were above 81 years old. These findings provide valuable insights into the age-related patterns of UTI occurrence within our study population.

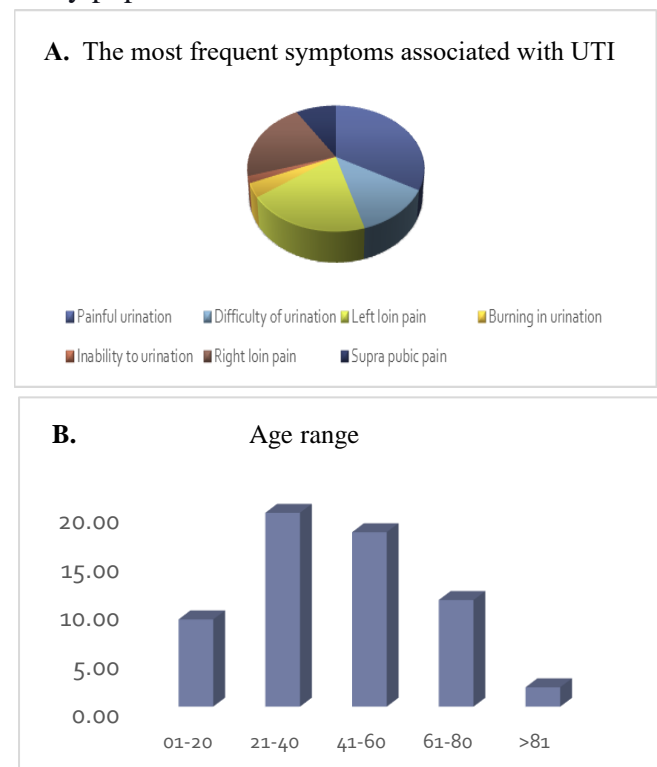


Figure 6. A: Diverse range of symptoms encountered in UTI cases. B: distribution of UTI cases across different age groups

DISCUSSION

Our study findings are consistent with previous research, highlighting the higher prevalence of urinary tract infections (UTIs) among females (35 patients) compared to males (25 patients). This disparity can be attributed to anatomical and physiological differences between the urogenital and digestive systems in males and females, as well as factors such as menses and sexual activity that increase susceptibility in females¹³. Notably, our findings align with other studies that demonstrate the common use of Gentamycin as a treatment for UTIs. For example, intravesical Gentamycin has shown positive results in reducing the frequency of recurrent UTIs in patients with lower urinary tract

dysfunction¹⁴. The use of once-daily intravenous Gentamycin has also been suggested for treating multi-resistant Gram-negative bacteria in complicated UTIs¹⁵.

Furthermore, our research is in line with a study that investigated acute cystitis in both males and females¹⁶, reporting higher severity and disturbance of urinary symptoms in females with dysuria compared to those without dysuria¹⁷. Similarly, other studies have shown that patients who did not receive antibiotics or had antibiotic-resistant organisms experienced more severe symptoms lasting several days¹⁸. The absence of strong predictors for infection, such as suprapubic pain or painful urination, aligns with the findings of other studies¹⁹. Additionally, our findings support the predominant role of *Escherichia coli* (*E. coli*) as the primary causative agent in UTIs among well-conditioned females aged 18-39 years, followed by *Staphylococcus saprophyticus*²⁰.

In conclusion, our study confirms the higher prevalence of UTIs among females and the frequent diagnoses of acute pyelonephritis and cystitis. The reported symptoms of dysuria, frequency, and fever, along with the common finding of suprapubic tenderness during medical examinations, contribute to the understanding of UTIs. Moreover, our findings support the effectiveness of Gentamycin as a commonly prescribed treatment for UTIs.

CONCLUSION & RECOMMENDATION

In conclusion, our study provides valuable insights into the incidence, diagnosis, and management of urinary tract infections (UTIs) in our study population. We observed a higher prevalence of UTIs among females, with acute pyelonephritis and cystitis being the most frequently diagnosed conditions. Symptoms such as dysuria, frequency, and fever were commonly reported by the patients. Our findings highlight the importance of prompt and effective management of UTIs to alleviate symptoms, prevent complications, and minimize antibiotic resistance.

To improve the management of urinary tract infections (UTIs) and enhance patient outcomes, we propose the following recommendations. Firstly, there is a need to increase awareness and

education, specifically targeting females, to promote understanding of UTI risk factors, symptoms, and preventive measures through educational programs and campaigns. Secondly, it is crucial to promote antibiotic stewardship by encouraging appropriate antibiotic prescribing practices, including proper selection, dosage, and duration, to optimize treatment outcomes and minimize the development of antibiotic resistance. Thirdly, regular surveillance and monitoring of UTI trends, causative agents, and antibiotic resistance patterns are essential for informed clinical decision-making and the development of effective treatment strategies. Fourthly, adopting individualized treatment approaches that consider patient-specific characteristics such as age, sex, and medical history will help tailor UTI management and minimize complications. Lastly, prioritizing future research to investigate additional factors influencing UTI occurrence, such as behavioral and lifestyle factors, and exploring alternative treatment options and preventive measures, including non-antibiotic approaches, will further advance UTI management. By implementing these recommendations, healthcare providers can significantly improve UTI management, reduce the burden of infection, and enhance patient outcomes.

