Prevalence, Epidemiological Pattern and Causative Pathogen of Urinary Tract Infection Among Children Admitted to the Pediatric Department of Tobruk Medical Center

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Received: 02/06/2024 Accepted: 11/06/2024

ABSTRACT:

Background: Urinary tract infections (UTIs) are common in pediatric populations and are among the most prevalent bacterial diseases worldwide, particularly in infants and young children, making them a significant pediatric health concern[1]. UTIs can manifest with varying degrees of severity and can be caused by a spectrum of pathogens. UTIs are particularly important to address because when they affect the upper urinary tract, they can form scars that damage the growing kidney and predispose individuals to hypertension and chronic kidney disease [3].

Patients and Method: To estimate the prevalence of urinary tract infection (UTI) and to determine the causative pathogens among children admitted to the pediatric department at Tobruk Medical Center, a retrospective study design was employed. pediatric patients admitted between August 2022 and August 2023 were reviewed. Out of 775 patient urine samples submitted for culture and sensitivity testing, 40 patients with a confirmed diagnosis of UTI were identified based on documented clinical symptoms, and laboratory findings. Descriptive statistics were utilized to analyze the prevalence rates of UTIs and the distribution of causative pathogens among the study population.

Result: 775 patients with complaints of UTI and associated risk factors were analyzed. Among these, 40 samples tested positive for UTI, while 735 had negative urine cultures. The overall prevalence rate of UTI was 5.2%. Out of the 40 positive cases, 31 cases (77.5%) were attributed to gram-negative bacteria, while 9 cases (22.5%) were attributed to gram-positive bacteria. Among the gram-negative bacterial isolates, Escherichia coli was the predominant pathogen, accounting for 51.5% of cases, followed by Klebsiella at 12.5%.

Conclusion: This study enhances the understanding of the prevalence, epidemiological characteristics, and causative pathogens of pediatric UTIs in Tobruk, offering critical insights for improving diagnosis, treatment, and prevention strategies in pediatric healthcare. So that, healthcare providers can better manage UTIs in children, ultimately improving patient outcomes.

KEYWORDS: Urinary tract infections; children; risk factors; Antibiotic Resistance.

INTRODUCTION

Urinary tract infections (UTIs) are common in pediatric populations and are among the most prevalent bacterial diseases worldwide, particularly in infants and young children, making them a significant pediatric health concern[1]. Among children, UTIs can manifest with varying degrees of severity and can be caused by a spectrum of pathogens. Understanding the specific pathogens responsible for these infections is crucial for effective diagnosis and treatment[2]. UTIs are particularly important to address because when they affect the upper urinary tract, they can form scars that damage the growing kidney and predispose individuals to hypertension and chronic kidney disease [3].

The incidence of UTIs among children has drawn significant attention due to its implications for pediatric healthcare management [4]. UTIs represent a frequent challenge, often necessitating hospitalization for proper diagnosis and management. These infections can arise from various causative pathogens, ranging from bacteria to fungi, each with its unique clinical implications and treatment considerations. Consequently, the prevalence of UTIs among children admitted to pediatric wards has become a focal point of research and clinical attention[5] [6] .

The American Academy of Pediatrics (AAP) clinical practice guidelines emphasize the importance of urine culture and the presence of pyuria for the diagnosis of UTI. Pyuria is identified by urinalysis showing more than or equal to 10 white blood cells (WBC)/mm³ or more than or equal to 5 WBC per high-powered field (HPF), or by the presence of leukocyte esterase (LE) on a dipstick. A positive urine culture is defined by the isolation of a single uropathogen at a density greater than 50,000 colony-forming units (CFU)/mL [5].

The pathogenesis of UTIs involves the ascent of bacteria from the periurethral area, migrating in a retrograde fashion through the urethra to reach the bladder and potentially the upper urinary tract. Periurethral colonization with uropathogenic bacteria is a crucial factor in the development of UTIs. The increased susceptibility of girls to UTIs is attributed to the shorter female urethra and the frequent colonization of the perineum by enteric organisms. Hematogenous spread, although less common, can also occur, particularly in the first few months of life [7] [6] .

