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Original Article

# Clinico-Microbiological Profile and Concordance of Empirical Antibiotic Therapy with Culture Sensitivity in Pediatric Urinary Tract Infections: A Descriptive Observational Study

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## ABSTRACT

**Introduction:** Urinary tract infection (UTI) is one of the most common bacterial infections encountered in pediatric clinical practice and remains a significant contributor to morbidity among children worldwide. It accounts for a considerable proportion of pediatric outpatient visits, hospital admissions, and antibiotic prescriptions. Early diagnosis is often challenging due to non-specific clinical presentation, particularly in infants and younger children. Empirical antibiotic therapy is commonly initiated prior to availability of urine culture reports; however, increasing antimicrobial resistance among uropathogens has raised concern regarding the effectiveness of empirical treatment. Evaluation of the clinical profile, microbiological spectrum, and concordance between empirical therapy and culture sensitivity is therefore essential for optimizing treatment outcomes.

**Aim:** To evaluate the clinico-microbiological profile of pediatric urinary tract infections and assess concordance between empirical antibiotic therapy and urine culture sensitivity patterns.

**Methodology:** A hospital-based descriptive observational study was conducted over a period from January 2025 to April 2026 in a tertiary care teaching hospital. A total of 150 pediatric patients aged 1 month to 18 years with clinically suspected urinary tract infection were enrolled. Detailed clinical history, demographic profile, laboratory investigations, urine microscopy, urine culture, and antimicrobial susceptibility testing were performed. Empirical antibiotic therapy initiated at admission was compared with final culture sensitivity reports to determine concordance.

**Results:** Among 150 children included in the study, 98 (65.3%) were culture positive. Female predominance was observed in 90 (60.0%) cases. *Escherichia coli* was the most common organism isolated in 60 (61.2%) cases followed by *Klebsiella* 18 (18.3%) and *Proteus* 9 (9.1%). High resistance was observed to ampicillin and cotrimoxazole, whereas higher sensitivity was noted with amikacin and nitrofurantoin. Concordance between empirical antibiotic therapy and culture sensitivity was observed in 58 (59%) cases, while 40 (41%) showed discordance.

**Conclusion:** Pediatric urinary tract infections demonstrate significant antimicrobial resistance with only moderate concordance between empirical antibiotic therapy and culture sensitivity. Regular surveillance of antimicrobial

susceptibility patterns and timely culture-guided therapy are essential to improve treatment outcomes and reduce antibiotic resistance.



***Keywords****: Pediatric urinary tract infection; Uropathogens; Culture sensitivity; Antibiotic resistance; Empirical antibiotic therapy.*

## INTRODUCTION

Urinary tract infection is among the most frequently encountered bacterial infections in children and represents an important cause of pediatric morbidity globally (1). It contributes substantially to febrile illness, outpatient consultations, emergency visits, and hospital admissions in childhood. The disease burden is particularly significant in developing countries such as India, where delayed diagnosis, inappropriate antimicrobial use, and limited access to diagnostic microbiology often complicate management (2).

The epidemiology of pediatric urinary tract infection varies according to age and sex. During infancy UTIs are common in both sexes; however, beyond infancy the prevalence is higher among female children because of anatomical susceptibility including a shorter urethra and ascending bacterial colonization (3). Early recognition and appropriate treatment are important because untreated or recurrent infection may result in renal scarring, hypertension, reflux nephropathy, and chronic kidney disease later in life (4).

Clinical presentation in children is often variable and nonspecific. Infants frequently present with fever, poor feeding, irritability, vomiting, lethargy, or failure to thrive, whereas older children may present with dysuria, increased urinary frequency, urgency, abdominal pain, flank pain, or fever (5). Due to this varied presentation, diagnosis is frequently delayed.

Urine culture remains the gold standard investigation for confirming UTI, identifying the causative organism, and determining antimicrobial susceptibility (6). However, because culture reports require time, empirical antibiotic therapy is usually initiated at presentation based on clinical suspicion and institutional practice (7).

