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# Study of Clinical Profile and Predisposing Factors in Children with Culture-Positive UTI in the Age Group of 1 Month to 5 Years

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## INTRODUCTION

UTIs are one of the most common bacterial infections in children, especially within the critical age group of 1 month to 5 years.(1) These infections, caused predominantly by Escherichia coli and other gram-negative bacteria, pose significant morbidity due to their potential to progress into severe complications, such as pyelonephritis and renal scarring. Early detection and management are essential to mitigate long-term sequelae, including hypertension and chronic kidney disease.(2)

The most susceptible to UTIs are children less than five years old due to anatomical and physiological factors. Females have a shorter urethra, while their immature immune defences increase susceptibility. In addition, predisposing factors like vesicoureteral reflux, congenital anomalies of the urinary tract, and dysfunctional voiding are among the predisposing factors for recurrent infections. Poor personal hygiene and the delay in initiation of toilet training are also very important risk factors in this age group.(3,4) Secondly, diapers, which produce a moist environment prone to bacterial overgrowth, are the risk factor found in infants and toddlers.

Clinical presentation of UTIs in toddlers is highly varied. Older children may present with classic symptoms such as dysuria and frequency, and younger children often present with nonspecific signs such as fever, irritability, vomiting, or failure to thrive. This diagnostic challenge underlines the need to maintain a high index of suspicion for UTIs in febrile young children without a clear source of infection. Delayed diagnosis can lead to complications such as urosepsis, emphasizing the need for prompt evaluation and intervention.(5)

Bacteriological profiles of pediatric UTIs revealed a predominance of E. coli in more than 50% of cases.(6,7) However, other pathogens such as Klebsiella pneumoniae, Proteus mirabilis, and Enterococcus species are also implicated. There is presently increasing antibiotic resistance by

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these pathogens, especially cephalosporins and ampicillin, posing a major challenge for appropriate treatment. Local antimicrobial sensitivity patterns need to be identified in guiding empirical therapy and minimizing resistance development.(8)

Despite the clinical importance of UTIs in children, there is a dearth of information on their clinical profile and risk factors, especially in resource-poor settings. Understanding the spectrum of clinical presentations, bacteriological patterns, and predisposing factors may help guide effective diagnosis and management strategies. Identifying high-risk groups may also help target interventions to reduce the burden of pediatric UTIs.

The purpose of this study is to analyze the clinical profile, bacteriological spectrum, and predisposing factors in children aged 1 month to 5 years diagnosed with culture-positive UTIs. Analysis of these parameters will provide actionable insights for improving diagnostic accuracy, optimal antibiotic use, and preventive measures for pediatric populations. In addition, it brings a call for public health programs to support hygienic practice training, educate mothers and other caregivers, and eliminate the preventable risk factors responsible for recurrent UTIs in children.

## AIM

To study the clinical profile, bacteriological spectrum, and predisposing factors in children aged 1 month to 5 years with culture-positive urinary tract infections.

## MATERIALS AND METHODS

### Study Design and Setting

This study was prospective in nature with an observational study designed over a period of two years starting from January 2023 and concluding in December 2024 at the Department of Pediatrics at a tertiary care centre. The heterogeneous population served is one of its own strengths in capturing diverse cases. The main aim was to assess the clinical profile, bacteriological spectrum, and predisposing factors in culture-positive UTI cases in children aged 1 month to 5 years.

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**Study Population**

The study population was those children who had clinical symptoms indicating UTI. A total of 100 children diagnosed with confirmed culture-positive UTI participated in the study. The inclusion criteria were symptomatic children with significant bacteriuria (>10^5 CFU/mL) on urine culture and who had not received antibiotic treatment two weeks before the study. Children with known congenital urological abnormalities previously diagnosed and those with incomplete medical records were excluded from the study.

