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RESEARCH ARTICLE

Clinical Profiles, Identification of Bacteria, and Anti-bacterial Sensitivity Pattern in Urinary Tract Infection in Children Attending at Janaki Medical College, Ramdaiya, Dhanusha, Nepal

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ABSTRACT

Background: Urinary tract infection (UTI) is a common pediatric condition involving the lower and/or upper urinary tract and is associated with significant morbidity if not diagnosed early. Clinical presentation in children is often non-specific, particularly in infants, leading to delayed diagnosis. Increasing antimicrobial resistance among uropathogens has further complicated management, especially in developing countries like Nepal. **Objectives:** The objective of the study is to assess the clinical profile, identify causative bacterial organisms, and determine the antibacterial sensitivity pattern among pediatric patients with UTI. **Methods:** This study was conducted among children presenting with suspected UTI at Janaki Medical College, Ramdaiya, Dhanusha, Nepal. Diagnosis was based on clinical features along with laboratory confirmation, including significant bacteriuria ($\geq 10^5$ colony-forming units/mL) and the presence of pyuria. Urine samples were analyzed for bacterial isolation and antimicrobial susceptibility patterns using standard microbiological techniques. **Results:** UTI presented commonly with fever, abdominal pain, dysuria, increased frequency of urination, and poor feeding, particularly in younger children. The most frequently isolated organism was *Escherichia coli*, followed by *Proteus* spp., *Klebsiella* spp., *Citrobacter* spp., and *Staphylococcus aureus*. A higher prevalence was observed among female children. Emerging antimicrobial resistance patterns were noted among commonly used antibiotics, emphasizing the need for local antibiogram-based treatment. **Conclusions:** Pediatric UTI presents with varied and often non-specific clinical features, necessitating a high index of suspicion for early diagnosis. *E. coli* remains the predominant pathogen. Increasing antibiotic resistance highlights the importance of regular surveillance of antimicrobial sensitivity patterns to guide empirical therapy and reduce complications such as renal scarring, hypertension, and chronic kidney disease.

Keywords: Antibiotic resistance, *Escherichia coli*, Nepal, pediatrics, urinary tract infection

INTRODUCTION

Pediatric urinary tract infection (UTI) is a common clinical condition caused by microbial infection of the lower urinary tract (cystitis), upper urinary tract (pyelonephritis), or both. The presence of pyuria along with clinical symptoms differentiates UTI from asymptomatic bacteriuria. In children, UTI is typically defined by the presence of $\geq 10^5$ colony-forming units/mL of a single organism in a properly collected urine specimen.[1]

The clinical presentation of UTI in children varies with age. Infants and young children often present with non-specific features such as fever, irritability, poor feeding, vomiting, failure to thrive, or even

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signs of sepsis, whereas older children may present with more localized symptoms such as dysuria, increased frequency of micturition, abdominal pain, or flank pain. UTIs in younger children are frequently associated with underlying urinary tract anomalies.[2] Fever has long been considered a clinically significant indicator, often suggesting renal parenchymal involvement (pyelonephritis).[3] Early recognition and prompt management of UTI in children are essential to prevent significant morbidity and long-term complications, including renal scarring, hypertension, and chronic renal failure.[4] Therefore, appropriate and timely investigations play a crucial role in diagnosis and management.[5]

Among the causative organisms, *Escherichia coli* is the most predominant pathogen, accounting for the majority of pediatric UTIs. Other organisms such as *Proteus* spp., *Klebsiella* spp., *Citrobacter* spp., and *Staphylococcus aureus* are less commonly implicated.[6] Several studies have demonstrated variability in pathogen distribution, with *E. coli* remaining the leading isolate, followed by other Gram-negative and Gram-positive organisms.[7]

The first episode of UTI in infancy and early childhood often represents the beginning of a recurrent process rather than a single isolated event. Due to the non-specific nature of symptoms, many cases are initially misdiagnosed, emphasizing the need for a high index of clinical suspicion. Common presenting features include fever, abdominal pain, decreased appetite, dysuria, increased frequency of urination, nausea, vomiting, foul-smelling urine, irritability, failure to thrive, and occasionally diarrhea.[8,9]

In recent years, the widespread and often inappropriate use of antibiotics has led to a significant rise in antimicrobial resistance among uropathogens worldwide.[10] This growing resistance, particularly in hospitalized patients, necessitates rapid and accurate identification of pathogens along with their antimicrobial susceptibility patterns to guide effective therapy.[11-13] In developing countries like Nepal, this issue represents an even greater public health challenge due to limited resources, diagnostic constraints, and irrational antibiotic use.

