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Research Article

Bacteriological Frequency and Antibiotic Susceptibility Patterns of Urinary Tract Infection in Children, Sirajganj Sadar

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Abstract

A retrospective study was carried out to determine the bacterial profiles of urinary tract infections (UTI) in children, as well as their antibiotic susceptibility patterns, among Bangladeshi children living in Sirajganj Sadar, Bangladesh, in 2022. Routine, culture, and sensitivity tests were performed on urine samples obtained at the laboratory. In this study, the antimicrobial susceptibility of bacterial isolates was determined using the Kirby-Bauer Disc Diffusion method, which was recommended by the Clinical and Laboratory Standard Institute (CLSI). Results: 59 (31.21%) of the 190 mid-stream urine samples taken from suspected cases of UTI from various hospitals and clinics were positive for pathogenic organisms. The positive growth rate between the sexes was nearly identical (Female: 55.9 % and Male: 44.1%). Escherichia coli were responsible for 86.4% of the bacterial isolates followed by Enterococcus faecalis (5.1%), Klebsiella pneumoniae (3.4%), Pseudomonas aeruginosa (3.4%), and Proteus mirabilis (3.4%). Amoxicillin, cefixime, cephradine, ceftriaxone, cefuroxime, ciprofloxacin, ceftazidime, cefepime, gentamycin, meropenem, nitrofurantoin, levofloxacin, and cotrimoxazole were used to test bacterial isolates from urine samples. It was discovered that children had high percentages of uropathogens that were multi-drug resistant.

Keywords: UTI, Bacterial profiles, Antibiotics Susceptibility, Children, Sirajganj Sadar.

1. Introduction

Urinary tract infection (UTI) is characterized by bacteriuria and urinary symptoms, as well as the presence of many organisms of a single species in the urine. Infections of the urinary tract are a common medical concern in children and a significant source of morbidity. The risk of UTI in children varies

according to their age and gender. UTI is more common in boys during the first year of life, but 3–5% of girls are also affected after that, rising to 10% by adolescence (Ahmed *et al.*, 2019). Although fungi and viruses can cause UTIs, bacteria are the most common cause, accounting for more than 95% of UTI cases (Bonadio *et al*., 2001).

Proteus mirabilis, E. faecalis, P. aeruginosa, K. pneumoniae, C. freundii, and *Staphylococcus spp* are responsible for at least 80.0% of UTIs in children (Watson *et al*., 1998). Antibiotics should be chosen based on patterns of antibiotic susceptibility. Different antibiotics must be evaluated regularly because antibiotic sensitivity patterns might change over short periods (Jones *et al*.,1982).

Antibiotic resistance among urinary pathogens, particularly *E. coli*, to frequently prescribed medications such as cotrimoxazole has become a worldwide problem (Manges *et al*., 2001). Antibiotics are widely used by medical professionals, leading to an increase in antibiotic resistance.

It is crucial to isolate the organisms that cause UTIs and determine their antibiotic susceptibility for optimal therapy (Gruneberg,1984).As a result, this research was carried out in Sirajganj Sadar, Bangladesh, to determine the organisms that cause UTIs and their sensitivity patterns.

2. Materials and Methods:

A retrospective study was performed among Bangladeshi children aged less than 12 years to determine the causal agents of urinary tract infections and their antibiotic susceptibility patterns. From December 2021 to March 2022, this was done in the Department of Microbiology at Khwaja Yunus Ali University.

The study included urine samples from children ranging in age from newborn to twelve years old. Following the standard bacteriological procedure, clean-catch midstream urine samples were collected into a wide-mouthed sterile container and inoculated on MacConkey and Chromogenic UTI agar (Biomaxima, Poland) using a calibrated platinum loop and incubated at 37^0 C overnight. Pure bacterial colonies with counts of > 10^5 CFU/ml or above were considered significant and identified using colony features and biochemical testing.

