

# Clinico-Laboratory Profile And Drug Sensitivity Pattern In Urinary Tract Infection Of Children In A Tertiary Care Hospital

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## Abstract

**Objective:** Any component of the urinary system can get infected with bacteria, which is known as a urinary tract infection (UTI). It is one of the most common bacterial diseases in children. The study's objectives included identifying the clinical symptoms of UTI in children between the ages of one month and fifteen, as well as the bacteria responsible for the illness and their sensitivity to various medicines.

**Methods:** This cross-sectional study was conducted at the CMH Rawalpindi, Pakistan from January to June of 2022. Our analysis comprised 137 strongly suspected instances of UTI in children (1 month to 15 years old).

**Results:** A total of 137 urine samples from paediatric patients suspected of having UTI were obtained in which the 93 samples (67.88%) generated significant bacteria. The two most common clinical symptoms of UTI patients in our research were fever and dysuria. *E. coli* was the most prevalent isolate in cases with paediatric UTI. Ampicillin, Ciprofloxacin, and cotrimoxazole were the medications that were most effective against *E. coli* and *Klebsiella*, respectively.

**Conclusions:** This study highlights the importance of identifying the clinical symptoms, bacteria causing urinary tract infections (UTIs), and their drug sensitivity patterns in children. The findings emphasize the need for early detection through urine culture sensitivity tests and provide valuable insights for clinicians to effectively manage UTI cases in children, including selecting appropriate empirical antibiotic treatment.

**Keywords:** Children, Urinary tract infection (UTI), *E. coli*

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## 1. Introduction

A bacterial infection known as a urinary tract infection (UTI) can affect any area of the urinary system. Among children, it is one of the most prevalent bacterial illnesses <sup>[1]</sup>. *Escherichia coli* is the most common bacterium causing urinary tract infections (UTIs) in children, primarily affecting their urinary tracts *Klebsiella*, *Proteus*, *Enterococcus*, *Pseudomonas*, and *Citrobacter* are additional microbes <sup>[2]</sup>. The variable and non-specific signs and symptoms of infection in infants and young children, however, complicate the epidemiology of UTI <sup>[3]</sup>. Infants with UTIs may experience a variety of different, non-specific symptoms, including fever, sepsis, lethargy, extended jaundice, haematuria, poor feeding, vomiting, diarrhoea, irritability, failure to grow, and murky or odorous urine <sup>[4]</sup>. Although UTI is rarely linked to fatality still it is a significant cause of morbidity. Additionally, they may be linked to long-term issues such as chronic renal failure, hypertension, and renal scarring. <sup>[5]</sup> According to estimates, 2-20% of newborns and young children worldwide get UTIs <sup>[6]</sup>. It can affect

up to 5% of girls and 1-2% of boys. UTI prevalence changes with age. The male-to-female ratio in the first year varies between 2.8 and 5.4:1. After 1-2 years, there is a female majority with a male-to-female ratio of 1:10 <sup>[7]</sup>.

The procedure used to collect urine is the first and most important stage in making a diagnosis of UTI. Special attention should be paid to the preparation of the periurethral and perineum areas in young children before using a sterile plastic container for urine collection. <sup>[8]</sup> Urethral percutaneous suprapubic bladder aspiration or catheterization is considered the optimal method for aseptically obtaining urine for culture in infants. <sup>[9]</sup> These steps prevent the possible issue of contaminated urine cultures, which frequently happen when bag specimens are used <sup>[10]</sup> After thoroughly cleaning the urethral region, kids and teenagers might be told to take a midstream urine sample. Before the results of urine cultures are available, the most accurate and quick way to diagnose a UTI is through microscopic evidence of bacteria. UTIs can be identified by the presence of 10<sup>5</sup> colony-forming units (CFU) of a single organism per ml of urine <sup>[11]</sup>.

The study's goals included examining the clinical signs of UTI in kids aged 1 month to 15 years old as well as the causative microorganisms and how susceptible they were to various medications when those kids had urinary tract infections.