*Escherichia coli* continues to be the predominant uropathogen responsible for pediatric UTIs, followed by *Klebsiella*, *Proteus*, and other gram-negative organisms (8,9). Increasing resistance to commonly used antibiotics including ampicillin, cotrimoxazole, and cephalosporins has emerged as a major therapeutic challenge worldwide (10).

Several studies have demonstrated significant discordance between empirical therapy and final culture sensitivity reports, leading to delayed response, antibiotic modification, prolonged hospital stay, increased healthcare cost, and emergence of multidrug-resistant organisms (11,12). Regional variations in microbiological profile and antibiogram further emphasize the importance of institution-specific surveillance (13–15).

Recent evidence has reinforced the need for culture-guided treatment in pediatric urinary infections. Tullus and Shaikh (16), Coulthard et al. (17), Bryce et al. (18), Stein et al. (19), Mistry et al. (20), Shaikh et al. (21), Tewari et al. (22), Hsiao et al. (23), Kline and Lewis (24), and Freedman et al. (25) have all highlighted the growing clinical challenge of antimicrobial resistance in pediatric urinary pathogens and the need for regular surveillance-based antibiotic stewardship. The present study was therefore undertaken to evaluate the clinico-microbiological profile of pediatric urinary tract infections and assess the concordance between empirical antibiotic therapy and culture sensitivity patterns in children attending a tertiary care hospital.

## MATERIALS AND METHODS

### Study Design

The present study was conducted as a **hospital-based descriptive observational study**. The study was planned to evaluate the clinical profile, bacteriological spectrum, antimicrobial susceptibility pattern, and concordance between empirical antibiotic therapy and urine culture sensitivity among pediatric patients clinically suspected to have urinary tract infection.

### Study Setting

The study was carried out in a **tertiary care teaching hospital** with facilities for pediatric inpatient and outpatient management, microbiological culture, and antimicrobial sensitivity testing. All clinical evaluation, sample collection, laboratory processing, and treatment were performed at the same institution.

### Study Duration

The study was conducted over a period of **One year and Four month**, from **January 2025 to April 2026**.

### Study Population

The study population included **150 pediatric patients** aged **1 month to 18 years** presenting with clinical suspicion of urinary tract infection.
Children were evaluated on the basis of symptoms suggestive of UTI and enrolled after fulfilling eligibility criteria.

**Inclusion Criteria**
Children were included in the study if they presented with one or more of the following clinical features suggestive of urinary tract infection:

- Fever
- Dysuria
- Increased frequency of micturition
- Abdominal pain
- Vomiting
- Poor feeding
- Irritability
- Clinical suspicion of urinary tract infection

**Exclusion Criteria**
Children were excluded from the study if they had:

- History of antibiotic intake within the previous 48 hours
- Congenital urinary tract anomalies
- Chronic kidney disease
- Immunocompromised status

**Sample Collection**
Detailed demographic and clinical history was recorded in a structured case proforma at the time of admission or clinical evaluation.

Urine samples were collected under strict aseptic precautions using an age-appropriate collection method.
Methods used for sample collection included:

- **Clean catch midstream urine sample**
- **Catheterized urine sample**
- **Urine collection bag**

The method of collection depended on the age and clinical condition of the child.
All samples were transported immediately to the microbiology laboratory for further analysis.

**Processing of Urine Sample**
Collected urine samples were subjected to routine microscopic examination and microbiological processing.
Microscopy was performed to detect:

- Pyuria
- Pus cells
- Bacteria
- Other urinary deposits wherever indicated

Samples were processed promptly to avoid contamination or delay-related bacterial overgrowth.

**Method of Urine Culture**
Urine culture was performed using standard microbiological laboratory methods.
Culture plates were incubated under appropriate laboratory conditions, and bacterial growth was examined after incubation.
Organism identification was carried out based on:

- Colony morphology
- Gram staining characteristics
- Standard biochemical reactions

Growth pattern and colony count were interpreted according to standard microbiological diagnostic criteria.

**Antimicrobial Susceptibility Testing**
Antimicrobial susceptibility testing was performed for all culture-positive isolates using the **Kirby–Bauer disc diffusion method**.

Sensitivity testing was carried out according to **Clinical and Laboratory Standards Institute (CLSI) guidelines**.

