

BACTERIOLOGICAL PROFILE AND ANTIBIOGRAM OF UROPATHOGENS IN PEDIATRIC AGE GROUP POPULATION FROM A TERTIARY CARE HOSPITAL IN WESTERN NEPAL

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ABSTRACT

INTRODUCTION

Urinary tract infection (UTI) is one of the most common bacterial infections encountered in day to day pediatrics practices. It has been a significant cause of acute morbidity and is also a significant cause of hospital attendance among children. In children, despite the presence of simple and reliable methods of preliminary screening of children's urine, UTI continues to be under-diagnosed. The study aimed to know the clinical and bacteriological profile of urinary tract infection and to find out the drug resistance of bacterial isolates in pediatric age group population attending Universal College of Medical Sciences Teaching Hospital, Bhairahawa.

MATERIAL AND METHODS

Three hundred and seven non-repetitive urine samples from UTI suspected pediatric patients were included in the study and subjected for microscopic urine analysis followed by semi-quantitative culture by calibrated loop method for estimation of significant bacteriuria.

RESULTS

Present study showed that UTIs are more common in girls (54.07%) than in boys (45.92%). In terms of urine culture, 98 (31.92%) subjects had positive urine culture. There was no consistent symptom common to all patients with UTI other than fever. *E. coli* was the commonest uropathogens isolated. *E. coli* was the principal isolates showing high susceptibility to Imipenem (90.5%).

CONCLUSIONS

The result is a high percentage of resistance to commonly prescribed drugs. The urine of all suspected cases of UTI should be cultured and sensitivity pattern be determined for appropriate treatment.

KEYWORDS Bacteriological profile, Pediatric age group, Western Nepal.

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INTRODUCTION

Urinary tract infection (UTI) is one of the most common bacterial infections encountered in day to day pediatrics practices. Reported rates of urinary tract infection in children consulting for any acute condition vary widely from 2-20% depending on setting and inclusion criteria.^{1,2} It has been estimated that about 6 million patients per year are visited worldwide for UTI, out of which around 30,000 are treated in the wards.³ Urinary tract disorders in Nepal are estimated to be about 7% and urinary tract infection constitutes majorities of this disorders.⁴

UTI is defined as the presence of 10^5 or more organisms per ml of urine. The incidence varies according to age, race, and sex.^{5,6} It is estimated that 1% of boys and 3% of girls develop UTI during the first ten years of life.^{7,8} It has been a significant cause of acute morbidity and is also a significant cause of hospital attendance among children. It affects male children more than females in the first year of life and female after one year of age.⁷ UTI is mainly due to the ascending infection from the urethra. The diagnosis of UTI in young children is important as it may be the marker of urinary tract abnormalities. Complications include renal parenchymal damage and renal scarring that can lead to hypertension and progressive renal insufficiency in later life.^{9,10} Diagnosis based on clinical features is difficult because of the varied non-specific clinical features. In children, despite the presence of simple and reliable methods of preliminary screening of children's urine, urinary tract infection continues to be under diagnosed. Clinical presentation of UTI in infants and young children can be very subtle and atypical and a high index of suspicion must be kept to diagnose.¹¹ UTI in children should be suspected if there is the presence of fever, chills, and rigor, burning micturition, foul-smelling of urine, pain abdomen, vomiting, facial puffiness, loose stool, seizures, hematuria, constipation, loss of appetite, and failure to thrive.⁹

The exact information on the etiology and resistance pattern of pediatric UTIs in a region is usually not available, and if available it is outdated as antimicrobial sensitivity patterns are bound to change over a period of time. This study was undertaken to know the clinical and bacteriological profile of urinary tract infection in children in the Universal College of Medical Sciences Teaching Hospital (UCMS-TH) which is located in the Western part of Nepal. The distribution of bacterial strains isolated from UTI and their resistance pattern against commonly used antibiotics at our setting was also studied.

MATERIAL AND METHODS

A hospital-based prospective study was conducted at UCMS-TH, Bhairahawa from January 2017 to November 2017.