Many children with UTIs have structural abnormalities of the urinary tract [3] . The ultrasonography is recommended with the first-time febrile UTI to rule out structural abnormalities and detect hydronephrosis, which needs further evaluation such as voiding cystourethrography (VCUG). [8]

Understanding the epidemiology of UTIs and their causative pathogens is essential for effective diagnosis, treatment, and prevention strategies. This study aims to estimate the prevalence of UTIs, the epidemiological patterns, and the distribution of causative pathogens among children admitted to the pediatric department of Tobruk Medical Center over the past year. By analyzing these trends, we hope to provide insights that will enhance the management of UTIs in pediatric patients and improve outcomes.

PATIENTS AND METHOD

To estimate the prevalence of urinary tract infection (UTI) and to determine the causative pathogens among children admitted to the pediatric department at Tobruk Medical Center, a retrospective study design was employed. Medical records of pediatric patients admitted to the pediatric ward between August 2022 and August 2023 were reviewed, focusing on cases suspected of having UTIs. Infants and children under 15 years of age were included in the study population. Relevant demographic data, clinical presentations, and microbiological results were extracted from the patients' medical records.

Urinary tract infection was defined as bacterial growth of >10^5 CFU/mL in urine culture.

Patients with a colony count meeting this criterion were considered to have a confirmed diagnosis of UTI.
Out of 775 patient urine samples submitted for culture and sensitivity testing, 40 patients with a confirmed diagnosis of UTI were identified based on documented clinical symptoms, laboratory findings, and pediatrician diagnoses. Descriptive statistics were utilized to analyze the prevalence rates of UTIs and the distribution of causative pathogens among the study population.

RESULTS AND DISCUSSION

In this study, 775 urine samples from pediatric patients with complaints of UTI and associated risk factors were analyzed. Among these, 40 samples tested positive for UTI, while 735 had negative urine cultures. The overall prevalence rate of UTI was 5.2%.

Table (1): Distribution of the studied cases regarding the incidence of UTIs

CASES	Number	Percent
Positive	40	5.2
Negative	735	94.8
Total	775	100

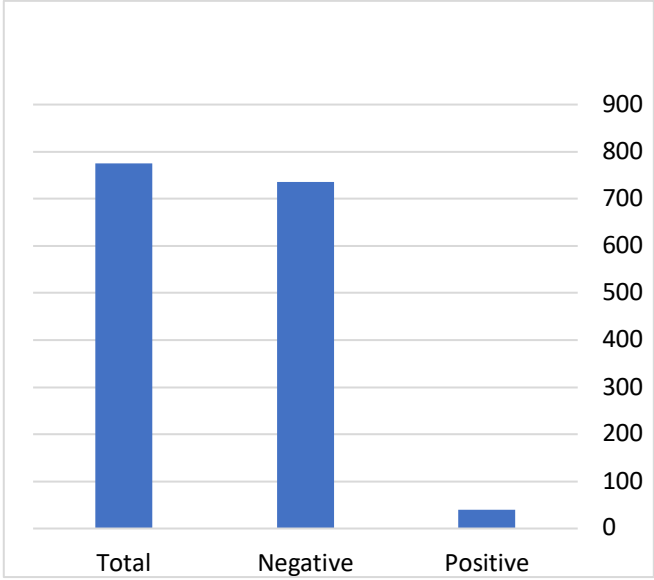

Fig. (1): Distribution of the studied cases regarding the incidence of UTIs

Table (2): shows the distribution of UTIs according to gender. Cases with positive urine culture in males were 16(40%), while in females were 24(60%).