**2. Materials & Methods**

This cross-sectional study was carried out for six months (January-June 2022) at CMH Rawalpindi, Pakistan.

The predesigned proforma was filled up with patient information taken from hospital and outpatient records, including age, sex, clinical presentation, prior history of UTI, and any congenital anomalies. A total of 137 highly suspected cases of UTI in children (1 month to 15 years) were included in our investigation. The study included children with UTI between the ages of 1 month and 15 years who attended both the outpatient and inpatient departments and met the inclusion criteria during the study period.

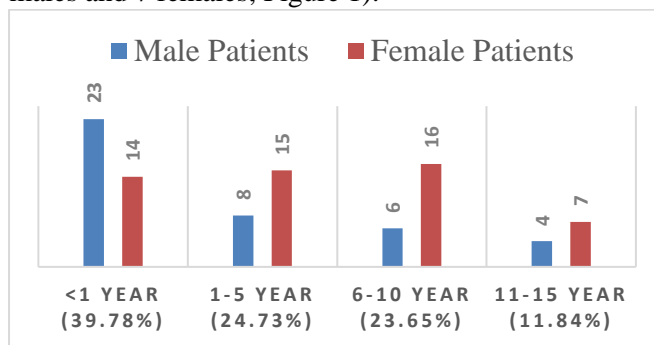
Repetition of samples from a patient who has already been included in the research and samples showing signs of perineal contamination were eliminated from the analysis.

In the case of newborns and young infants, a urine sample was obtained using a sterile urobag. Clean catch midstream urine was gathered from older kids. Urinalysis with > 5 pus cells per high power field, and a culture sensitivity of > 10<sup>5</sup> cfu/ml provided further evidence that the patient had a urinary tract infection. However, if a culture sensitivity (C/S) test was positive and the colony count was greater than 10<sup>4</sup>cfu/ml, children who had symptoms despite having a urinalysis that revealed 6 pus cells/HPF were also determined to have a UTI. The trial excluded patients with a history of recurrent urinary tract infections (UTIs), obstructions of the urinary tract, neurogenic bladder, or a comorbid condition like cancer.

The Kirby-Bauer disc diffusion technique was used to assess antibiotic susceptibility in the presence of any possible growth. For this purpose, different drugs were used i.e. Ampicillin, Ciprofloxacin, Co-Trimoxazole, Aminoglycosides, Ceftriaxone, Cefixime, Cefuroxime, Cotrimoxazole, Amikacin and Nitrofurantoin. Statistical Programme for Social Sciences (SPSS) Software version 16 was used for the statistical analysis.

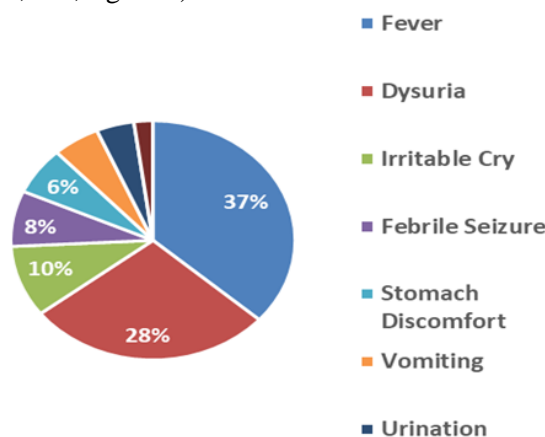
**3. Results**

A total of 137 urine samples from pediatric patients suspected of having UTI were collected, and 93 (67.88%) of those samples produced significant bacteria. Of these, 37 (39.78%) were babies (23 males and 14 females), 23 (24.73%) were children between the ages of one and five (8 males and 15 females), 22 (23.65%) were children between the ages of six and ten (6 male and 16 females), and 11 (11.84%) were children between the ages of eleven and fifteen (4 males and 7 females; Figure 1).