Therefore, this study aims to evaluate the current clinical profile, bacterial spectrum, and antimicrobial sensitivity patterns of pediatric UTI. The findings are expected to guide empirical treatment and promote evidence-based management, ultimately reducing morbidity, complications, and mortality associated with pediatric UTI.

MATERIALS AND METHODS

Objective

General objective

To collect clinical symptoms and signs of UTI, bacterial isolation, identification, and antibacterial sensitivity pattern.

Specific objectives

1. To collect clinical symptoms and signs of UTI
2. To find out pre-requisite of infection
3. To identify bacterial isolates
4. To find the antibacterial sensitivity pattern
5. To analyze sociodemographic status.

Study Design

Prospective descriptive observational study.

Study Site

Tertiary Hospital of Janaki Medical College, Ramdaiya, Dhanusha.

Study Population

All cases of patients with symptoms and signs or clinical suspicious of UTI.

Study Duration

Samples were taken till the size of sample is achieved.

Sampling Method

All samples of hospital with suspected UTI.

Sample Size Determination

Sample size = $z^2 \times p \times q/d^2$
Where q = 1-p
P = 0.05
Z2 = 3.84
D = 5%
S = 73.

Study Variables

Age, sex, UTI clinical symptoms and signs.

Inclusive Criteria

Any patients with signs and symptoms of UTI or clinically suspected UTI patients.

Exclusive criteria

Clinically viral and fungal infection.
Recent antibiotic use 48 h.

Procedure

Morning midstream urine sample of 10 mL was collected aseptically and immediately inoculated in Blood Agar and McConkey Agar plate and incubated in an incubator at 37°C for 24–48 h. After that, the plate was read for bacterial growth. Mixed growth plate was discarded, and sample was again taken and forwarded to a similar procedure. Isolated colony was followed by Gram stain and classified as per gram staining. The isolated colony was again inoculated to Biochemical Media such as Urease media, triple sugar iron agar media, Citrate Media, and SIM media for bacterial identification. Catalase and coagulase tests were done as if needed. Antibiotic susceptibility testing of bacterial isolates was done by Kirby–Bauer disc diffusion method by a microbiologist. Urine RE/ME with other necessary tests was also performed. Data from clinical profiles were collected and analyzed. Statistical analysis will be done using the Statistical Package for the Social Sciences version 16. Frequency and percentages were calculated.

RESULTS

41% of participants were female with more than 54% of total participants aged above 5 years. Table 1 represents the sociodemographic status of admitted patients in the pediatric department.
81% of admitted patients had fever and 39% of patients had burning micturition. 28% of patients had vomiting and 29% had nausea. Other clinical profiles of admitted patients are in Table 2.
Headache and suprapubic pain showed a significant. Association with age. Most other symptoms were Not significantly different across age groups. Suggests clinical presentation is broadly similar. Across ages, but: Younger children → more non-Specific symptoms and Older children → more localized symptoms as in Table 3.

- Fever was the most predominant symptom (88.88%)
- Urinary symptoms:
  - Burning micturition → 66.66%
  - Frequency → 55.55%
- Classical symptoms such as dysuria, urgency, Hesitancy → absent
- Many children presented with non-specific features as in Table 4.

Pediatric UTI may present without classical urinary symptoms, emphasizing the need for high clinical suspicion.
In Table 5, amikacin and nitrofurantoin show statistically high effectiveness; amoxicillin–clavulanic acid shows significant resistance. Most other antibiotics are not significantly different from moderate effectiveness. "Only a few antibiotics demonstrated statistically significant sensitivity, while many commonly used drugs showed reduced or inconsistent efficacy, highlighting emerging antimicrobial resistance."

