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Bacteriological Profile of UTI and their Antimicrobial Resistance Pattern in Pediatric Age group patients at RMCH

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ABSTRACT: ***Background:*** Urinary tract infections (UTIs) are common pediatric infections and contribute to high morbidity. Gram negative bacilli predominating the infections. At present, the antimicrobial resistance has quadrupled worldwide and poses a serious threat to the treatment of patients. ***Objectives:*** The present study was designed to find out the bacteriological profile of urinary tract infection and their antibiotic resistance pattern in children. ***Material and Methods:*** A cross-sectional study was done in the department of Microbiology, Rajshahi Medical College from July to December 2024. Midstream urine samples were collected from clinically suspected cases of UTI in the age group of 0 to 18 years from various indoor and outdoor patients attending at Rajshahi Medical College hospital. ***Results:*** Out of 984 cases, 195 (19.8%) were culture positives, where females were 110(56.4%) and male were 85(43.6%). Most common isolate identified was Escherichia coli 113(57.9%), followed by Klebsiella spp.31(15.9%), Pseudomonas aeruginosa 18(9.2%) and Enterococci spp. 19(9.8%). Gram negative organisms show highest resistance to cefixime, ceftriaxone, cefuroxime, azithromycin, amoxiclav and ciprofloxacin and highest sensitivity to Colistin, nitrofurantoin and imipenem. Gram positive bacteria were highly resistant against cefixime, Cotrimoxazole, ceftriaxone, cefuroxime, azithromycin, amoxiclav and ciprofloxacin. ***Conclusion:*** This study indicates that gram-negative bacteria, particularly E. coli are the commonest isolated organism, and all isolates show resistance to commonly used antimicrobial agents. Urinary tract infections as well as the significant growth and spread of resistant bacterial pathogens in children should be monitored regularly.

Keywords: Paediatric Age Group, Urinary Tract Infection, Uropathogens, Antimicrobial Resistance.

Article at a glance:
Study Purpose*: To contribute to existing knowledge or propose new ideas.*
Key findings: *Among gram-negative bacteria, predominant gram-positive bacteria were isolated in children Escherichia Coli 113 (57.9%).*
Newer findings: *In this study, Gram negative bacteria showed higher resistance to commonly used antibiotics from previous study.*
Abbreviations: *UTI: Urinary Tract Infection.*

INTRODUCTION

Urinary Tract Infection (UTI) is a common disease in pediatric practice. Early diagnosis and prompt treatment can reduce the risk of renal scarring and its long-term sequelae such as hypertension and end stage renal failure.[1] The estimated incidence of UTI is 3% in girls and 1% in boys during the first ten years of life. After the initial UTI, the prevalence of UTI during the first 6-12 months is upto 30% in infants and children. The risk of having a UTI before the age of 14 years is approximately 3-10% in girls and 1-3% in boys. The prevalence of UTI among paediatric patients worldwide was 2-20%.[2] The clinical and laboratory diagnosis of UTI in children poses some difficulties as presentation varies among different age groups. Diagnosis is often missed in infants and young children because urinary symptoms are minimal and often nonspecific. Collection of appropriate samples of urine for investigations is also often difficult in this age group. The presence of significant bacteriuria in urine culture is essential to diagnose UTI and patients then must be evaluated for

anomalies of the urinary tract to prevent recurrence and complications.[3] Most common cause of UTI in children is *Escherichia coli* followed by other organisms like *Klebsiella* species, *Enterococcus* species, Pseudomonas species, *Staphylococcus aureus*, *Enterobacter* species, *Proteus* species and *Coagulase negative staphylococcus*.[4] In suspected cases of UTI, empirical treatment with antibiotics is started after collecting urine samples for culture and antimicrobial sensitivity. The selection of antibiotics should be based on the commonly prevalent urinary pathogens and their antibiotic sensitivity in the region. This is important because injudicious use of antibiotics has led to bacterial resistance to antibiotics. Depending upon the extent of use of antibiotics, the antibiogram pattern is different in different countries and in different regions of the same country.[5] This study is therefore undertaken to study the current scenario of UTI in children in Rajshahi region. The aim of the study is clinical profile, bacteriology and antibiotic sensitivity pattern of bacteria causing UTI in children attending Rajshahi medical college hospital.