Antibiotics commonly used in pediatric urinary tract infection management were tested against isolated organisms. Sensitivity and resistance patterns were recorded for analysis.

**Definition of Positive Urine Culture**
A urine culture was considered **positive** when significant bacterial growth of a urinary pathogen was identified on culture according to standard microbiological criteria.

Culture-negative samples showed no significant bacterial growth after incubation.
For analysis, patients were classified into:

- **Urine culture positive**
- **Urine culture negative**

**Data Collection**
Detailed data were collected for every enrolled patient using a predesigned structured proforma.

The following information was recorded:

- Age
- Sex
- Presenting complaints
- Duration of symptoms
- Clinical findings
- Urine microscopy findings
- Urine culture report
- Isolated organism
- Antimicrobial susceptibility pattern
- Empirical antibiotic prescribed
- Modification of antibiotic after culture sensitivity report

All findings were entered systematically and verified before analysis.

**Study Procedure**
At presentation, all children with suspected urinary tract infection underwent detailed clinical evaluation.
Based on institutional treatment protocol, **empirical antibiotic therapy** was initiated at presentation before availability of urine culture report.

Once urine culture and antimicrobial sensitivity reports became available, antibiotic therapy was reassessed.
Treatment was then either:

- continued unchanged if organism was sensitive to empirical therapy, or
- modified if resistance was demonstrated

Concordance between empirical antibiotic prescribed and culture sensitivity pattern was assessed.

**Concordance** was defined as sensitivity of the isolated organism to the empirical antibiotic initially prescribed.
**Discordance** was defined as resistance of the isolated organism to the empirical antibiotic prescribed empirically.

**Statistical Analysis**
Collected data were entered into **SPSS software version 22.0** for analysis.
Continuous variables were expressed as **mean ± standard deviation (SD)**.
Categorical variables were expressed as **frequency and percentage**.
Comparison between categorical variables was performed using the **Chi-square test** wherever applicable.
A **p-value of <0.05** was considered statistically significant.

**RESULTS**

**Table 1. Age and Gender Distribution**

| Age Group | Male | Female | Total |
|---|---|---|---|
| <5 years | 28 | 36 | 64 |
| 5–10 years | 18 | 24 | 42 |
| >10 years | 14 | 30 | 44 |

The above table shows the age and gender distribution of 150 pediatric patients with suspected urinary tract infection. Most patients belonged to the age group below 5 years, accounting for 64 cases. Female predominance was observed in all age

groups. Overall, 90 (60%) patients were females and 60 (40%) were males. This indicates that urinary tract infection was more commonly observed in younger children and was more frequent among female patients in the present study.

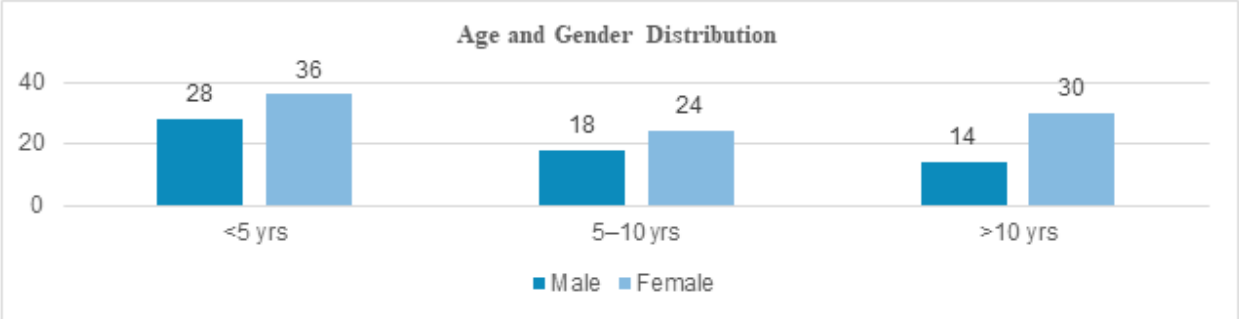



**Table 2. Culture Positivity**

| Result | Number | Percentage |
|---|---|---|
| Positive | 98 | 65.3% |
| Negative | 52 | 34.7% |

The above table illustrates urine culture findings among the study population. Out of 150 pediatric patients with suspected urinary tract infection, 98 (65.3%) showed significant bacterial growth on urine culture, while 52 (34.7%) had no growth. The culture positivity rate in the present study indicates that nearly two-thirds of clinically suspected cases were microbiologically confirmed, highlighting the importance of urine culture in diagnosis and management of pediatric urinary tract infection.

