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FREQUENCY OF URINARY TRACT INFECTION IN FEBRILE PRESCHOOL CHILDREN IN COMBINED MILITARY HOSPITAL ABBOTTABAD, PAKISTAN

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ABSTRACT

Introduction: Urinary tract infection (UTI) is a common cause of unexplained fever in preschool children. Prompt diagnosis is essential to prevent complications such as renal scarring and recurrent infections. This study evaluates the frequency and microbiological profile of UTIs in febrile preschool children at Combined Military Hospital Abbottabad.

Objective: To determine the frequency, causative organisms, and antimicrobial sensitivity patterns of UTIs in febrile preschool children.

Material and Method: This cross-sectional study was conducted from January, 2021 to July, 2021 at CMH Abbottabad. Febrile children aged 1–5 years without a known infection source were enrolled. Urine samples were collected using age-appropriate methods. UTI was diagnosed based on pyuria and positive culture results. Data were analyzed using SPSS.

Results: Out of 210 children, 52 (24.8%) were diagnosed with UTI. Female children had a higher prevalence (29.8%) compared to males (17.4%). *Escherichia coli* was the most common organism (80.8%). Highest sensitivity was observed for cefixime (88.1%) and ciprofloxacin (84.5%), while ampicillin showed the most resistance (72.5%).

Conclusion: UTIs are prevalent in febrile preschool children, especially in females. Empirical therapy should be guided by local resistance trends to improve outcomes.

Keywords: Urinary tract infection, febrile children, preschool, *Escherichia coli*, antibiotic resistance, CMH Abbottabad, pediatric UTI.

INTRODUCTION

Urinary tract infection (UTI) is one of the commonest bacterial infections among febrile children, and it continues to be a significant cause of morbidity in different countries (1). UTIs in preschool children and especially in children under the age of 5 frequently are nonspecific, and they can be detected only by fever, which makes the issue challenging to diagnose and cure (2). This necessitates its early detection to avoid complications like renal scarring, high blood pressure, and chronic kidney disease in adulthood (3). The recognition of UTI in younger children is not common because of the lack of ability to communicate, incomplete immune development and somatic similarity to other pediatric diseases (4). Therefore, it is very important to determine the frequency and epidemiological features of UTIs in febrile preschool children in order to enhance the clinical outcome and determine the principles of empiric antibiotic therapy (5). A number of researchers have tried to measure the risk of UTI in febrile children to help guide decisions on diagnosis. As an example, Shaikh et al. designed and validated a prognostic calculator of clinical features to predict the likelihood of UTI in febrile infants, indicating their clinical heterogeneity (6). The increasing problem of antimicrobial resistance in the global population complicates the control of pediatric UTIs. According to a systematic review conducted by Bryce et al., antibiotic resistance rates were very high amongst pediatric uropathogens, especially Escherichia coli, which continues to be the most common causative organism of childhood UTIs (7). This tendency demonstrates the necessity of local data on pathogen surveillance and epidemiology of resistance in order to derive empirical treatment plans (8).

UTIs are more frequent in the female population in the pediatric group due to anatomy, but uncircumcised males under one year of age also have a higher risk (9). The work-up that is required to determine the aetiology of a febrile child covered with clinical suspicion of UTI is urinalysis and urine cultures, although it is practically very hard to obtain a clean-catch specimen in febrile children of this age (10). UTI in children is not a burden experienced only in Canada and America. Unhygienic practices, failure to get access to health care and late detection typically contribute to the rising incidence of complications in poor nations such as Pakistan (11). A study conducted in Ethiopia recorded the same case because the prevalence of UTIs in febrile children was accompanied by a concerning resistance pattern to first-line antibiotics (12). UTIs in children are divided into lower (cystitis) and upper (pyelonephritis), and the latter is worse still and would predispose lifelong renal-related outcomes in the event of their untimely treatment (13). According to Becknell et al., it was most important to make an early and accurate diagnosis to differentiate these two types, as the treatment and outcome differ significantly (14). However, the UTIs recurrent in pediatric populations are notable and tend to be caused by anatomical deformation along with a bladder malfunction or incorrect timing of first UTIs management (15). In that regard, the recurrence rate of the first-time and repeated infection in preschool kids may provide data concerning the existing health issues and better inform specific further diagnostic tests.