Description of Results

A total of 100 pediatric patients with clinically suspected UTI were included in the study. Among them, 59% were male and 41% were female, with a male predominance. The majority of patients (54%) were aged above 5 years, followed by 37%

Table 1: Sociodemographic representation of patients

Particulars	*n*	*n* (%)
Sex		
Female	41	41.0
Male	59	59.0
Age Range		
(0–1 years)	9	9
1–5 years	37	37
>5 years	54	54
District		
Dhanusha	95	95.0
Mahottari	5	5.0
Nidus of infection		
Abdominal pain	3	3.0
Acute gastroenteritis	1	1.0
B-thalassemia	1	1.0
Fever	1	1.0
None	21	21.0
Pneumonia	1	1.0
URTI	1	1.0
UTI	68	68.0
UTI with URTI	1	1.0
viral hepatitis	2	2.0
Past history		
None	97	97.0
Present	3	3.0
Co-morbidity		
None	100	100.0
Religion		
Hindu	97	97.0
Muslim	3	3.0
Education		
Baby	3	3.0
Pre-primary	4	4.0
Play group	34	34.0
Primary	59	59.0
Total	100	100
Socioeconomic status		
Lower	7	7.0
Middle	93	93.0
Antibiotic use		
None	40	40.0
Yes	60	60.0
Over-the-counter drugs		
None	33	33.0
Yes	67	67.0
Economic source		
Enough	92	92.0
Poor	8	8.0
Residency		
Non-concrete	5	5.0
Pucca or concrete	95	95.0
Traditional healer		
None	96	96.0
Yes	4	4.0
Vaccination		
None	5	5.0
Yes	95	95.0
Vehicle use		
Bike	17	17.0
Bus	18	18.0
On foot	18	18.0
Tempoo	47	47.0
Family history		
Leprosy	1	1.0
None	99	99.0
Lab test interest		
No	38	38.0
Yes	62	62.0
Carrier/vector		
Both	49	49.0
Flies/mosquito	36	36.0
None	15	15.0
Disease concept		
None	73	73.0
Yes	27	27.0
Diagnosis		
Abdominal pain	4	4.0
Acute bronchiolytics	1	1.0
AGE	1	1.0
Acute respiratory infection	1	1.0
B-thalessemia	1	1.0
Fever	2	2.0
Hepatitis	1	1.0
Pneumonia	1	1.0
Upper respiratory tract infection (URTI)	1	1.0
Urinary tract infection (UTI)	86	86.0
UTI with URTI	1	1.0
Drinking water		
Hand pump	98	98.0
Tap water	2	2.0
Washing water		
Hand pump	98	98.0
Tap water	2	2.0
Sanitary latrine		
None	16	16.0
Yes	84	84.0

(Contd...)

Table 1: ***(Continued)***

Particulars	*n*	*n* (%)
Sanitary barrier		
None	21	21.0
Yes	79	79.0
Waste disposal		
None	17	17.0
Yes	83	83.0
Air pollution		
None	32	32.0
Yes	68	68.0
Veg/non-veg		
Mixed	3	3.0
Non-veg	80	80.0
Veg	17	17.0
Milk/meat		
Both	86	86.0
Meat	1	1.0
Milk	13	13.0
Preservative food		
None	42	42.0
Yes	58	58.0
Roasted food		
None	41	41.0
Yes	59	59.0
Food adulteration		
None	33	33.0
Yes	67	67.0
Balance diet		
None	16	16.0
Yes	84	84.0
Domestic sanitation		
None	18	18.0
Yes	82	82.0
Garbage disposal		
None	13	13.0
Yes	87	87.0
Safe kitchen		
None	13	13.0
Yes	87	87.0
Personal hygiene		
None	18	18.0
Yes	82	82.0
Pet/Animal		
None	37	37.0
Yes	63	63.0
Cooking status		
Both	31	31.0
Gas	48	48.0
Wood	21	21.0
Herd immunity		
None	12	12.0
Yes	88	88.0
Diabetes mellitus/Hypertension		
None	100	100.0
Malnutrition		
None	83	83.0
Yes	17	17.0
Obesity		
None	97	97.0
Yes	3	3.0

(Contd...)

in the 1–5-year age group and 9% below 1 year. Most participants (95%) were from Dhanusha district.