Ethical approval was taken from the institutional review committee (IRC) of UCMS-TH. Pediatric patients ranging from two months to 13 years of age of either sex attending pediatric outpatient department as well as in the wards with symptoms like fever, abdominal pain, dysuria, smelly urine were subjected for urine routine and microscopic examination. Sick child who were already on antibiotics were excluded from the study. Verbal consent was taken from the parents or guardians before enrolling them in the study. A detailed history of selected cases was recorded that included name, age, sex, address, duration of illness and other complaints.

Two methods were used for collecting urine for microbiological analysis: the clean-catch midstream specimen method for children who were able to control urination and the sterile plastic bags method for younger children who were not able to control urination. The choice of sampling (evacuating bladder catheter vs. spontaneous voiding) was done following accepted guidelines for each age group.¹² Fifty milliliters of clean-catch midstream urine specimen was collected in a sterile universal container. The semi-quantitative technique to determine significant bacteriuria was employed by using a 0.01 mL calibrated wire loop to inoculate 5% blood agar and MacConkey agar with uncentrifuged urine. Culture plates were incubated at 37°C for 18-24 hour well-isolated bacterial colonies were processed for antibiotic sensitivity and biochemical tests.¹³

After the inoculation of media, the remaining sample was centrifuged at 2000 rpm for 5 minutes and sediment was used for microscopy and Gram stain. Urine samples were examined microscopically especially for pus cells to confirm urinary tract infection via quantitative unspun wet film examination. Microscopy was done to detect pyuria (>1 pus cell/7 high power fields), bacteriuria, hematuria of well-mixed uncentrifuged urine samples. The diagnosis of UTI was made utilizing positive urine culture for one organism with a count greater than or equal to 50,000 colony forming units (CFU) if it was collected by a urinary evacuating catheter and greater than or equal to 100,000 CFU/ML, if it was collected by spontaneous voiding, according to criteria established by the American Pediatric Academy.¹⁴

The isolates were identified by standard microbiological techniques. The bacterial isolates were tested for *in vitro* antibiotic susceptibility by disc diffusion (Kirby-Bauer) method using Muller-Hinton agar medium as described by the National Committee for Clinical Laboratory Standards (presently called Clinical Laboratory Standard Institute).¹⁵ Antibiotics were selected according to CLSI guidelines. The antibiotic discs used for testing were selected according to CLSI (2014) schedule were amikacin (30 µg), gentamicin (10

µg), cotrimoxazole (1.25/23.75 µg), nitrofurantoin (300 µg), imipenem (10 µg), norfloxacin (10 µg), ciprofloxacin (5 µg), nalidixic acid (30 µg), ceftriaxone (30 µg), vancomycin (30 µg) and clindamycin (2 µg). Antibiotic discs were bought from Hi-Media diagnostic laboratory, Mumbai, India. Minimum Inhibitory Concentration (MIC) was not done.

RESULTS

Out of 307 pediatric patients suspected of UTIs enrolled in this study, the majority 183 (59.60%) of cases were from the outpatient department (Figure 1).

Distribution of cases

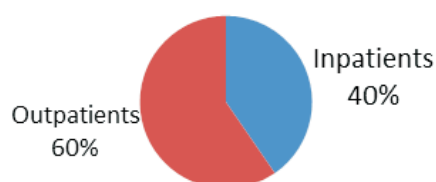


Figure 1. Total number of inpatients and outpatients taken for investigation

Of the 307 urine samples processed for routine microscopy and culture, 98 (31.92%) samples showed culture positive. All suspected UTIs were occurring between the ranges of 2 months to 13 years of age. The highest incidence was seen in the age group of 2-5 years with 97 cases (31.59%) followed by age group 0-1 year with 80 cases (26.05%) and 10-13 years with 70 cases (22.80%) which is shown in Figure 2.