Gender	no.	%
Male	16	40
Female	24	60
Total	40	100

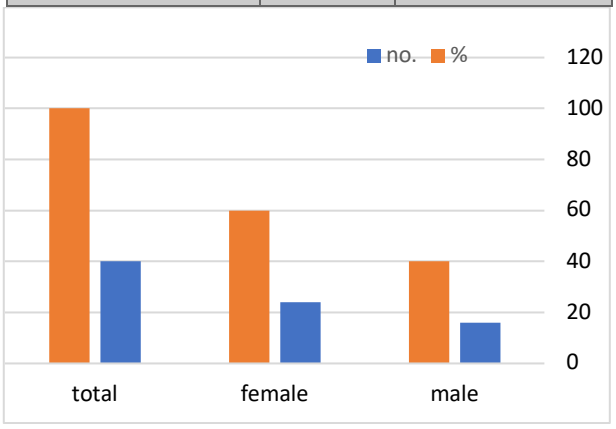

Fig. (2): Distribution of UTIs cases according to gender

The majority of positive cases were in the 0-1 year age group, with 22 cases comprising 55% of the total positive cases. Of these, 15 cases (68%) involved males, while 7 cases (32%) involved females. Above the age of one year, the majority of cases were female.

Table (3): Distribution of the positive cases according to age groups

Age group Years	Total no.	Male	Female
0 – 1	22	15	7
1 – 5	11	0	11
5 - 10	5	0	5
10 - 15	2	1	1

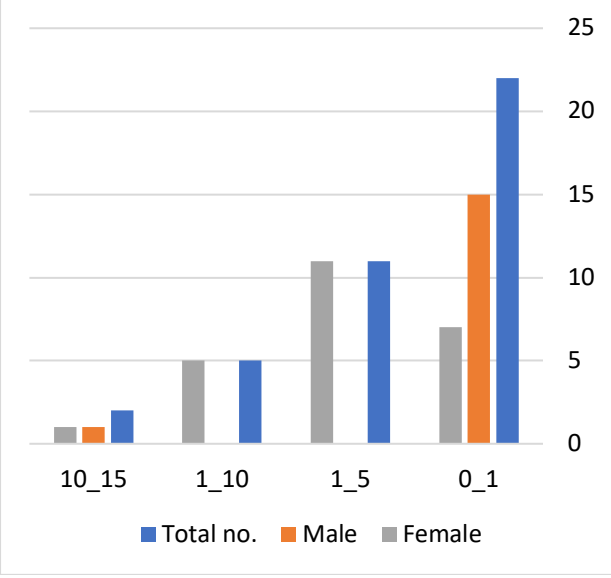

Fig (3): Distribution of the positive cases according to age groups

Regarding place of residence, 31 cases from urban areas, while 9 cases were from rural areas.

Table (4): Distribution of positive cases by place of residence.

Residence place	Positive	
	No.	%
Urban	31	77.5
Rural	9	22.5
Total	40	100.0

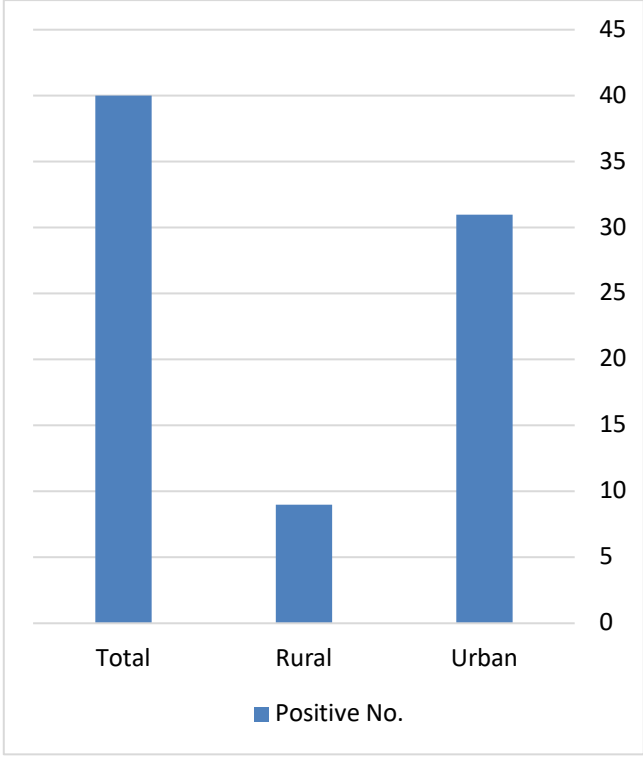

Fig (4): Distribution of positive cases according to place of residence.