**Figure-1** Prevalence of Significant Bacterial Infections among Pediatric UTI Cases

In our study, Fever (n=34; 37%) and Dysuria (n=26; 28%) were the two most frequent clinical manifestations of UTI patients. Other clinical characteristics were crying out inconsolably (n=9; 10%), febrile seizures (n=7; 8%), stomach discomfort (n=6; 6%), vomiting (n=5; 5%), more frequent urination (n=4; 4%), and feverish status epilepticus (n=2; 2%; figure 2).



**Figure-2** Prevalence of Clinical Manifestations in UTI Patients.

In instances of paediatric UTI, *E. coli* (33.33%) was the most common isolate, followed by *Klebsiella pneumoniae* (26.88%), *Pseudomonas aeruginosa* (11.83%), *Proteus mirabilis* (9.38%), *Morganella morganii* (6.45%), *Acinetobacter baumannii* (7.53%) and *Enterococcus faecalis* (4.30%; Table 1).

**Table 1** Prevalence of Bacterial Infections by Organism and Age Group

Organism	Cases (N)	Age Group				Percentage (%)
		<1	1-5	6-10	11-15	
<i>E. coli</i>	31	10	9	8	4	33.33%
<i>Klebsiella Pneumoniae</i>	25	12	8	4	1	26.88%
<i>Pseudomonas Aeruginosa</i>	11	6	0	3	2	11.83%
<i>Proteus mirabilis</i>	9	4	1	2	2	9.68%
<i>Morganella morganii</i>	6	2	1	2	1	6.45%
<i>Acinetobacter baumannii</i>	7	2	3	1	1	7.53%
<i>Enterococcus faecalis</i>	4	1	1	2	0	4.30%

**Table 2** Drug Susceptibility Profiles of Bacterial Isolates

Drugs	<i>E. coli</i> n=31	<i>K. Pneumoniae</i> n=25	<i>P. Aeruginosa</i> n=11	<i>P. mirabilis</i> n=9	<i>M. Morganii</i> n=6	<i>A. baumannii</i> n=7	<i>E. faecalis</i> n=4
	Percentage (%)						
Ampicillin	89.39	87	87.5	74.32	85.68	71.97	60
Ciprofloxacin	89.39	84	71.2	100	23.52	18.54	33.3
Co-Trimoxazole	85.68	85	54.23	73.48	27.31	59.7	20.7
Gentamicin	39.97	60	20.7	18.54	18.54	12.98	17.9
Ceftriaxone	43.48	33.7	6.6	100	41.87	20.7	89.21
Cefixime	32.57	60	17.9	00	25.78	6.6	33.3
Cefuroxime	23.52	33.3	20.7	18.54	18.54	17.9	41.87
Moxifloxacin	27.31	20.7	00	60	59.7	21.34	23.52
Amikacin	8.54	6.6	11.78	13.3	00	12.54	14.31
Nitrofurantoin	34.7	17.9	58.7	20.7	17.9	00	18.54

*E. coli* was the most often isolated pathogen in 37 cases with recurrent UTI and congenital abnormality.

The most sensitive drugs for *E. coli* (89.39%, 89.39%, and 85.68%), and *Klebsiella* (87%, 84%, and 85%) were ampicillin, Ciprofloxacin and co-trimoxazole respectively.

The most sensitive medication (above 80% sensitivity) for *Klebsiella pneumoniae* was ampicillin Ciprofloxacin and co-trimoxazole. The two medicines with the highest sensitivity for *Proteus mirabilis* were Ceftriaxone and Ciprofloxacin, however, Cefixime showed (0%) drug sensitivity. The medication with the highest sensitivity to *Enterococcus faecalis* was ceftriaxone (89.21%). Amikacin was the medicine that was least tolerant to all microorganisms. Furthermore, *Pseudomonas aeruginosa*, *Morganella morganii*, *Proteus mirabilis*, and *Acinetobacter baumannii* demonstrated 0% drug sensitivity to Moxifloxacin, Amikacin, Cefixime and Nitrofurantoin (Table 2).