MATERIAL AND METHODS

This cross-sectional study was carried out in the Microbiology department of Rajshahi medical college over a period from July to December 2024. Patients from the age of 0 upto 18 years presenting with urinary symptoms (dysuria, urgency, frequency, incontinence, hematuria and suprapubic pain) and those with fever without a focus were enrolled in the study. Wet mount microscopy of urine was done to detect pyuria, hematuria and presence of any other abnormal cells. Clean catch midstream urine samples were collected in older children while transurethral bladder catheterization was done to obtain urine samples in infants and younger children. Urine culture was done on Mac conkey agar, Nutrient agar and Hichrome UTI agar with a calibrated loop. A growth of greater than 10 colony forming units/ml of a single organism for midstream urine samples and greater than 5x10 colony forming units/ml for samples obtained by catheterization was considered significant bacteriuria and UTI. The antibiotic sensitivity test was done on Mueller-Hinton agar by Kirby-Bauer disc diffusion test.[6]

RESULTS

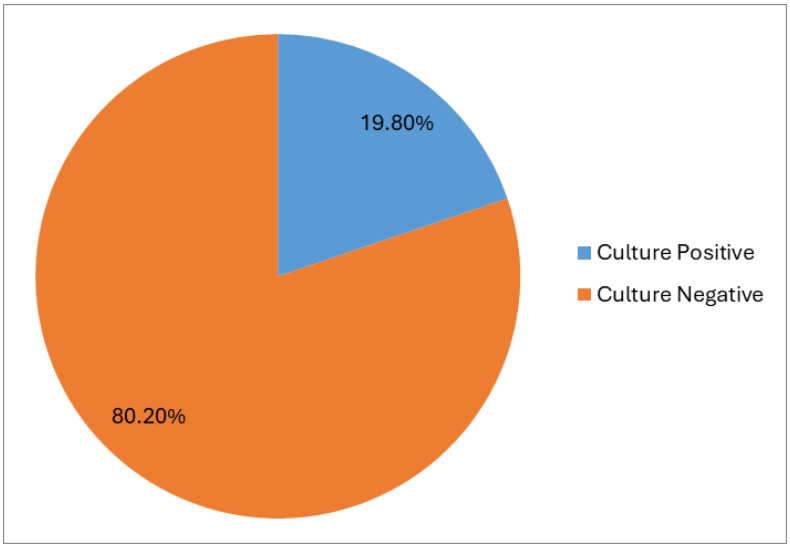

Figure 1: Frequency of Culture Positive and Negative Cases (N=984)

Figure 1 shows culture positivity of isolated organisms. Out of 984 samples, 195(19.80%) samples were culture positive while 789(80.20%) samples were culture negative.

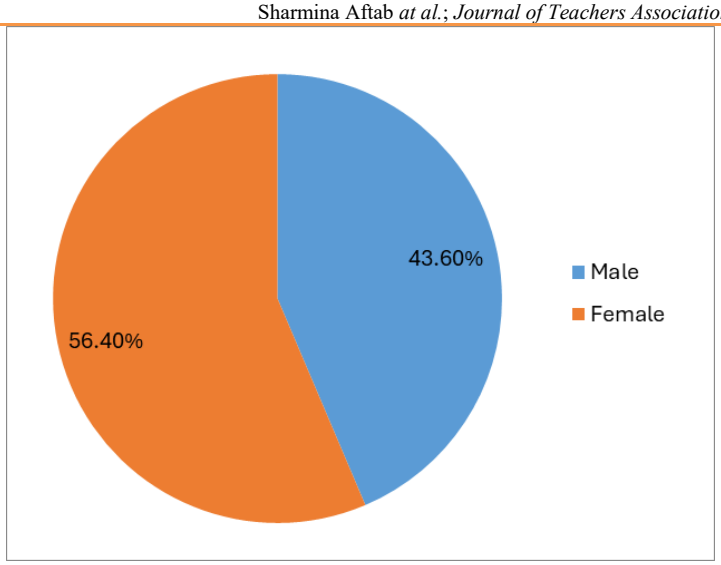

Figure 2: Sex Distribution of Culture Positive Cases (N=195).

Figure 2 shows sex distribution of culture positive cases. Males were 43.6% and females were 56.4% giving a male and female ratio 1:1.3.

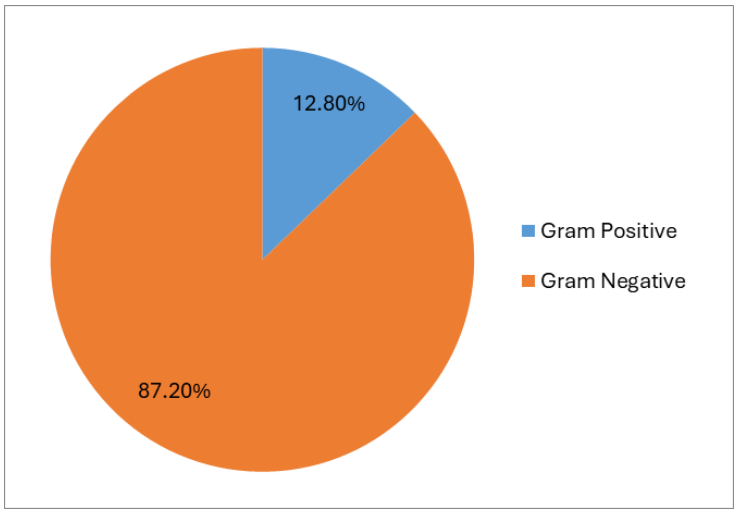

Figure 3: Frequency of Gram Positive and Gram-Negative Bacteria (N=195)

Figure 3 shows the distribution of gram-positive and gram-negative isolate among culture positive cases. Among the total 195 isolates, Gram negative bacteria were 170(87.20%) and gram-positive bacteria were 25(12.80%).