Out of the 40 positive cases, 31 cases (77.5%) were attributed to gram-negative bacteria, while 9 cases (22.5%) were attributed to gram-positive bacteria. Among the gram-negative bacterial isolates, Escherichia coli was the predominant pathogen, accounting for 51.5% of cases, followed by Klebsiella at 12.5% and Pseudomonas at 5%. Among the gram-positive bacteria, Staphylococcus was the predominant isolate, accounting for 12.5% of cases, followed by Enterococcus at 5%.

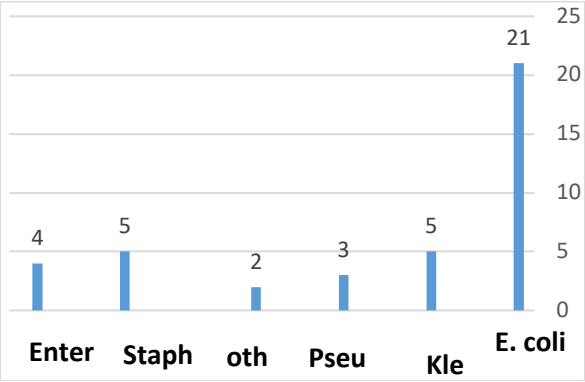

Fig. (5): Distribution of causative pathogens by positive case.

Table. (5): Distribution of causative pathogens by positive cases.

Gram stain				No.	%
Gram negative	31	77.5	E. coli	21	52.5
			Klebsiella	5	12.5
			Pseudomonas	3	37.5
			others	2	5
Gram positive	9	22	Staphylococcus	5	12.5
			Enterococcus	4	10

Regarding the ultrasound examination findings, 36 cases were normal, 3 cases had hydronephrosis, and one case had pelvis-ureteric junction stenosis (PUJ).

Table (6): Distribution of positive cases according to ultrasound examination findings.

Ultrasound examination finding	Positive	
	No.	%
Normal	36	90
Hydronephrosis	3	7.5
PUJ-Stenosis	1	2.5

DISCUSSION

The results of this study provide a comprehensive overview of the prevalence, epidemiology, and causative pathogens of urinary tract infections (UTIs) among pediatric patients admitted to Tobruk Medical Center.

Prevalence and Demographic Distribution

The overall prevalence of UTIs in this pediatric population was found to be 5.2%. This prevalence aligns with other studies that have reported similar rates of UTIs in children, indicating that UTIs are a common issue in

pediatric healthcare [4]. Notably, the study found that the majority of positive cases were in the age group of 0-1 year, with 55% of the total positive cases. Within this age group, males were disproportionately affected (68%). This gender distribution in infants could be attributed to factors such as uncircumcised status in male infants and congenital

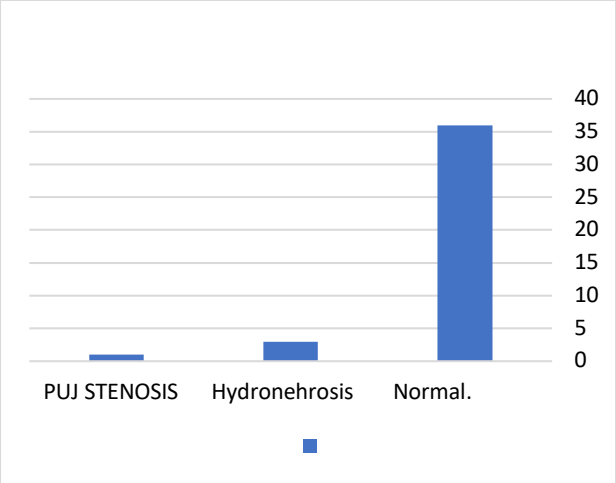

Fig (6): Distribution of positive cases according to ultrasound examination finding.

abnormalities that predispose them to UTIs, which contrasts with the general trend observed in older children where females are more commonly affected by UTIs [9] [10] .
Above the age of one year, the majority of UTI cases were female, which is consistent with the established understanding that females have a higher risk of UTIs due to anatomical and physiological differences[5]. This shift in gender distribution underscores the importance of targeted prevention and intervention strategies based on age and gender.