An antibiotic sensitivity test was performed by the disc diffusion method (Kirby-Bauer's technique) using commercially available discs (Biomaxima, Poland), namely amoxicillin (30µg), azithromycin (30µg), cefixime (5µg), cephradine (30µg), ceftriaxone (30µg), cefuroxime (30µg), ciprofloxacin (5µg), ceftazidime (30µg), cefepime (30µg), gentamycin (10µg), meropenem (10µg), nitrofurantoin (300µg), levofloxacin (5µg), cotrimoxazole (1.25/23.75 µg), and the results were recorded following the instructions of the manufacturer.

3. Results and Discussion

One hundred ninety urine samples were obtained from children of all ages and sexes suspected of having UTIs. Only 31.2% of the 190 urine samples tested positive for urinary tract infections (**Table 2**).

Table 1 shows the age and sex distribution of the children from whom urine samples were taken and the pattern of culture-positive models in various age groups and sexes.

Table-1: Age and sex distribution of children included in the study

Age group (yr)	Sex					
	Male		Female		Total	
	n	%	n	%	n	%
<1-5	9	75	3	25	12	20.4
6-10	12	36.4	21	63.6	33	55.9
>11	4	28.6	10	71.4	14	23.7
Total	25	42.4	34	57.6	59	100

Note: n= Number. % = Percentage

The majority of the instances involved children under the age of ten. Male children provided many more samples than female children. 59 (31.21%) of the 190 samples tested positive for harmful pathogens (**Table-2**).

Table-2: Bacterial growth positive rate in urine samples collected in children

Culture results	Samples (n)	%age (%)
Positive	59	31.2
Negative	131	68.8
Total	**190**	**100.0**

There was no contaminated or mixed growth in this investigation. In the two genders, the positive growth rate was 11.8 % higher (Female: 55.9% and Male: 44.1%). The majority of growth positive instances were in the under ten-year-old age group.

Figure 1 depicts the isolated microorganisms, showing that Gram-negative bacteria were more common (86.4%) than Gram-positive bacteria (13.6%).

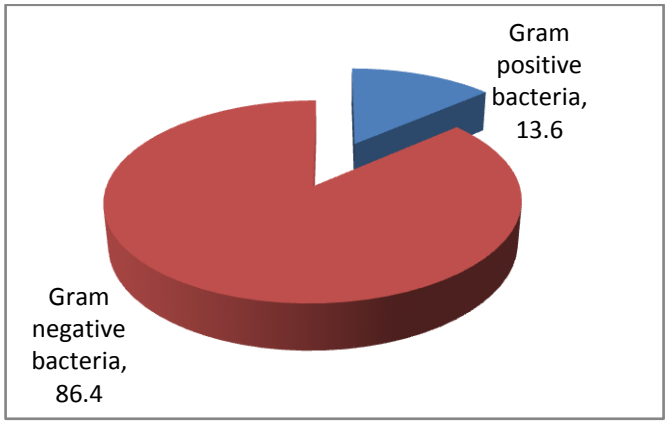

Fig 1: The total %age of microorganisms isolated from positive urine culture.

The frequency of isolated microorganisms in which *E. coli* was the most common pathogen was 51(86.4%), followed by *E. faecalis* 3(5.1%), *K. pneumoniae* 2(3.4%), *P. aeruginosa* 2(3.4%), and *P. mirabilis* 1(1.7%). The types of organisms isolated are shown in **Table 3.**

Table-3: Pattern of bacterial isolated from urine samples.

Bacterial isolates	Isolates number	Frequency (%)
Escherichia coli	51	86.4
Others:		
Enterococcus faecalis	3	5.1
Klebsiella pneumoniaee	2	3.4
Pseudomonas aeruginosa	2	3.4
Proteus mirabilis	1	1.7
Total	**59**	**100.0**

E. coli was found to be highly sensitive to meropenem (94.1%) and gentamycin (54.9%) and resistant to the majority of commonly used antibiotics, including cefixime (80.4%), cephradine (60.8%), ceftriaxone (66.7%), cefuroxime (68.6%), ceftazidime (86.3%), and cotrimoxazole (56.9%),

and intermediately sensitive to ciprofloxacin (41.2%) (**Fig. 2**).