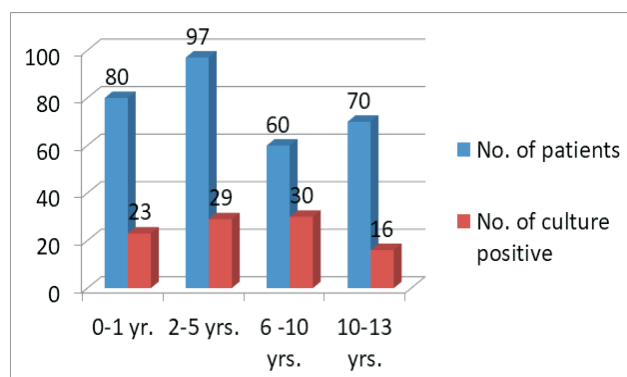


Figure 2. Total number of children (in groups) and culture positivity

Among 307 patients who had complaints related to UTI and were subjected to routine urine and culture, 166 (54.07%) were females and 141 (45.92%) were males with a male to female ratio 1:1.71 (Table 1).

Table 1. Sex-wise distribution of total cases

	Females	Males	Total	Male: Female (Ratio)
No. of cases	166	141	307	1:1.71
Percentage	54.07%	45.92%	100%	

Fever was the most common presenting clinical symptom accounting for 63.51% of patients followed by nausea/vomiting (24.42%), increased frequency of micturition (23.45%), dysuria (22.14%), abdominal pain (19.54%), and headache (9.44%) (Table 2).

Table 2. Clinical manifestations of UTIs

Symptoms	Total	Percentage
Fever	195	63.51%
Headache	29	9.44%
Nausea/ vomiting	75	24.42%
Pain abdomen	60	19.54%
Frequency of urine	72	23.45%
Dysuria	68	22.14%
Myalgia	12	3.9%
Back pain	15	4.88%

Urine analysis was done in all suspected cases of UTI (164; 53.42%). Among them, 64 had WBC >10/hpf, followed by 104 which had WBC between 6-10/hpf. Only 39 (12.70%) had WBC 5 or less. Among all urine analyses, 162 (52.76%) samples revealed RBCs in the urine. In terms of urine culture, 98 (31.92%) subjects had positive urine culture (Table 3).

Table 3. Result of urine analysis and urine culture

Urine RME	Number (%)
Urine WBC	
WBC < 5 HPF	39 (12.70%)
WBC 6- 10 HPF	104 (33.87%)
WBC > 10 HPF	164 (53.42%)
Urine RBC	
Present	162 (52.76%)
Absent	145 (47.23%)
Urine epithelial cells	
Present	184 (59.93%)
Absent	123 (40.06%)
Urine culture	
Positive	98 (31.92%)
Negative	209 (68.07%)

Out of 307 cases, 98 cases showed significant bacterial growth. *E. coli* was the commonest uropathogens isolated in 42 pediatric patients with a percentage of 42.85% followed by *Klebsiella* species 22 (22.44%), Coagulase-negative

staphylococci 11 (11.24%), *Staphylococcus aureus* 9 (9.18%), Non-fermenting GNB 6 (6.12%), *Citrobacter* species 4 (4.08%), *Pseudomonas* species 2 (2.04) and *Enterococcus* species 2 (2.04%) as shown in Figure 3.