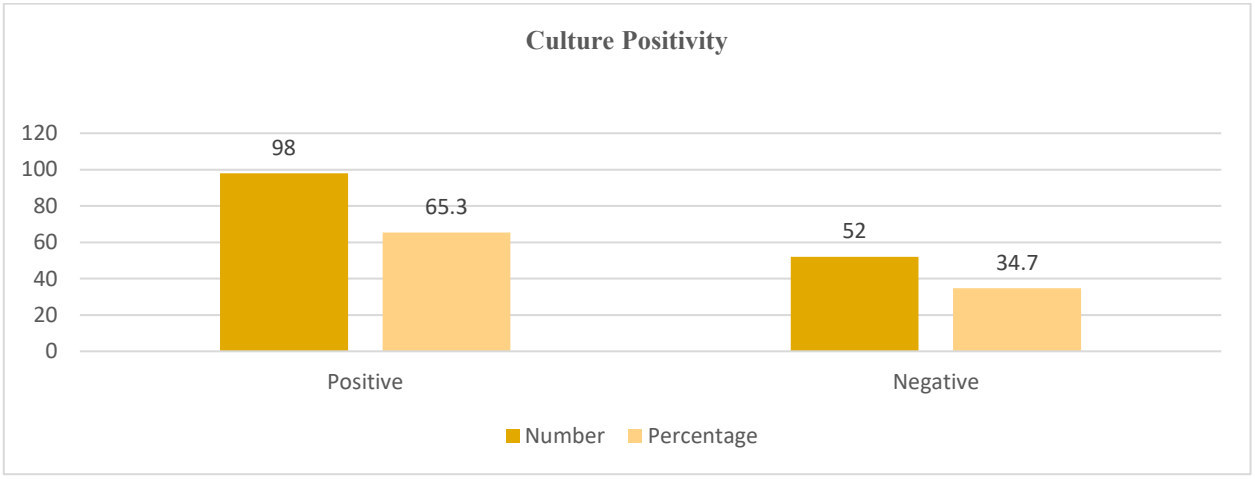



**Table 3. Organism Distribution**

| Organism | Frequency | Percentage |
|---|---|---|
| E. coli | 60 | 61.2% |
| Klebsiella | 18 | 18.3% |
| Proteus | 9 | 9.1% |
| Others | 11 | 11.4% |

*Escherichia coli* was the predominant pathogen isolated followed by *Klebsiella* and *Proteus* species. The above table shows the distribution of organisms isolated on urine culture. *Escherichia coli* was the most common organism isolated, accounting for 60 cases (61.2%), followed by *Klebsiella* in 18 cases (18.3%) and *Proteus* in 9 cases (9.1%). Other organisms constituted 11 cases (11.4%). These findings indicate that *E. coli* was the predominant uropathogen in the present study population.