The other important factor affecting pediatric care relates to geographical differentiation in the prevalence of UTI and antimicrobial resistance patterns. Shrestha et al. reported the microbial aetiology and susceptibility pattern of UTIs among Nepalese pediatric patients, which underlines the importance of region-specific data, used to conduct local antibiotic stewardship initiatives (16). Few data are available in Pakistan regarding the prevalence of UTIs in febrile preschool children in military healthcare institutions, where the population characteristics of military personnel might deviate due to the civilian nature of a hospital. The absence of such data can leave healthcare professionals to refer to international guidelines that are in effect irrelevant to the local pathogen distribution or resistance pattern (17). Vazouras et al. also pointed out that improper use of antibiotics can promote resistance, and it is essential to anchor empirical treatment here on correct epidemiological information (18). The latest changes in global guidelines have tried to harmonize the management and definition of paediatric UTIs, although there are differences among protocols. Likewise, the European Association of Urology (EAU) and the European Society for Paediatric Urology (ESPU) promote the use of early imaging in recurrent or unusual UTIs to identify underlying abnormalities, unlike other guidelines, which are more conservative (2). A thorough comparison

conducted by Okarska-Napierala et al. evidenced a discrepancy in pediatric UTI management strategy, which implied that the approach has to be individualized by clinicians in many cases according to the risk factors and the resources available (18).

Given the diagnostic uncertainty and the severe complications that may ensue when febrile preschoolers have UTIs untreated or recurrent, it is paramount to explore the prevalence of this disease. This research would address a major vacuum in pediatric care in Pakistan in the form of assessing the burden of UTIs in febrile children being brought to the Combined Military Hospital, Abbottabad. The results can be used to develop a diagnostic protocol, inform the development of an empirical treatment policy, and eventually benefit the outcomes of pediatric patients in comparable healthcare facilities.

Objective: To identify the prevalence of fever among preschool children who attend emergency departments with urinary tract infection at Combined Military Hospital, Abbottabad, Pakistan, and to measure the clinical and microbiological attributes of the infection.

MATERIALS AND METHODS

Study Design: Cross-sectional study.

Study Setting: The study was conducted at the Pediatric Department of Combined Military Hospital (CMH) Abbottabad, Pakistan, a tertiary care facility serving military personnel and their families.

Duration of the Study: The study spanned six months, from January, 2021 to July, 2021..

Inclusion Criteria: The children 1-5 years old who attended with fever (Temperature -38 degrees Celsius and above) and lasting above 24 hours without any apparent source of infection were selected. They had to exclude those who had been administered antibiotics within the last 48 hours. Male and female children were accepted regardless of the circumcision condition or toilet training.

Exclusion Criteria: Children with a history of known congenital urinary anomalies or previously diagnosed urinary tract disorders, documented infections, such as pneumonia, otitis media, and gastroenteritis, were excluded. Patients with chronic illnesses like nephrotic syndrome, diabetes mellitus, or immunodeficiency were also ruled out in order to reduce confounding variables.

Methods

The urine samples were collected using age-related methods, the clean-catch midstream technique in toilet-trained children and sterile urine bags in non-toilet-trained children with strict supervision skills to minimise contamination. Samples were sent right away through urinalysis and urine culture. The dipstick technique was used to examine urinalysis, and it was examined with a microscope. A UTI diagnosis was confirmed if the urine culture showed a single organism growth of $\geq 10^5$ colony-forming units/mL along with pyuria (≥5 WBCs per high-power field). Sample collection was followed by empirical antibiotic treatment and subsequent changes according to the culture sensitivity results. The Kirby-Bauer disk diffusion method was used to test all isolates to commonly used antibiotics such as amoxicillin-clavulanate, cephalosporins, trimethoprim-sulfamethoxazole and ciprofloxacin in accordance with the CLSI standards. The analysis of the data was made with the help of SPSS 25. The categorical variables were expressed as frequencies and percentages, and the age and temperature are continuous variables where means and standard deviation were obtained.

RESULTS

A total of 210 febrile preschool children aged between 1 and 5 years who presented to the study over a six-month period were enrolled in the study. Of them, 32 (41%) were men and 44 (59%) were women. The average child's age was 3.2 1.1 years. Among 210 children, it was found that 52 children had urinary tract infection with positive urinalysis and urine culture results, which created a 24.8 percent frequency in the studied children. Gender-based prevalence of UTI revealed that 15 (17.4%) of the male and 37 (29.8%) of the female children were positive with UTI, proving 29.8% and 17.4%

respectively. The 3-to-4-year age group was represented by the highest UTI occurrence (n=20, 38.5%), followed by 2-to-3-year incidence (n=14, 26.9%).