Pathogen Distribution

The study identified a predominance of gram-negative bacteria (77.5%) in UTI cases, with Escherichia coli being the most common pathogen, accounting for 51.5% of cases. This finding conforms to reports from Sudanese children, where E. coli was the most commonly isolated pathogen (60%) [11] and also in Gulf region [12] . This finding is also in line with global data indicating that E. coli is the leading cause of UTIs in both adults and children [6] [7] . The second most common organism was Klebsiella, seen in 12.5% of cases, similar to observations in Saudi Arabia [10]. The presence of other gram-negative bacteria such as Klebsiella (12.5%) and Pseudomonas (5%) highlights the diversity of pathogens that can cause UTIs and the need for broad-spectrum empirical antibiotic coverage [13].
Gram-positive bacteria were responsible for 22.5% of UTI cases, with Staphylococcus accounting for 12.5% and Enterococcus for 5% of the cases. The inclusion of gram-positive pathogens in the etiological profile of UTIs is essential for developing effective treatment protocols, particularly in cases where initial empirical therapy may not cover these organisms [6] [14].

Clinical Implications

The high prevalence of E. coli underscores the need for empiric antibiotic therapy that effectively targets this pathogen. However, the presence of other gram-negative and gram-positive bacteria necessitates ongoing surveillance of antimicrobial susceptibility patterns to ensure appropriate empirical therapy [15] . This is crucial for preventing the development of antibiotic resistance, which remains a significant concern in pediatric UTI management [7] [16] .
Moreover, the significant proportion of UTIs in infants and young children suggests a need for heightened vigilance and possibly more aggressive diagnostic approaches in this age group. Given the difficulty in distinguishing between cystitis and pyelonephritis based on clinical presentation alone, particularly in infants, prompt and accurate diagnosis is essential to prevent complications such as renal scarring [9] [2] .

Limitations and Future Directions

While this study provides valuable insights, it is not without limitations. The retrospective design may be subject to biases related to the completeness and accuracy of medical records. Additionally, the study is limited to a single medical center, which may affect the generalizability of the findings to other settings.

Future studies could focus on prospective data collection and multi-center collaborations to validate these findings and explore regional variations in UTI pathogens and resistance patterns. Further research into the risk factors contributing to the high prevalence of UTIs in male infants could also provide more tailored preventive strategies

CONCLUSION

This study provides an investigation of the prevalence, epidemiological factors, and causative pathogens of urinary tract infections (UTIs) among children admitted to the pediatric department of Tobruk Medical Center. The overall prevalence rate of UTIs in this pediatric population was found to be 5.2%, highlighting the significance of this condition in childhood.

Infants, particularly males under the age of one year, were disproportionately affected, accounting for 55% of the total positive cases. This suggests that specific factors such as uncircumcised status and congenital abnormalities in male infants contribute to the increased susceptibility in this age group. Above the age of one year, females being more commonly affected, consistent with broader epidemiological patterns observed in other studies.

Pathogen distribution analysis revealed that gram-negative bacteria were the predominant causative agents, with Escherichia coli accounting for 51.5% of the cases, followed by Klebsiella and Pseudomonas. Gram-positive bacteria, primarily Staphylococcus and Enterococcus, were also significant contributors to the UTI cases. This pathogen profile underscores the need for empirical antibiotic therapy that effectively targets both gram-negative and gram-positive organisms to ensure comprehensive treatment.

In conclusion, this study enhances the understanding of the prevalence, epidemiological characteristics, and causative pathogens of pediatric UTIs in Tobruk, offering critical insights for improving diagnosis, treatment, and prevention strategies in pediatric healthcare. So that, the healthcare providers can better manage UTIs in children, ultimately improving patient outcomes.

ACKNOWLEDGEMENT

Conflict of interest: The authors declare that they have no conflict of interest**.**

Funding: This research received no funding.

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