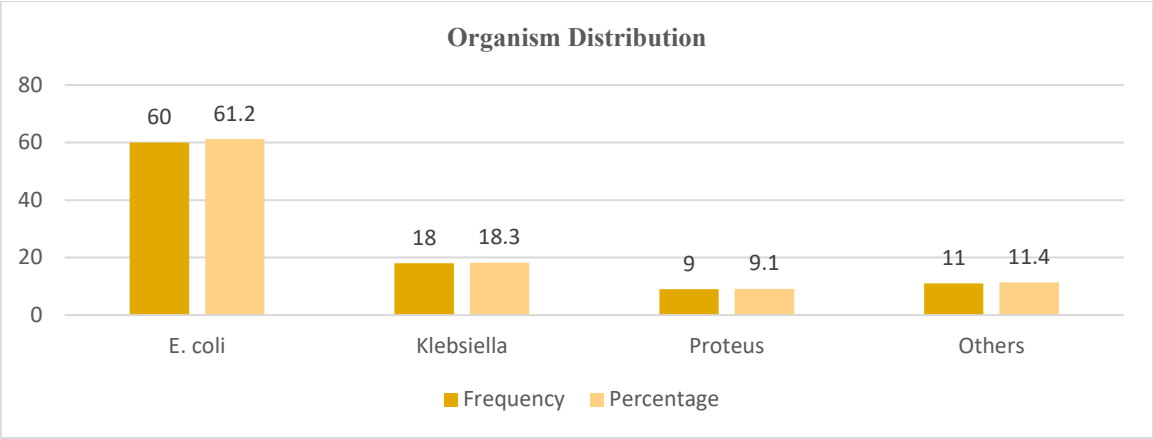
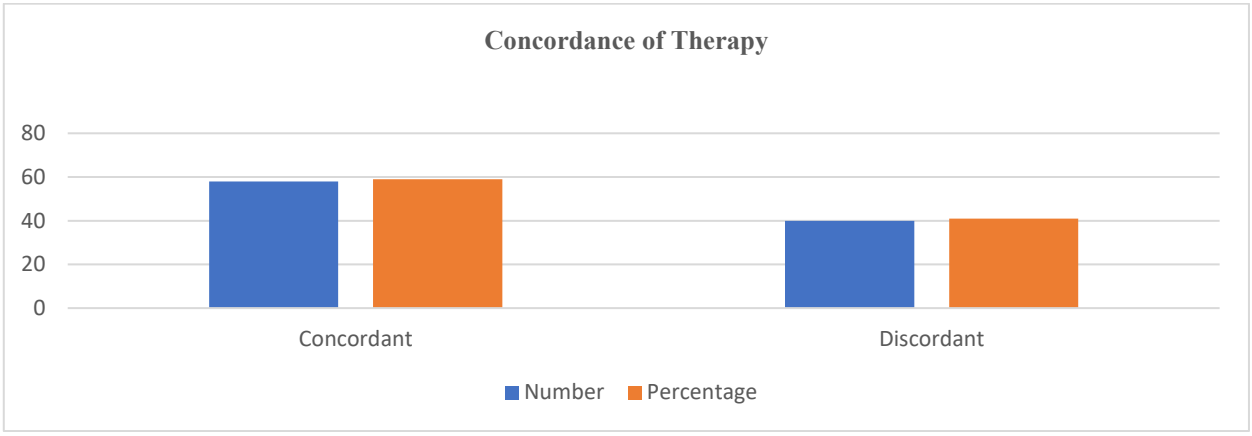



**Table 4. Concordance of Therapy**

| Category | Number | Percentage |
|---|---|---|
| Concordant | 58 | 59% |
| Discordant | 40 | 41% |

The above table shows concordance between empirical antibiotic therapy and final urine culture sensitivity. Concordance was observed in 58 cases (59%), whereas discordance was seen in 40 cases (41%). These findings suggest that although empirical antibiotic therapy was appropriate in a majority of cases, a significant proportion showed mismatch between initial antibiotic selection and microbial sensitivity, emphasizing the importance of culture-guided modification of treatment.




## DISCUSSION

The present study was conducted to evaluate the clinical profile, microbiological spectrum, antimicrobial susceptibility pattern, and concordance between empirical antibiotic therapy and urine culture sensitivity among pediatric patients with urinary tract infection presenting to a tertiary care teaching hospital. Urinary tract infection remains one of the most frequently encountered bacterial infections in childhood and continues to contribute significantly to pediatric morbidity across both outpatient and inpatient settings. Because symptoms may be nonspecific in younger children, diagnosis is often delayed, which may increase the risk of recurrent infection, renal scarring, and long-term renal damage. For this reason, understanding the local microbiological pattern and antibiotic sensitivity profile remains important in guiding appropriate treatment and reducing complications.