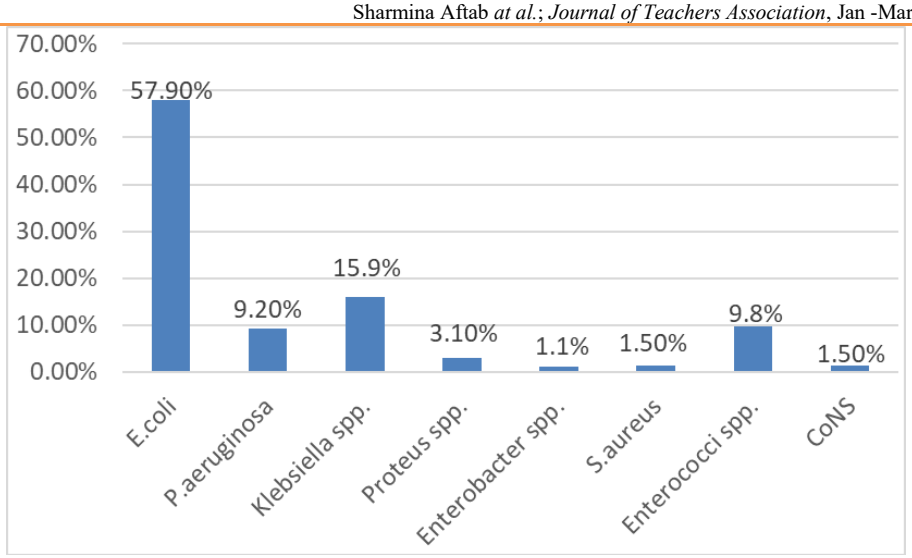

Figure 4: Bacteria Isolated from Culture Positive Cases (N=195).

Figure 4 shows the identified species of bacteria isolated from culture positive cases. Out of 984 samples, a total of 195 bacteria were identified. *E. coli* was 113(57.9%) followed by *Klebsiella spp.* 31 (15.9%), *Enterococci spp.* 19(9.8%), *P. aeruginosa* 18(9.2%) and *proteus* spp. 6(3.1%).

Table 1: Antimicrobial Resistance Pattern of Gram-Negative Bacteria

Antimicrobial agents	***E. coli* (N=113)**	***Klebsiella spp.* (N=31)**	***Pseudomonas aeruginosa* (N=18)**	***Proteus spp.* (N=06)**	***Enterobacter spp.* (N=2)**
Imipenem	19(16.8%)	06(19.4%)	05(27.8%)	01(16.7%)	00
Azithromycin	93(82.3%)	27(87.1%)	17(94.4%)	05(83.3%)	02(100%)
Ciprofloxacin	55(48.7%)	16(51.6%)	09(50%)	03(50%)	01(50%)
Ceftriaxone	92(81.4%)	29(93.5%)	15(83.3%)	05(83.3%)	02(100%)
Cefepime	52(46.1%)	19(61.3%)	16(88.8%)	03(50%)	01(50%)
Piperacillin/tazobactam	7(32.7%)	09(29.1%)	06(33.3%)	02(33.3%)	01(50%)
Cefixime	95(84.1%)	30(96.8%)	18(100%)	05(83.3%)	02(100%)
Aztreonam	47(41.6%)	14(45.2%)	10(55.6%)	04(66.7%)	01(50%)
Amikacin	57(50.4%)	15(48.4%)	08(44.4%)	03(50%)	01(50%)
Cefuroxime	98(86.7%)	30(96.8%)	18(100%)	06(100%)	18(100%)
Colistin	07(6.2%)	02(6.5%)	02(11.1%)	00	00
Levofloxacin	33(29.2%)	07(22.6%)	06(33.3%)	02(33.3%)	01(50%)
Amoxiclav	67(59.3%)	17(54.8%)	11(61.1%)	04(66.7%)	01(50%)
Nitrofurantoin	13(11.5%)	04(12.9%)	03(16.6%)	01(16.7%)	00

Table 1 shows the antimicrobial resistance pattern among gram negative bacteria. All the gram-negative bacteria were highly resistant against cefixime, ceftriaxone, cefuroxime, azithromycin, amoxiclav and ciprofloxacin. Colistin, nitrofurantoin, imipenem and levofloxacin were showed lower resistance against gram negative bacteria.