Acknowledgment

The authors express deep thanks to all participants and allowing us to take oral swab despite his/her suffering.

Conflict of Interest

The authors declare they have no conflicting interests.

REFERENCES

1. Campbell MF, Wein AJ, Kavoussi LR. *Campbell-Walsh urology*. 9th ed. ed. W.B. Saunders; 2007.
2. Rowe TA, Juthani-Mehta M. Urinary tract infection in older adults. *Aging Health*. 2013;9(5):519-528.
3. Stamm WE. Measurement of pyuria and its relation to bacteriuria. *The American journal of medicine*. 1983;75(1):53-58.
4. August SL, De Rosa MJ. Evaluation of the prevalence of urinary tract infection in rural Panamanian women. 2012;
5. Shaikh N, Mattoo TK, Keren R, et al. Early antibiotic treatment for pediatric febrile urinary tract infection and renal scarring. *JAMA pediatrics*. 2016;170(9):848-854.
6. Mitchell B, Gardner A, Beckingham W, Fasugba O. Healthcare associated urinary tract infections: a protocol

- for a national point prevalence study. *Healthcare infection*. 2013;19(1):26-31.
7. Johnson JR, Scheutz F, Ulleryd P, Kuskowski MA, O'Bryan TT, Sandberg T. Host-pathogen relationships among *Escherichia coli* isolates recovered from men with febrile urinary tract infection. *Clin Infect Dis*. 2005;40(6):813-822.
 8. Perna NT, Plunkett III G, Burland V, et al. Genome sequence of enterohaemorrhagic *Escherichia coli* O157: H7. *Nature*. 2001;409(6819):529-533.
 9. Raz R, Gennesin Y, Wasser J, et al. Recurrent urinary tract infections in postmenopausal women. *Clin Infect Dis*. 2000;30(1):152-156.
 10. Torpy JM, Schwartz LA, Golub RM. JAMA patient page. Urinary tract infection. *JAMA*. May 2 2012;307(17):1877. doi:10.1001/jama.2012.3885
 11. Front Matter. *British Medical Journal (Clinical Research Edition)*. 1984;289(6447)
 12. Leung AKC, Wong AHC, Leung AAM, Hon KL. Urinary Tract Infection in Children. *Recent Pat Inflamm Allergy Drug Discov*. 2019;13(1):2-18. doi:10.2174/1872213x13666181228154940
 13. Tan CW, Chlebicki MP. Urinary tract infections in adults. *Singapore Med J*. 2016;57(9):485.
 14. Abrams P, Hashim H, Tomson C, Macgowan A, Skews R, Warren K. The use of intravesical gentamicin to treat recurrent urinary tract infections in lower urinary tract dysfunction. *Neurourol Urodyn*. Nov 2017;36(8):2109-2116. doi:10.1002/nau.23250
 15. Pallett A, Hand K. Complicated urinary tract infections: practical solutions for the treatment of multiresistant Gram-negative bacteria. *J Antimicrob Chemother*. 2010;65(suppl_3):iii25-iii33.
 16. Gupta K, Grigoryan L, Trautner B. Urinary Tract Infection. *Ann Intern Med*. Oct 3 2017;167(7):Itc49-its64. doi:10.7326/aitc201710030
 17. Dune TJ, Price TK, Hilt EE, et al. Urinary Symptoms and Their Associations With Urinary Tract Infections in Urogynecologic Patients. *Obstet Gynecol*. Oct 2017;130(4):718-725. doi:10.1097/aog.0000000000002239
 18. Little P, Merriman R, Turner S, et al. Presentation, pattern, and natural course of severe symptoms, and role of antibiotics and antibiotic resistance among patients presenting with suspected uncomplicated urinary tract infection in primary care: observational study. *BMJ*. Feb 5 2010;340:b5633. doi:10.1136/bmj.b5633
 19. Medina-Bombardó D, Jover-Palmer A. Does clinical examination aid in the diagnosis of urinary tract infections in women? A systematic review and meta-analysis. *BMC Fam Pract*. 2011;12(1):1-13.
 20. Sohail M, Khurshid M, Saleem HGM, Javed H, Khan AA. Characteristics and antibiotic resistance of urinary tract pathogens isolated from Punjab, Pakistan. *Jundishapur journal of microbiology*. 2015;8(7)