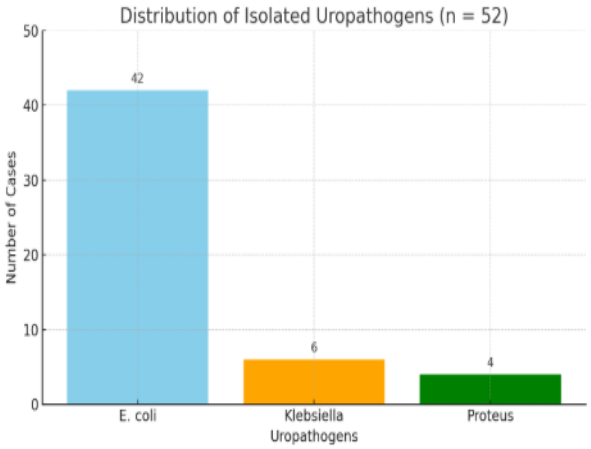
Table 1

Variable	Frequency (n)	Percentage (%)
Gender		
Male	86	41.0
Female	124	59.0
Age Group (Years)		
1–2	38	18.1
2–3	54	25.7
3–4	68	32.4
4–5	50	23.8
UTI Positive	52	24.8
UTI Negative	158	75.2

Demographic Characteristics of Study Participants (N = 210)

Urine cultures identified *Escherichia coli* as the most common pathogen, responsible for 42 (80.8%) of the UTI cases. Other organisms included *Klebsiella pneumoniae* in 6 (11.5%) cases, and *Proteus mirabilis* in 4 (7.7%) cases.

Graph 1



Antibiotic sensitivity testing revealed that *E. coli* isolates showed the highest sensitivity to cefixime (88.1%), followed by ciprofloxacin (84.5%) and nitrofurantoin (76.2%). Conversely, resistance was noted against ampicillin (72.5%) and trimethoprim-sulfamethoxazole (64.3%).

Table 2

Antibiotic	Sensitive Isolates (n)	Sensitivity (%)
Cefixime	37	88.1
Ciprofloxacin	35	84.5
Nitrofurantoin	32	76.2
Amoxicillin-Clavulanate	26	61.9
Trimethoprim-Sulfamethoxazole	15	35.7
Ampicillin	12	28.5

Antibiotic Sensitivity Pattern of E. coli Isolates (n = 42)

The results highlight a concerning level of resistance to commonly prescribed oral antibiotics, necessitating the use of more potent agents as first-line therapy. Among the UTI-positive children, 18 (34.6%) had a history of prior UTI, and 12 (23.1%) had a family history of urinary infections. No significant association was found between circumcision status and UTI occurrence among male participants.

Table 3

Age Group (Years)	Male UTI Positive (n, %)	Female UTI Positive (n, %)	Total UTI Positive (n, %)
1–2	3 (7.9%)	6 (15.8%)	9 (17.3%)
2–3	4 (7.4%)	10 (18.5%)	14 (26.9%)
3–4	6 (8.8%)	14 (20.6%)	20 (38.5%)
4–5	2 (4.0%)	7 (14.0%)	9 (17.3%)

Distribution of UTI by Age Group and Gender (N = 52)

The results indicate that the percentage of resistance against the most popular oral antibiotics is high, so the usage of more powerful antibiotics must be regarded as one of the first treatments. Among the UTI-positive children, 18 (34.6%) had a history of UTI, and 12 (23.1%) had a family history of urinary infections. The circumcision status did not demonstrate any significant relationship with the prevalence of UTIs among the male respondents. These findings emphasise the importance of an active UTI screen in febrile preschoolers, especially the female population and children aged 24 months, to guide the diagnosis of patients and therapy with reference to the distribution of prevalence and antibiotic resistance of UTI pathogens, including at the local level.

Discussion

This research was carried out to find out the prevalence of urinary tract infections (UTIs) occurring in febrile children between the ages of 1 and 5 years in the Combined Military Hospital (CMH) Abbottabad, Pakistan. Since the frequency rate of UTIs was 24.8%, our results are consistent with the assertion that UTIs are a widely spread cause of unexplained fever in children aged between 1 and 5 years. This prevalence is no different from the other regional and international studies. The prevalence was found to be similar in the study by Singh and Parihar, where they studied fever in Indian preschool children (1), and the problem once again underlines the importance of early detection and testing among people with similar health profiles. The most notable observation in our study is that females experience significantly more UTIs than males (29.8 vs. 17.4%). This gender difference concurs with other published information that has shown that anatomical variations between men and women, such as a short urethra, make women susceptible to ascending infections (2, 3). Besides, the EAU/ESPU guidelines also highlight the increased occurrence of UTIs in female children, especially after infancy (2). Oliveira and Mak observed that although male infants are found to be affected by infections more than female infants in the neonatal period, their frequency becomes more prevalent among female children after infancy (3). Escherichia coli was the most prolific organism isolated, capturing 80.8 percent of the UTI incidences. This observation is in line with various studies that state that E. coli is the commonest uropathogen of pediatric patients (4, 5).