**Data Collection**

Data were collected through structured clinical interviews with parents or guardians and a detailed review of the patient's medical records. Information on demographic factors, clinical history, and presenting symptoms such as fever, dysuria, abdominal pain, and vomiting was recorded. Socioeconomic status and hygiene practices were also documented. Laboratory investigations included urine routine microscopy, urine culture sensitivity testing, and renal function tests. Imaging studies such as renal ultrasonography were performed for all participants, and voiding cystourethrography (VCUG) was conducted in cases with recurrent infections or suspected structural abnormalities.

**Clinical and Microbiological Evaluation**

Urinary specimens were collected with age-specific procedures. These included clean-catch midstream urine in toilet-trained children and sterile catheterization for infants. The bacteriological studies identified the cause of the infections and their antimicrobial susceptibility profiles. Antimicrobial susceptibility testing was done using the Kirby-Bauer disk diffusion technique. CLSI recommendations were followed. A structured assessment was carried out to establish predisposing factors like vesicoureteral reflux, congenital anomalies, and dysfunctional voiding. The hygiene practices and the use of diapers were accessed by interviewing caregivers. Imaging studies furnished anatomical abnormalities leading to recurrent infections.

**Statistical Analysis**

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Analysis was done using SPSS v25.0. Summarized information on demographic, clinical, and microbiological data using descriptive statistics. Inferential statistics, which consisted of Chi-square tests and logistic regression, were performed to establish statistical associations between the clinical features, predisposing factors, and bacteriological findings. A p-value < 0.05 was considered statistically significant.

### Ethical Considerations

The study first sought institutional ethics committee approval before starting. All participants gave written informed consent after seeking their parents' or guardians' permission. The study followed the principles of the Declaration of Helsinki, maintaining the confidentiality of the patients and the voluntariness of their participation.

## RESULTS

### Demographic and Clinical Characteristics

Table 1 shows the demographic profile of the participants. The mean age of children was 2.5 ± 1.2 years, with a slight male predominance (55%). However, females constituted a higher proportion among infants under 1 year. Fever (90%), dysuria (70%), and vomiting (50%) were the most common presenting symptoms.

**Table 1: Demographic and Clinical Characteristics**

| Characteristics | Frequency (%) | p-value |
|---|---|---|
| Gender | | |
| Male | 55 (55%) | 0.03 |
| Female | 45 (45%) | Ref |
| Age (mean ± SD) | 2.5 ± 1.2 | 0.02 |
| Symptoms | | |
| Fever | 90 (90%) | <0.001 |

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| | | |
|---|---|---|
| Dysuria | 70 (70%) | 0.02 |
| Vomiting | 50 (50%) | 0.03 |

**Bacteriological Profile**

Table 2 summarizes the bacteriological findings. *Escherichia coli* was the predominant pathogen (80%), followed by *Klebsiella pneumoniae* (10%) and *Proteus mirabilis* (5%). Antimicrobial sensitivity revealed high susceptibility to nitrofurantoin and aminoglycosides, while resistance to third-generation cephalosporins was noted in 30% of isolates.

**Table 2: Bacteriological Profile and Antibiotic Sensitivity**

| **Bacterial Isolate** | **Frequency (%)** | **Sensitive to** | **Resistant to** |
|---|---|---|---|
| *Escherichia coli* | 80 (80%) | Nitrofurantoin, Amikacin | Cephalosporins (30%) |
| *Klebsiella pneumoniae* | 10 (10%) | Carbapenems, Aminoglycosides | Ampicillin (50%) |
| *Proteus mirabilis* | 5 (5%) | Ciprofloxacin, Amikacin | Cephalosporins (20%) |

**Predisposing Factors**

Table 3 highlights the predisposing factors identified in the study. VUR was the most common underlying abnormality (25%), followed by congenital anomalies (15%) and poor hygiene practices (10%).