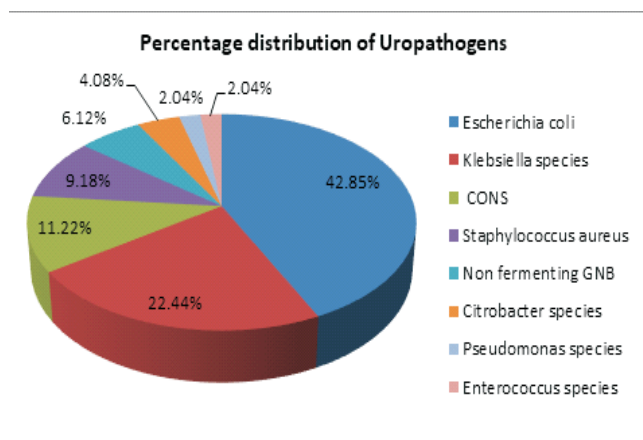


Figure 3. Different bacteria isolated from UTI cases of pediatric patients

All the isolated Gram-negative organisms showed a high degree of sensitivity towards Imipenem. Among 76 Gram negative bacteria, *E. coli* showed 90.5% and 88.1% sensitivity to imipenem and amikacin respectively. While it showed less sensitivity to norfloxacin. i.e., 26.2% and least sensitive to ceftriaxone, i.e., 19.1%. *Klebsiella* species have showed 81.8% sensitivity to imipenem while less sensitivity (22.7%) to ceftriaxone (Table 4).

Table 4. Antibiotic sensitivity of common Gram-negative bacilli

Antibiotic	<i>E. coli</i> (N=42)	<i>Klebsiella</i> species (N=22)	<i>Citrobacter</i> species (N=04)	<i>Pseudomonas</i> species (N=2)	Non-fermenting GNB (N=06)
Amikacin	37 (88.1%)	18 (81.8%)	03 (75%)	01 (50%)	05 (83.3%)
Gentamicin	26 (61.9%)	16 (72.7%)	04 (100%)	01 (50%)	03 (50%)
Cotrimoxazole	19 (45.2%)	08 (36.4%)	03 (75%)	02 (100%)	03 (50%)
Nitrofurantoin	35 (83.3%)	14 (63.6%)	02 (50%)	01 (50%)	03 (50%)
Imipenem	38 (90.5%)	18 (81.8%)	04 (100%)	01 (50%)	05 (83.3%)
Norfloxacin	11 (26.2%)	13 (59.1%)	02 (50%)	01 (50%)	02 (33.3%)
Nalidixic acid	14 (33.3%)	09 (40.9%)	02 (50%)	02 (100%)	02 (33.3%)
Ceftriaxone	08 (19.1%)	05 (22.7%)	01 (25%)	03 (100%)	06 (00%)
Ciprofloxacin	32 (76.2%)	14 (63.6%)	02 (50%)	01 (50%)	03 (50%)

The Gram-positive cocci were found to be of the sensitive variedly with high degree of sensitivity to amikacin, nitrofurantoin and followed by gentamicin and cotrimoxazole (Table 5).

Table 5. Antibiotic sensitivity patterns of Gram-positive cocci isolated

Antibiotic	Coagulase negative staphylococci N=11	<i>Staphylococcus aureus</i> N=09	<i>Enterococcus</i> species N=02
Amikacin	08 (72.72%)	09 (100%)	02 (100%)
Gentamicin	07 (63.6%)	09 (100%)	01 (50%)
Cotrimoxazole	08 (72.7%)	07 (77.8%)	01 (50%)
Nitrofurantoin	08 (72.7%)	09 (100%)	02 (100%)
Vancomycin	05 (45.5%)	08 (88.9%)	02 (100%)
Clindamycin	05 (45.5%)	09 (100%)	01 (50%)
Ciprofloxacin	03 (27.3%)	06 (66.7%)	02 (100%)
Norfloxacin	06 (54.5%)	06 (66.7%)	02 (100%)

DISCUSSION

Urinary tract infection (UTI) is one of the commonest bacterial infections seen by Pediatricians in children. However, diagnosis remains a difficult task probably because its presentation is non-specific and similar to other common illnesses. Therefore, it is often missed in the diagnosis of children. In our study, the prevalence rate of isolation of uropathogens was 31.92% out of total of 307 urine samples from pediatric patients. Khadka et al¹¹ studies showed similar results with a prevalence of 28.04%, whereas studies by Rai GK, et al¹² and Chhetri PK, et al¹³ showed a slightly lower rate of isolation as 25.7% and 21.8% respectively.