Table 2: Antimicrobial Resistance Pattern of Gram-Positive Bacteria

Antimicrobial agents	***Enterococci spp.* (N=19)**	***CoNS* (N=03)**	***S. aureus* (N=03)**
Imipenem	04(21.1%)	01(33.3%)	01(33.3%)
Azithromycin	16(84.2%)	03(100%)	03(100%)
Ciprofloxacin	09(47.4%)	01(33.3%)	16(66.7%)
Ceftriaxone	15(78.9%)	02(66.7%)	02(66.7%)
Vancomycin	00	00	00

Linezolid	02(10.5%)	00	00
Nitrofurantoin	03(15.7%)	00	00
Amoxiclav	12(63.2%)	01(33.3%)	02(66.7%)
Amikacin	10(52.6%)	01(33.3%)	02(66.7%)
Cefuroxime	18(94.7%)	02(66.7%)	03(100%)
Cefixime	17(89.5%)	02(66.7%)	03(100%)
Levofloxacin	05(26.3%)	01(33.3%)	01(33.3%)
Cotrimoxazole	15(78.9%)	02(66.7%)	03(100%)

Table 2 shows the antimicrobial resistance pattern among gram positive bacteria. Gram positive bacteria were highly resistant against cefixime, cotrimoxazole, ceftriaxone, cefuroxime, azithromycin, amoxiclav and ciprofloxacin. Vancomycin, linezolid, nitrofurantoin and imipenem were showed lower resistance against gram positive bacteria.

DISCUSSION

Out of 984 urine samples obtained in the Microbiology laboratory from RMCH, Rajshahi for aerobic culture and sensitivity, 19.8% yielded positive culture whereas 80.2% yielded no growth. This study was nearly similar with the study of Rafi *et al.* Nag *et al.* and Venugopal *et al.*, but dissimilar with the study of Sharmin *et al*. and Koli *et al.*[7-11] Figure 2 shows sex distribution of culture positive cases. Among them, 85 (46.6%) were male and 110 (56.4%) were female. Females are at increased risk due to a shorter urethra and its proximity to the anus which encourages contamination and ascent of fecal flora into the urinary tract. This study was nearly similar with the study of Sharmin *et al.*[10] and Patel *et al*.[3] but dissimilar with the study of Nazme *et al*. and Koli *et al.*[11, 12] Out of a total 984 samples, Gram negative bacteria were accounted for higher isolation rate (Gram-positive 12.8% and Gram-negative 87.2%) than gram positive bacteria. This study was nearly similar with the study of Nahar *et al.* and Arora *et al.* but nearly dissimilar with the study of Thaddanee *et al.* and Khandelwal *et al*.[13-16] The reason for this high occurrence of culture positivity may be due to the fact that most of the study population belonged to lower middle and lower socioeconomic group with poor knowledge about personal hygiene, poor sanitation system, overcrowding of patients in hospital, inadequate measures for prevention of the spread of resistant pathogens in hospital environment. Among gram negative bacteria, *E. coli* were the most frequent isolates 113(57.9%) .Study were similar with the study of Nazme *et al.* and Patel *et al.* but findings were dissimilar with Thaddanee *et al.* and Khandelwal *et al*.[3, 12, 15, 16] *E. coli* is a common cause of UTIs in children because it resides in the digestive tract and can easily migrate to the urethra and urinary tract, where it can multiply and cause infection and also due to their developing immune systems, frequent hand-to-mouth contact, and exposure to contaminated environments. Among gram positive bacteria, *Enterococci spp.* was the most common bacterial isolates 19(9.8%). This study was similar with the study of Nazme *et al.* and Patel *et al.* Study was dissimilar with the study of Islam *et al.* Arora et al.3, 12, 14, 17 The isolated gram-negative bacteria were highly resistant to cefixime, ceftriaxone, cefuroxime, azithromycin, amoxiclav and ciprofloxacin. Colistin, nitrofurantoin, imipenem and levofloxacin are effective against gram negative bacteria. This study was nearly similar with Nazme *et al.* and Islam *et al.*[12, 17] The isolated gram-positive bacteria were highly resistant to cefixime, Cotrimoxazole, ceftriaxone, cefuroxime, azithromycin, amoxiclav and ciprofloxacin. But relatively lower resistance was observed against vancomycin, nitrofurantoin, linezolid and imipenem. This study was nearly similar with Nazme *et al.* and Patel *et al.*[3, 12] These variations may be due to differences in local conditions, prevention protocols, antibiotic policy as well as duration of study, variation in host and immune status of the host.

Ethical approval: Ethical clearance for the study was taken from the Institutional Review Board and concerned authorities, Rajshahi Medical College & Hospital.

Conflict of interest: None declared.
Consent: Informed written consent was taken from each patient or patient's attendant.

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