## 5. Discussion

The choice of empirical antibiotic treatment depends on understanding the sensitivity pattern of prevalent uropathogens as determined by regional epidemiology research. Studies suggest that policy for treating UTIs in children should be reviewed every five years in light of resistance rates.<sup>[12]</sup> Our current study found that 67.88% of children with symptoms had culture-positive UTIs, which is nearly comparable to studies done in China and Italy.<sup>[13, 14]</sup> Nevertheless, just a small number of cases approximately (18.44%) were noted in Nepal, Tanzania, Nigeria, and Gondar, respectively.<sup>[15, 16, 17]</sup>

In our study, the age group of children under one year old was the most affected. This is consistent with Indian research carried out in South Kerala and Bareilly.<sup>[18, 19]</sup> In the first year of life, males predominated over females. Due to the possibility of microbial growth in the prepuce, male babies who have not been circumcised are more susceptible to getting UTI. This is completely in line with earlier research by Dyaneshwari et al., Ramagopal et al, Pal et al, Dash et al, and Mehta et al.<sup>[20, 21, 22, 23, 24]</sup>

In our research sample, fever, which was experienced by 34 patients (37%), was the most prevalent presenting symptom. Fever is the most frequent

presenting characteristic, according to multiple additional publications, including those by Ramgopal et al., Shrestha et al. and Vaidya et al.<sup>[25, 26, 27]</sup> Dysuria (n=26, 28%) was the second most frequent presenting symptom in our sample, which is nearly comparable according to Anis-ur-Rehman et al.<sup>[28]</sup>

In 37 individuals, *E. coli* was the most often identified uropathogen (33.33%). According to our analysis, *Klebsiella* (26.88%) was the second most common uropathogen. Other uropathogens identified in our investigation were *Proteus mirabilis* (9.38%), *Morganella morganii* (6.45%), *Acinetobacter baumannii* (7.53%), and *Enterococcus faecalis* (4.30%). Research conducted in the Philippines had nearly similar results.<sup>[29]</sup>

The drugs most susceptible to *E. coli* and *Klebsiella* were ampicillin, Ciprofloxacin, and co-trimoxazole. The medications that were most effective against *Klebsiella pneumoniae* were ampicillin and Ciprofloxacin. The *Proteus mirabilis* was most sensitive to ceftriaxone and Ciprofloxacin (100% each), whereas Cefixime was least sensitive (0%). Amikacin was the drug that tolerated bacteria the least. This outcome is consistent with the work of Paul et al.<sup>[30]</sup>

## 5. Conclusion

In conclusion, urinary tract infection (UTI) is a common bacterial disease in children, and it is crucial to identify the clinical symptoms, causative bacteria, and drug sensitivity patterns for effective treatment. This study found that UTI primarily affected children between the ages of 1 and 5 years, with fever and dysuria being the most common symptoms. *Escherichia coli* (*E. coli*) was the predominant bacteria causing UTI, followed by *Klebsiella pneumoniae*. Ampicillin, Ciprofloxacin, and co-trimoxazole were the most effective drugs against *E. coli* and *Klebsiella*, respectively. The study emphasizes the importance of early detection through urine culture sensitivity tests to avoid recurrent UTIs and reduce pediatric morbidity and mortality. Understanding the sensitivity pattern of prevalent uropathogens is crucial for selecting appropriate empirical antibiotic treatment. These findings contribute to the knowledge of UTI in children and can guide clinicians in managing UTI cases more effectively.

**CONFLICTS OF INTEREST-** None**Financial support:** None to report.**Potential competing interests:** None to report**Contributions:**

M.B - Conception of study

M.B, A.J - Experimentation/Study Conduction

M.B, A.S - Analysis/Interpretation/Discussion

M.B, M.T.N - Manuscript Writing

M.B, A.D - Critical Review

I.A - Facilitation and Material analysis

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