Several studies in pediatric reported female predominance, with a variable ratio. This can be easily attributed due to short urethra in females. In this study too, UTI is seen more frequently in girls (54.07%) than in boys (45.92%) constituting for male:female ratio as 1:1.71 which is similar to the study done by Shrestha SP, et al.¹⁴ The other probable reasons behind the low percentage of UTI among males, besides longer urethra, could be the better health care preferences to males in the Nepalese society. UTI was more common in the age group of 2-5 years with 97 cases (31.59%) which is consistent with the findings of other studies by Singh SD, et al¹⁵ and Jitendranath A, et al¹⁶ also showed a common age for UTI was between two to five years. In contrast, a study by Umesh et al¹⁷ reported the majority of the patients belonged to age groups 6-10 years.

There was no consistent symptom common to all patients with UTI other than fever. In the present study, among all these children, 63.51% presented with febrile UTI. Dysuria and vomiting were the predominant symptoms. A study by Islam MN, et al¹⁸ also indicates a high association of these symptoms and urinary tract infection. These findings indicate that clinical presentation plays a very important role in diagnosing UTI. Although clinical presentations are very strong enough, urine culture and sensitivity are essential to diagnose UTI. Among

all urine analyses 87.3% had significant pyuria. The above-mentioned result correlated with the studies done by Singh SD, et al¹⁵ and Islam MN, et al¹⁸ which reported the incidence of significant pyuria in 95.8% and 91% of total cases respectively.

In keeping with other studies, among those who showed positive for bacteriuria, Gram-negative organisms accounted for over 77% of the isolates with *E. coli* predominating.^{14,15} *E. coli* and *Klebsiella* species form the bulk of organisms isolated and constitute 65.30% of all cases. This was less than that of findings reported by Rai GK, et al¹² (93%). In this study, isolation of Gram-positive cocci was 22.44% among which CONS was the most common isolates followed by *Staphylococcus aureus* and *Enterococcus* species, which was somewhere near to that of the findings by Gupta S, et al (21.1%).¹⁹ *E. coli* was the principal isolates showing high susceptibility to imipenem (90.5%), amikacin (88.1%) followed by nitrofurantoin (83.3%) and ciprofloxacin (76.2%). Rodriguez Arlene²⁰ reported imipenem as the most sensitive drug which is similar to the findings of the present study.

Similarly, in our present study, *Klebsiella* species were found to be sensitive to amikacin and imipenem in (81.8%) cases whereas *Citrobacter* species was sensitive to gentamicin 100% and imipenem to 100%. A study by Rai GK, et al¹² showed that *Klebsiella* spp. most sensitive to ofloxacin followed by ceftriaxone and least to amikacin and nitrofurantoin. These findings are not consistent with our present study. Out of 76 Gram-negative isolates, the four highest observed resistances were for ceftriaxone 69.73%, norfloxacin 61.84%, nalidixic acid 61.82%, and cotrimoxazole 53.94%. Discussing drug sensitivity and prevalence of Gram-positive isolates will be way too early due to a smaller number of these isolates.

LIMITATIONS OF THE STUDY

As this study is carried out among pediatric age group patients visiting our hospital, hence, this study may not reflect overall scenario of UTIs among pediatric population of this region. The study carried out among general population yields a better and reliable prevalence rate.

CONCLUSION

Culture positivity among urine specimens was found to be 31.92%. UTI was commonly seen in age groups of 2-5 years of pediatric patients. Female children are affected more than male. *Escherichia coli* were the most frequently isolated uropathogens followed by *Klebsiella species*. Among Gram positive uropathogens, CONS were most common isolates. Imipenem and amikacin were most effective drugs showing

considerably high sensitivity among Gram negative isolates, whereas amikacin, cotrimoxazole, nitrofurantoin and vancomycin showed higher sensitivity among Gram positive isolates.

RECOMMENDATION

This type of study should be done periodically to assess the pattern of microorganisms causing UTI and their susceptibility, which will guide in the selection of antibiotics for empirical treatment. Moreover, the data would also help authorities to formulate antibiotic prescription policies, at least for a region. Present study along with previous studies indicates the need for periodic monitoring of organisms with antibiotic sensitivity of the same.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interests.

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