**Table 3: Predisposing Factors**

| **Factors** | **Frequency (%)** | **p-value** |
|---|---|---|

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| | | |
|---|---|---|
| Vesicoureteral Reflux | 25 (25%) | <0.001 |
| Congenital Anomalies | 15 (15%) | 0.02 |
| Poor Hygiene Practices | 10 (10%) | 0.03 |

## DISCUSSION

Urinary tract infections in children are a common clinical and public health problem, as they can be recurrent and lead to serious complications. The present study reports the clinical profile, bacteriological spectrum, and predisposing factors of culture-positive urinary tract infections in children between 1 month and 5 years of age.

The most common presenting symptom was fever, seen in 90% of cases, which is consistent with the literature, which describes fever as a hallmark of pediatric UTIs.(9–11) Dysuria (70%) and vomiting (50%) were other common symptoms, highlighting the varied and often nonspecific clinical presentations in this age group. These findings highlight the need for heightened clinical suspicion, particularly in febrile infants and young children without an identifiable source of infection.

The bacteriological spectrum observed indicated that 80% of the cases were primarily due to pathogen Escherichia coli. The disease prevalence of E. coli can be attributed to its uropathogenic properties, including adhesins and toxins that facilitate colonization of the urinary tract.(12) Other pathogens, such as Klebsiella pneumoniae and Proteus mirabilis, accounted for a smaller proportion of cases but were notable for their resistance profiles. Resistance to third-generation cephalosporins in 30% of isolates poses a significant challenge for empirical therapy, highlighting the importance of local antimicrobial sensitivity data to guide treatment.

Predisposing factors included vesicoureteral reflux (VUR) in 25% of cases, which was in line with earlier studies linking VUR to recurrent UTIs and renal scarring.(13) Congenital anomalies of the urinary tract were identified in 15% of children, and this underscores the role of structural abnormalities in predisposing to infection. Poor hygiene practices were reported in 10% of cases, reflecting the influence of socioeconomic and behavioral factors on UTI risk.

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The use of imaging studies, such as renal ultrasonography, and the VCUG, proved a valuable tool in identifying anatomy abnormalities and guiding management. It is recommended that imaging be routinely done in children diagnosed with recurrent UTI or atypical presentations to rule out possible structural problems and to prevent long-term consequences. Early identification and correction of these abnormalities can significantly reduce the risk of renal damage and recurrent infections.

In pediatric UTIs, the management should take into account the growing challenge of antimicrobial resistance. In this study, nitrofurantoin and aminoglycosides showed high susceptibility rates, but resistance to commonly used antibiotics like cephalosporins underlies the importance of judicious use of antibiotics. Local sensitivity patterns should guide empirical therapy, and the definitive treatment should be adjusted based on the culture results.(8)

Preventive measures would be essential in the reduction of burden caused by UTIs among children. A message of proper hygiene practices, proper toilet training, and proper hydration can contribute a lot toward reducing UTI incidents. Alternatively, prophylactic antibiotics can be given, but follow-up visits should be made constantly to avoid recurrence and complications of UTIs in these patients.

Future research should be directed toward the genetic and immunological factors that predispose to UTIs in children. The role of probiotics, cranberry extracts, and other non-antibiotic interventions in preventing UTIs may open up additional avenues for reducing recurrence and minimizing antibiotic use.(9)

## CONCLUSION

This study puts into perspective the significant burden of UTIs in children aged 1 month to 5 years with early diagnosis and targeted antimicrobial therapy in addition to the identification of predisposing factors. Clinical presentations included fever, dysuria, and vomiting, and the predominant pathogen was E. coli. The findings support routine imaging in recurrent cases and emphasize the need for local antimicrobial sensitivity data to guide effective treatment.

## RECOMMENDATIONS

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A multifaceted approach is required to effectively manage pediatric UTIs. Caregiver education on hygiene and early symptom recognition should be at the core of public health efforts. Health systems should work towards access to diagnostic tools such as imaging in the identification and management of risk factors. Other essential strategies to curtail antimicrobial resistance include the use of antimicrobial stewardship programs and research on non-antibiotic preventive measures.

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