Regarding socioeconomic and environmental characteristics, 93% belonged to the middle socioeconomic class, and 92% had adequate economic resources. The majority lived in pucca houses (95%), had access to safe drinking water (98% handpump), and sanitary latrines (84%). However, a significant proportion (68%) reported exposure to air pollution, and 63% had contact with domestic animals. Prior antibiotic use was observed in 60% of patients, while 67% reported over-the-counter drug use.

Clinically, fever was the most common presenting symptom (81%), followed by increased frequency of micturition (47%), anorexia (43%), and burning micturition (39%). Gastrointestinal symptoms such as vomiting (28%) and nausea (29%) were also frequently observed. Other symptoms included malaise (16%), suprapubic pain (14%), dysuria (7%), and urinary retention (7%), while urgency and hesitancy were uncommon.

Urine culture was positive in 9% of cases, and all isolates were identified as *E. coli*. Among culture-positive patients, fever was present in 88.9%, followed by burning micturition (66.7%) and increased urinary frequency (55.6%). Symptoms such as dysuria, urgency, hesitancy, and delirium were not observed among culture-positive cases.

Antibiotic sensitivity testing revealed that amikacin (100%) and nitrofurantoin (88.9%) were the most effective antibiotics, followed by levofloxacin

Table 2: Case profiles of admitted patients (*n*=100)

Characters	n	%
Fever		
Yes	81	81.0
No	19	19.0
Headache		
None	81	81.0
Yes	19	19.0
Vomiting		
None	72	72.0
Yes	28	28.0
Nausea		
None	71	71.0
Yes	29	29.0
Malaise		
None	84	84.0
Yes	16	16.0
Anorexia		
None	57	57.0
Yes	43	43.0
Delirium		
None	95	95.0
Yes	5	5.0
Burning micturition		
None	61	61.0
Yes	39	39.0
Frequency of micturition		
None	53	53.0
Yes	47	47.0
Dysuria		
None	93	93.0
Yes	7	7.0
Hesitancy		
None	99	99.0
Yes	1	1.0
Urgency		
None	98	98.0
Yes	2	2.0
Suprapubic pain		
None	86	86.0
Yes	14	14.0
Retention of urine		
None	93	93.0
Yes	7	7.0

(77.8%) and piperacillin-tazobactam (66.7%). Moderate numbers of sensitivity was observed with ceftriaxone and clindamycin (44.4% each). However, commonly used antibiotics such as cephalosporins and amoxicillin-clavulanic acid showed low to no sensitivity, indicating emerging antibacterial resistance.

Overall, the study demonstrates that UTI in children commonly presents with non-specific symptoms, with fever being the predominant feature. *E. coli* remains the principal causative organism, and there is a concerning trend of increasing resistance nowadays.

DISCUSSION

This study evaluated pediatric patients with suspected UTIs presenting with one or more symptoms such as fever, headache, vomiting, nausea, malaise, anorexia, delirium, burning micturition, increased frequency, dysuria, hesitancy, and urgency. Among these, 9% of patients demonstrated significant bacterial growth on urine culture. This prevalence is lower than that reported in several studies, which range from 21% to 12%.[7,14]

Among the 100 admitted cases, fever was the most common presenting symptom (81%), followed by increased frequency of micturition (47%), anorexia (43%), burning micturition (39%), nausea (29%), and vomiting (28%). These findings are lower compared to the study conducted by Shrestha *et al*. in 2018[15] but higher than those reported in a study from Poland.[16] Increased frequency of micturition was observed more frequently than in the study by Giri *et al*.,[17] whereas other systemic symptoms such as delirium, malaise, and headache were less common. Classical urinary symptoms, including suprapubic pain, urinary retention, dysuria, hesitancy, and urgency, were infrequently observed in this study.