In the present study, female children formed the majority of the study population. This finding is comparable with the observations reported by **Shaikh et al. (1)**, **Rushton (3)**, **Ganie et al. (5)**, and **Tullus et al. (16)**, who also demonstrated a higher incidence of urinary tract infection among girls. Female predominance in pediatric urinary tract infection has been consistently described in literature, especially beyond infancy. This may be explained by anatomical susceptibility, particularly the shorter female urethra, easier periurethral colonization by enteric bacteria, and ascending spread of infection into the urinary tract. In infancy, urinary infection may be common in both sexes, but with increasing age the female predominance becomes more evident. Our findings follow this established pattern and further support previously published epidemiological observations.

The age distribution in the present study also showed that most children belonged to the younger pediatric age group. Younger children, particularly those below five years of age, are known to be more vulnerable to urinary tract infection because of incomplete toilet training, increased bacterial exposure, poor local hygiene, and inability to express urinary symptoms clearly. This observation is also consistent with previously reported pediatric studies where UTI was more common in early childhood. The clinical relevance of this is important because younger children frequently present with vague symptoms such as fever, irritability, vomiting, poor feeding, or abdominal discomfort rather than classical urinary complaints, which can delay diagnosis.

The urine culture positivity rate in our study was **65.3%**, with significant bacterial growth observed in 98 out of 150 children. This is comparable with findings reported by **Woo et al. (6)** and **Zorc et al. (7)**, who also reported similar positivity rates among children clinically suspected of UTI. A positive urine culture remains the gold standard for confirmation of urinary tract infection, and our results highlight its continued diagnostic importance. At the same time, a proportion of clinically suspected cases in our study were culture negative. This may be explained by prior partial treatment before presentation, low bacterial colony count, improper sample collection, delayed processing, or noninfective urinary symptoms mimicking UTI. This further emphasizes that while clinical suspicion is important for early treatment initiation, microbiological confirmation remains essential whenever possible.

The microbiological profile observed in the present study demonstrated **Escherichia coli** as the most common uropathogen, accounting for **61.2%** of culture-positive isolates. This finding is in agreement with **Edlin et al. (9)**, **Foxman (10)**, **Freedman et al. (25)**, and **Shaikh et al. (21)**, all of whom reported *E. coli* as the predominant causative organism in pediatric urinary tract infection. This predominance is expected because *E. coli* possesses several virulence factors that promote adherence to uroepithelium and ascending infection. These include fimbrial adhesins, motility, biofilm formation, and efficient colonization of the periurethral area. The predominance of *E. coli* observed in our study therefore aligns well with global as well as regional data.

Other organisms isolated in our study included **Klebsiella**, **Proteus**, and other less common urinary pathogens. These findings are also comparable with earlier literature. Although these organisms were isolated less frequently than *E. coli*, they remain clinically relevant because they often demonstrate higher antimicrobial resistance and may be associated with recurrent or complicated infection. Identification of these pathogens is important because treatment response may vary according to the organism involved.

A major finding of the present study was the high antimicrobial resistance observed against commonly prescribed empirical antibiotics, particularly **ampicillin** and **cotrimoxazole**. This observation is consistent with studies by **Bryce et al. (18)**, **Mistry et al. (20)**, **Tewari et al. (22)**, and **Stein et al. (19)**, all of whom reported increasing resistance among pediatric urinary isolates. Rising antimicrobial resistance in urinary pathogens has become a major global concern and presents a therapeutic challenge in pediatric practice. Resistance to older first-line antibiotics may be related to frequent antibiotic exposure, inappropriate empirical prescribing, easy availability of antibiotics without prescription, incomplete treatment courses, and increasing bacterial adaptation over time.

In contrast, better sensitivity was observed with **amikacin** and **nitrofurantoin** in the present study. This is clinically meaningful because these antibiotics continue to remain useful treatment options in pediatric urinary tract infection in many settings. Knowledge of local susceptibility trends can directly improve patient care by helping clinicians select more effective empirical therapy while awaiting culture reports. Our findings therefore provide useful regional data that can contribute to antibiotic policy development at institutional level.