The dominance of E. coli as the causative agent of pediatric UTIs was also recorded by Hanna-Wakim and others, in which the susceptibility patterns varied significantly according to regions (5). This uniformity makes sense of the exercise of using empirical coverage of E. coli in starting treatment of febrile children awaiting culture results. According to the obtained antibiotic susceptibility data, E. coli was found to be most sensitive to cefixime, ciprofloxacin, and nitrofurantoin. These results are consistent with the ones stated by Shaikh et al., who proposed a cautious attitude toward antibiotic choice because of the changing tendencies in GN resistance (6). Nevertheless, the high rates of ampicillin (72.5%) and trimethoprim-sulfamethoxazole (64.3%) resistance are alarming in our study. This tendency should not be regarded as quite unusual because the meta-analysis of the investigations

of Bryce et al. revealed that resistance to the frequently used oral antibiotics in pediatric UTIs was widespread across the continents, especially in low- and middle-income countries (7). Such findings further emphasize the necessity of region-based antimicrobial stewardship policies, as local resistance patterns should inform them (8). Another major finding in our research was the relationship between the past UTI record and the present one, where 34.6 percent of the children found positive by UTI had previously been attacked by infections.

The occurrence of recurrent infections, as emphasized by Leung et al., can lead to the suggestion of structural or functional abnormalities (9), which should be addressed through subsequent examination. According to Copp and Schmidt, children with recurrent UTI should be subjected to imaging tests to eliminate the possibility of vesicoureteral reflux or obstruction, such as renal ultrasound or voiding cystourethrogram (VCUG) (10). Our data especially showed the correlation between antibiotic misuse and resistance. Similarly to Ethiopian and other LMICs as reported, careless antibiotic choice without a culture following its findings usually results in the failure of the treatment and increased resistance rates (11, 12). These results reiterate the demand of Becknell et al. about enhancing the accuracy of diagnosis and minimizing empirical therapies for ambiguous cases (1315). Such a method is strengthened by our findings in times when the resistance is increasing, and fewer oral antibiotics can be used to treat infections among children.

Our research confirms the conclusion made by Shrestha et al. that local epidemiology should be taken into consideration when developing algorithms to treat patients to prevent the use of empirical regimens that have lost their effectiveness in a certain population (16). Since both ampicillin and TMP-SMX have been among the weakest antibiotics in our study, prolonged use of these as first-line agents in empirical therapy can help reduce therapeutic delays and complications. The significance of gathering local and subsequent analysis of the data cannot be underestimated. Regional surveillance data on trends in susceptibility, as demonstrated by Vazouras et al., can allow healthcare providers to customize their treatment, thereby optimizing the outcomes and also maintaining antibiotic effectiveness (17). Few studies have been conducted in the recent past in Pakistan that particularly examine UTIs in febrile children, particularly in the military. Therefore, our data can fill this information gap because it gives up-to-date data regarding local UTI generality and resistance patterns among preschoolers.

Clinically, the results are well fitted in the international recommendation of Okarska-Napieral et al, which implies that where the source of infection in a febrile child is not clear, there should be a high suspicion concerning UTI among girls and children below the age of 4 years (18). Pre-screening at an early stage, urine culture-positive identification and sensitivity-directed treatment should become a norm to minimize the recurrence and avoidance of renal aftermaths. There are limitations of the study. Its single-centred and military-hospital-based nature does not necessarily portray the results of civilian populations or rural populations at all. In addition to this, efforts taken to ensure that users avoid contamination during urine collection have been met with some good efforts, but the potential of false positivity still exists, especially when using bag-collected samples. Lastly, renal outcomes and recurrence were not followed long-term, which might provide more information regarding the clinical relevance of these infections. It highlights the importance of prior vigilance in the diagnosis, the use of urine culture as a confirmatory mechanism, and an empirical use of antibiotics that also depends on the regional data against antibiotics. Future studies need to be extended to multi-centric facilities and address the longitudinal follow-up outcomes of renal scarring or sustained kidney disease along with children with repeated UTIs or a lack of response to the initial treatment.

Conclusion

UTIs are one of the major causes of morbidity in febrile pre-school children, with the frequency recorded in this study at 24.8 percent at the Combined Military Hospital, Abbottabad. High prevalence of E. coli as the causative organism and emergence of resistance to frequently used antimicrobials like ampicillin and trimethoprim-sulfametaxazole as first-line antimicrobials justify an urgent need for evidence-based empirical treatment modalities. The prevalence was higher in the

female gender and the age group of 2 to 4 years, making it imperative to carry out special screening among these population groups. The results suggest the routine urine study in febrile children with no obvious focus of infection and of culture-directed treatment. Since the issue of antimicrobial resistance has become a serious problem, local surveillance statistics must be routinely used by human beings to support empirical prescriptions. It is proposed that multi-center studies involving long-term follow-up should be conducted to assess the complications and facilitate an effective management plan, comprehensive in pediatric UTIs in Pakistan.

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