Section: Miscellaneous

Original Research Article

PROFILE OF URINARY TRACT INFECTION IN CHILDREN AT A TERTIARY CARE CENTER

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ABSTRACT

Background: Urinary tract infections (UTIs) persist as a primary source of acute bacterial illness and morbidity in the paediatric population. With the escalating global threat of antimicrobial resistance, ensuring timely and appropriate antibiotic selection guided strictly by local susceptibility data is critical to averting complications like renal scarring and hypertension. This study aimed to determine the prevalence, bacteriological profile, and antimicrobial sensitivity pattern of culture-positive UTI cases in children attending Madhubani Medical College, a tertiary care center. **Materials and Methods:** This retrospective cross-sectional study analyzed urine culture data from 329 children aged 1–12 years with suspected UTI. Significant bacteriuria was defined as a growth of $\geq 10^5$ colony-forming units (CFU)/ml of a single species in a clean-catch midstream urine specimen. Antimicrobial susceptibility testing was evaluated using the Kirby-Bauer disc diffusion method following standard guidelines. **Result:** Out of 329 suspected cases, 78 (23.7%) were found to have culture-positive UTI. Prevalence trends mirrored established data, being higher in the younger age group (1–5 years, with male predominance) compared to the older age group (6–12 years, with female predominance). *E. coli* (52.6%) remained the most frequently isolated organism, followed by *Klebsiella spp.* (17.9%) and *Enterococcus spp.* (11.5%). Overall, the highest rates of sensitivity were observed for Nitrofurantoin (88.5%) and Amikacin (83.3%). Conversely, low sensitivity was noted for Cotrimoxazole (16.7%) and Ceftriaxone (24.4%), highlighting significant resistance to commonly used empirical agents. **Conclusion:** *E. coli* and *Klebsiella* continue to be the predominant uropathogens. Amikacin and Nitrofurantoin demonstrated robust efficacy for empirical therapy in this local setting. Regular surveillance of antimicrobial patterns is mandatory to combat multi-drug resistant infections and ensure rational antibiotic usage.

INTRODUCTION

Urinary tract infections (UTIs) constitute one of the most common acute bacterial illnesses encountered in infants and children.[1,2] A UTI is defined as the microbial invasion of any tissue of the urinary tract, extending from the renal cortex to the urethral meatus. Although urine is normally a sterile fluid, it serves as an ideal culture medium for bacterial proliferation upon contamination.[3,4]

Diagnosing UTIs in children poses significant challenges, particularly in infants, as urinary symptoms are often minimal and non-specific.[5] Delays in diagnosis and the subsequent lack of appropriate antibiotic treatment can lead to serious long-term sequelae, including renal damage manifesting as scarring, hypertension, and eventual renal parenchymal loss.[6] In older children, symptoms are often better verbalized and include dysuria, frequency, urgency, new-onset urinary incontinence, abdominal or flank pain, suprapubic discomfort, and vomiting.

Treating UTIs has become progressively harder due to the rising prevalence of antimicrobial resistance among causative organisms.[7] The spectrum of bacteria causing UTIs and their antibiotic susceptibility varies significantly by geographical location. Consequently, adequate knowledge of the local pattern of urinary pathogens and their susceptibility profile is essential for selecting appropriate empirical therapy for children presenting with acute UTI.[8]

The most common uropathogen worldwide remains Escherichia coli, which historically accounts for the majority of pediatric UTIs.[9] Other common causative agents include Klebsiella, Proteus, Enterobacter, Citrobacter, Staphylococcus saprophyticus, and Enterococcus. Recent studies

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from 2024 indicate that resistance patterns are shifting, necessitating updated local data.[10,11]
Considering the context of increasing resistance and the need for evidence-based local treatment guidelines, this study was undertaken at Madhubani Medical College, a tertiary care center, to determine the prevalence of culture-positive UTI, the specific bacteriological profile, and the antibiotic sensitivity pattern among children aged 1–12 years.

MATERIALS AND METHODS

Study Design and Setting: This study followed a cross-sectional design conducted at Madhubani Medical College, a tertiary care hospital between May 2024 to April 2025.
Study Population and Sample Collection: A total of 329 children aged 1–12 years who were clinically suspected of having UTI were included. Clean-catch mid-stream urine samples were collected after preliminary cleaning of the genitalia by the caregiver/parent to minimize contamination, as recommended by recent ISPN guidelines.[2] Specimens were transported immediately to the Microbiology laboratory for analysis.
Laboratory Analysis: Samples were cultured aerobically on appropriate media. A positive urine culture (significant bacteriuria) was defined as a colony count of ≥ 105 colony-forming units (CFU)/ml of a single pathogenic organism in an appropriately collected midstream clean-catch specimen. Organisms grown in culture were identified using relevant biochemical reactions. Samples yielding mixed growth (more than three types of colonies) were rejected from analysis.
Antimicrobial Susceptibility Testing: Antimicrobial sensitivity testing was performed on all isolated organisms using the modified Kirby-Bauer disc diffusion method, strictly following the Clinical and Laboratory Standards Institute (CLSI) guidelines.[12,13]
Data Analysis: Data were analyzed using frequency distribution in number and percentage.