Only 9 out of 100 admitted patients had positive urine cultures, which is significantly lower than findings from studies by Giri *et al*. (52%),[17] Gupta *et al*. (35.4%),[18] and Gautam *et al*. (21.3%).[7] However, the prevalence is comparable to studies by Shrestha *et al*. (16%)[15] and Ganesh *et al*. (12.3%)[14] and slightly higher than that reported by Kaushik and Chaudhary (5%).[19]

Fever was the most consistent and predominant clinical feature among all culture-positive cases, consistent with previous studies.[15-17] Increased

Table 3: Age-wise distribution of symptoms with statistical significance

Symptoms	Response	<1 year *n* (%)	1–5 years *n* (%)	>5 years *n* (%)	*P*-value
Fever	Yes	8 (9.8)	29 (35.4)	45 (54.9)	>0.05 (NS)
	No	1 (5.6)	8 (44.4)	9 (50.0)	
Headache	Yes	0 (0.0)	4 (22.2)	14 (77.8)	<0.05 (S)
	No	9 (11.0)	33 (40.2)	40 (48.8)	
Vomiting	Yes	0 (0.0)	12 (42.9)	16 (57.1)	>0.05 (NS)
	No	9 (12.5)	25 (34.7)	38 (52.8)	
Nausea	Yes	2 (6.9)	12 (41.4)	15 (51.7)	>0.05 (NS)
	No	7 (9.9)	25 (35.2)	39 (54.9)	
Malaise	Yes	2 (12.5)	6 (37.5)	8 (50.0)	>0.05 (NS)
	No	7 (8.3)	31 (36.9)	46 (54.8)	
Anorexia	Yes	5 (11.6)	13 (30.2)	25 (58.1)	>0.05 (NS)
	No	4 (7.0)	24 (42.1)	29 (50.9)	
Delirium	Yes	1 (20.0)	3 (60.0)	1 (20.0)	>0.05 (NS)
	No	8 (8.4)	34 (35.8)	53 (55.8)	
Burning micturition	Yes	4 (10.3)	15 (38.5)	20 (51.3)	>0.05 (NS)
	No	5 (8.2)	22 (36.1)	34 (55.7)	
Frequency of micturition	Yes	4 (8.5)	16 (34.0)	27 (57.4)	>0.05 (NS)
	No	5 (9.4)	21 (39.6)	27 (50.9)	
Dysuria	Yes	0 (0.0)	3 (42.9)	4 (57.1)	>0.05 (NS)
	No	9 (9.7)	34 (36.6)	50 (53.8)	
Hesitancy	No	9 (9.0)	37 (37.0)	54 (54.0)	—
Urgency	Yes	0 (0.0)	0 (0.0)	2 (100.0)	>0.05 (NS)
	No	9 (9.2)	37 (37.8)	52 (53.1)	
Suprapubic pain	Yes	0 (0.0)	4 (28.6)	10 (71.4)	<0.05 (S)
	No	9 (10.5)	33 (38.4)	44 (51.2)	
Retention of urine	Yes	0 (0.0)	4 (57.1)	3 (42.9)	>0.05 (NS)
	No	9 (9.7)	33 (35.5)	51 (54.8)	

Table 4: Distribution of symptoms among culture-positive UTI cases (*n*=9)

Symptoms	Yes (*n*)	Yes (%)	No (*n*)	No (%)
Fever	8	88.88	1	11.11
Headache	0	0	9	100
Vomiting	1	11.11	8	88.88
Nausea	1	11.11	8	88.88
Malaise	1	11.11	8	88.88
Anorexia	3	33.33	6	66.66
Delirium	0	0	9	100
Burning micturition	6	66.66	3	33.33
Frequency of micturition	5	55.55	4	44.44
Dysuria	0	0	9	100
Hesitancy	0	0	9	100
Urgency	0	0	9	100
Suprapubic pain	2	22.22	7	77.77
Retention of urine	0	0	9	100

frequency of micturition was present in more than half of the culture-positive cases (55.55%), while burning micturition was noted in 66% of cases. Anorexia was observed in 33.33% of cases and suprapubic pain in 22.22%. Approximately 11.11% of patients presented with vomiting, nausea, or malaise. Notably, none of the culture-positive cases presented with urgency, hesitancy, dysuria, or urinary retention. These findings highlight that pediatric UTI may present predominantly with systemic or non-specific symptoms, without classical urinary manifestations.