Another important objective of the present study was to assess concordance between empirical antibiotic therapy initiated at presentation and final urine culture sensitivity results. In our study, **58 patients (59%)** showed concordance, whereas **40 patients (41%)** showed discordance. Similar findings have been described by **Hsiao et al. (23)** and **Shaikh et al. (21)**. This indicates that although empirical therapy was appropriate in more than half of cases, a substantial proportion of children initially received antibiotics to which the isolated organism was resistant.

This finding has important clinical implications. Discordance between empirical treatment and culture sensitivity may result in delayed clinical improvement, persistence of fever, prolonged urinary symptoms, need for antibiotic escalation, longer duration of hospitalization, increased healthcare cost, and additional exposure to broad-spectrum antibiotics. In children, ineffective early therapy may also increase the risk of upper urinary tract involvement and renal complications if not corrected in time. Therefore, while empirical therapy remains necessary in symptomatic children at first presentation, treatment must be reassessed once culture reports become available.

The findings of our study strongly reinforce the importance of **culture-guided antibiotic modification**. Urine culture should not only be viewed as a confirmatory test but also as a practical tool for improving antibiotic selection and reducing

unnecessary antibiotic use. Early empirical treatment is often unavoidable in febrile or symptomatic children; however, continuation of therapy should ideally be guided by final sensitivity reports whenever available.

The present study also highlights the importance of maintaining regular institutional surveillance of urinary pathogens and antimicrobial susceptibility trends. Resistance patterns vary across geographical areas and even between hospitals within the same region. Therefore, empirical treatment recommendations should ideally be based on local microbiological data rather than depending solely on standard textbook recommendations. Periodic antibiogram review can improve antibiotic stewardship and reduce development of resistant strains.

Overall, the present study demonstrated **female predominance**, **a culture positivity rate of 65.3%**, **predominance of Escherichia coli**, **significant resistance to commonly used antibiotics**, and **moderate concordance between empirical antibiotic therapy and culture sensitivity**. These findings are largely comparable with previously published literature and add valuable institution-based clinical evidence to the existing data on pediatric urinary tract infections.

The study emphasizes that urinary tract infection in children continues to require careful clinical suspicion, timely microbiological confirmation, rational antibiotic selection, and regular review of treatment after culture report availability. Early diagnosis and appropriate therapy remain essential for preventing complications and improving outcome. The results of the present study support the need for **rational antibiotic prescribing**, **regional antimicrobial surveillance**, and **prompt culture-based treatment modification** to achieve better management of pediatric urinary tract infections and to address the growing problem of antimicrobial resistance in routine pediatric practice.

**Recommendations**

1. Urine culture should be performed routinely in all clinically suspected pediatric UTI cases before or at the time of initiation of antibiotic therapy.
2. Empirical antibiotic selection should be guided by local hospital antibiogram and periodically updated resistance patterns.
3. Culture sensitivity reports should be reviewed early so that antibiotic therapy can be modified promptly whenever required.
4. Regular institutional surveillance of antimicrobial resistance should be maintained to support antibiotic stewardship.
5. Early diagnosis and culture-guided treatment may help reduce complications, recurrence, and development of resistant urinary pathogens.

**Limitations**

The present study had certain limitations. Being a single-centre hospital-based study, the findings may not be generalizable to all settings. The microbiological profile and antimicrobial sensitivity pattern may vary across different regions and over time. Long-term follow-up was not included; therefore, recurrence and long-term renal outcomes could not be assessed. Despite these limitations, the study provides useful clinical data on pediatric urinary tract infection and supports the importance of culture-guided antibiotic therapy.

## CONCLUSION

The present study demonstrated that pediatric urinary tract infections continue to be associated with substantial microbiological burden and increasing antimicrobial resistance. *Escherichia coli* remained the predominant uropathogen isolated. High resistance to commonly prescribed antibiotics such as ampicillin and cotrimoxazole was observed, whereas better sensitivity was seen with amikacin and nitrofurantoin.

Concordance between empirical antibiotic therapy and culture sensitivity was moderate, while a significant proportion of cases showed discordance requiring antibiotic modification after culture report.

These findings highlight the importance of early urine culture, region-specific antibiogram surveillance, rational empirical antibiotic selection, and timely culture-guided therapy for improved management and better clinical outcomes in pediatric urinary tract infections.

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