RESULTS

A total of 329 children aged 1–12 years were screened for suspected UTI.
Prevalence and Demographics
Out of 329 children screened, 78 (23.7%) were found to have culture-positive UTI. The prevalence rate was higher in the younger age group (1–5 years, 29.1% prevalence) compared to the older age group (6–12 years, 17.4% prevalence).
Culture-positive UTI was found to be predominantly in males (61.2%) in the 1–5 years age group and predominantly in females (56.7%) in the 6–12 years age group.

Table 1: Bacteriological Profile

Uropathogen	Number Isolated (n=78)	Percentage (%)
E. coli	41	52.6%
Klebsiella spp.	14	17.9%
Enterococcus spp.	9	11.5%
Pseudomonas spp.	5	6.4%
Proteus spp.	5	6.4%
Acinetobacter spp.	4	5.1%
Total	**78**	**100%**

E. coli was the commonest organism isolated (52.6%), followed by Klebsiella spp. (17.9%) and Enterococcus spp. (11.5%).

Table 2: Antimicrobial Sensitivity Pattern (Overall)

Antibiotics	Number Sensitive (n=78)	Percentage Sensitive (%)
Nitrofurantoin	69	88.5%
Amikacin	65	83.3%
Imipenem	62	79.5%
Gentamicin	57	73.1%
Amoxycillin Clavulanate	38	48.7%
Ciprofloxacin	30	38.5%
Ceftriaxone	19	24.4%
Cotrimoxazole	13	16.7%

Overall, the highest sensitivities were found for Nitrofurantoin (88.5%) and Amikacin (83.3%).

DISCUSSION

The prevalence of culture-proven UTI in this study was 23.7%. This figure aligns closely with the 22.9% prevalence reported by Priyadarshini et al. (2024) in Vadodara,[14] and falls within the 15.7%–26.8% range reported in other recent studies.[15] Variations in prevalence rates may be influenced by differences in age range selection, patient demographics, sample collection methods, and laboratory techniques.

Age and Gender Distribution
Consistent with contemporary literature,[16] the prevalence was higher in the younger age group (1–5 years) (29.1%) compared to the older group (6–12 years) (17.4%). This tendency for UTIs to occur more frequently in smaller children may be due to a lack of proper training regarding urination and challenges in maintaining proper genital hygiene.
Our data shows a male predominance in the 1–5 years age group (61.2%) and a female predominance in the

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6–12 years age group (56.7%). The increased prevalence in older females is generally attributed to the anatomical factor of a shorter urethra located closer to the anus, which facilitates the retrograde movement of fecal organisms into the lower urinary tract, a finding supported by Mandal et al. (2024).[5]

Bacteriological Profile

E. coli was the most frequently isolated pathogen (52.6%) in our analysis, which correlates with findings across India and globally.[1,5,14] This figure is comparable to the 45% reported by Mandal et al. (2024),[5] and slightly lower than the 78% reported in the Vadodara study.[14] The second most common isolate was Klebsiella spp. (17.9%), which is consistent with regional data reported by Koli et al.[8] Notably, Enterococcus spp. constituted 11.5% of our isolates. While this confirms the continued significance of Gram-positive organisms, it is lower than some historical highs but aligns with recent trends in tertiary settings.[10] The presence of Enterococcal infection, especially in hospital settings, remains a critical consideration for empirical therapy.

Antimicrobial Sensitivity Pattern

Our study highlights the potential utility of Nitrofurantoin and Aminoglycosides for empirical treatment in this region. Overall, the highest sensitivities were found for Nitrofurantoin (88.5%) and Amikacin (83.3%).

Specifically, our E. coli isolates showed high sensitivity to Amikacin (>80%) and Nitrofurantoin (>85%). High sensitivity to Amikacin is closely comparable to other 2024 studies,[6,17] and suggests that Amikacin still holds good efficacy for treating UTI. Furthermore, our high sensitivity to Nitrofurantoin supports the revised Indian Society of Pediatric Nephrology Guidelines (2023), suggesting oral Nitrofurantoin remains a cost-effective, sensitive initial empirical choice.[2]

In contrast, our data revealed alarmingly low sensitivity to frequently prescribed oral antibiotics: Cotrimoxazole (16.7%) and Ceftriaxone (24.4%). E. coli isolates commonly exhibit very poor susceptibility towards Cotrimoxazole, with recent sensitivity patterns reported to vary widely but generally remaining low.[11,14] The low sensitivity to third-generation cephalosporins (like Ceftriaxone) among uropathogens is an alarming finding, likely due to the rampant, injudicious, and irrational overuse of antibiotics in the community.[18]

CONCLUSION

This study on the profile of pediatric UTIs at Darbhanga Medical College confirms that E. coli remains the dominant uropathogen, followed by Klebsiella. The overall prevalence was 23.7%, with age- and gender-dependent distribution mirroring findings elsewhere in India (male predominance in 1–5 years; female in 6–12 years).

The emergence of resistance to traditional and commonly used oral antibiotics, such as Cotrimoxazole and Ceftriaxone, poses a severe challenge. Amikacin and Nitrofurantoin demonstrated predominant sensitivity in this local context. We conclude that empirical antibiotic selection must be restricted and monitored based strictly on local resistance patterns, rather than on universal guidelines, to preserve the efficacy of currently available antimicrobial agents.

Limitations

The inherent limitations of this study include its cross-sectional design, and its reliance on a relatively small sample size of 329. Additionally, prior antibiotic treatment is likely among some children admitted to the hospital, potentially leading to a false estimation of resistance patterns. Follow-up for long-term complications was also not included.

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