E. coli was the only organism isolated in culture-positive cases. This finding aligns with existing literature, which identifies *E. coli* as the most common causative organism of pediatric UTI in Nepal and globally.[15]

Table 5: Antibiotic sensitivity pattern with statistical significance (*n*=9)

Antibiotic	Sensitive (*n*)	Sensitivity (%)	*P*-value*
Amikacin	9	100.0	0.004 (S)
Nitrofurantoin	8	88.9	0.039 (S)
Levofloxacin	7	77.8	0.180 (NS)
Piperacillin–Tazobactam	6	66.7	0.508 (NS)
Clindamycin	4	44.4	1.000 (NS)
Ceftriaxone	4	44.4	1.000 (NS)
Cefoperazone	3	33.3	0.508 (NS)
Azithromycin	2	22.2	0.180 (NS)
Ofloxacin	2	22.2	0.180 (NS)
Cefepime	2	22.2	0.180 (NS)
Cefuroxime	1	11.1	0.039 (S)
Amoxicillin–Clavulanic acid	0	0.0	0.004 (S)

Regarding antimicrobial sensitivity patterns, amikacin was found to be the most effective antibiotic, with all isolates showing sensitivity. In contrast, complete resistance was observed against amoxicillin and clavulanic acid. Similar findings have been reported in multiple studies, where amikacin and nitrofurantoin remained the most effective agents against *E. coli* isolates.[7,14,15,18,19] Cephalosporins and penicillin group antibiotics demonstrated reduced sensitivity or resistance in several studies.[14,15,18,20]

These findings raise serious concerns regarding the increasing trend of antimicrobial resistance among uropathogens. The reduced effectiveness of commonly used antibiotics may lead to challenges in empirical treatment and an increased risk of complications, prolonged illness, and higher healthcare burden. This underscores the urgent need for regular surveillance of antimicrobial sensitivity patterns and rational antibiotic use to mitigate the growing threat of resistance.

CONCLUSION

Pediatric UTI presents with a wide spectrum of clinical manifestations, many of which are non-specific, thereby requiring a high index of clinical suspicion for timely diagnosis. Fever was the most common presenting feature (81%), followed by increased frequency of micturition (47%), anorexia (43%), burning micturition (39%), nausea (29%), and vomiting (28%).

E. coli was identified as the predominant causative organism in all cases. It demonstrated the highest sensitivity to amikacin (100%), followed by nitrofurantoin (88.9%), levofloxacin (77.8%), and piperacillin–tazobactam (66.8%).

The observed trend of increasing antimicrobial resistance underscores the critical need for continuous surveillance of antibiotic sensitivity patterns. This is essential to guide appropriate empirical therapy and to minimize the risk of complications such as renal scarring, hypertension, and progression to chronic kidney disease.

Recommendations

1. Due to the rising pattern of antimicrobial resistance, urine culture and sensitivity testing should be performed whenever feasible before initiating empirical antibiotic therapy
2. Healthcare facilities, especially in resource-limited settings, should ensure the availability and accessibility of urine culture and sensitivity testing to improve diagnostic accuracy and treatment outcomes
3. Periodic local antibiogram studies should be conducted to guide clinicians in selecting the most appropriate empirical antibiotics
4. Rational use of antibiotics should be strictly encouraged to prevent further development of resistance.

AUTHOR'S CONTRIBUTIONS

Conceptual design, manuscript writing, data collection, statistical analysis, reviewed literature, reference management, revision of drafts and editing, final revision-HNP, AKS, DS, DDS, DRP, NS, NPY. All authors contributed equally in all the phases of this study and approved the final draft for publication.

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CONFLICT OF INTEREST

No conflict of interest was declared

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