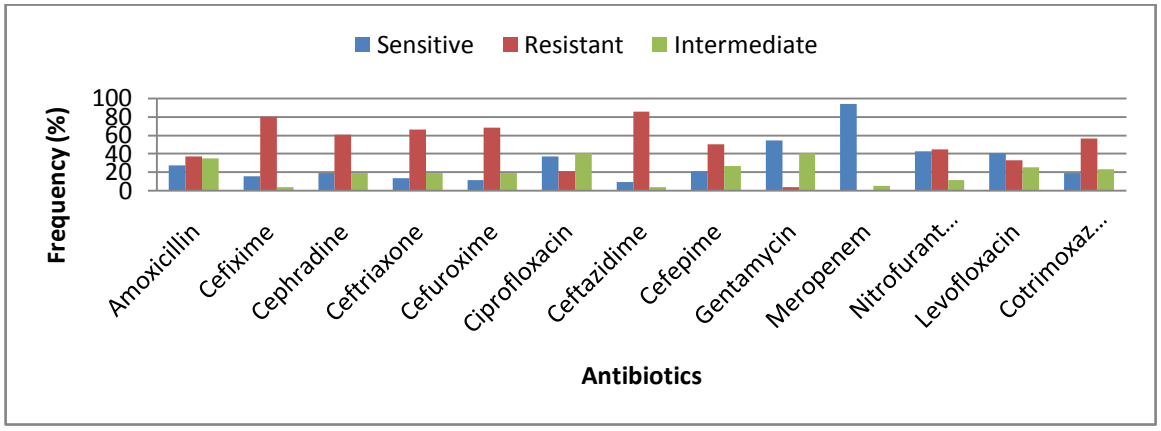

Fig. 2: Antibiotics susceptibility parameters of *E.coli*

Other bacterial isolates, such as *E. faecalis* (5.1%), *K. pneumoniae* (3.4%), *P. mirabilis* (1.7%), and *P. aerugenosa* (3.4%), were found to be the most sensitive to meropenem (100%). In comparison, the rest of the bacterial patterns showed resistance to 100% cefixime, 87.5% cephradine, 87.5% ceftriaxone, 75% cefuroxime, and 100% ceftriaxone (**Fig.3**).

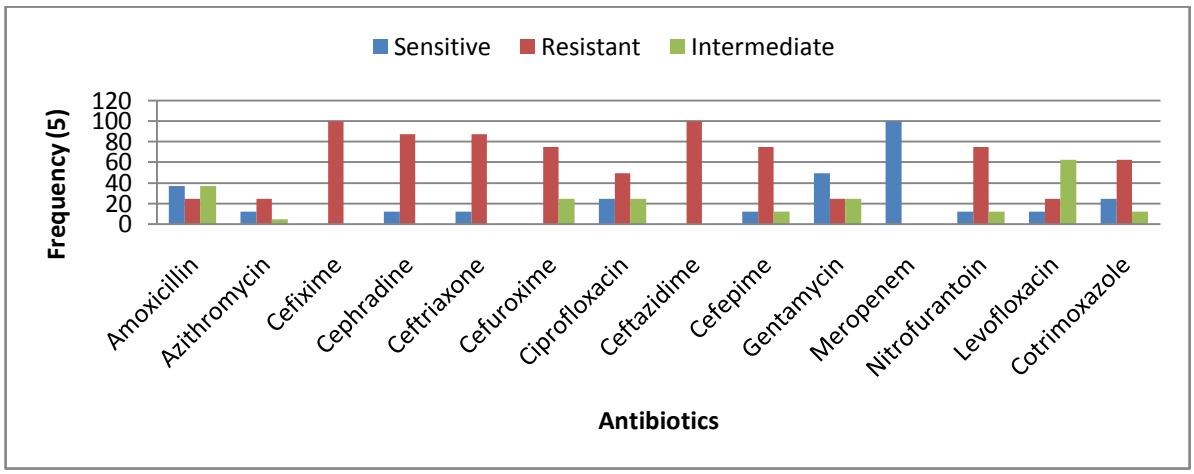

Fig. 3: Antibiotics susceptibility parameters of others bacterial isolates.

4. Discussion:

Urinary tract infections in children are a significant source of morbidity. It is noted that the risk of renal damage from UTI is most significant in children younger than five years; thus, early diagnosis and prompt treatment are essential (Mohammed *et al*., 2008). Freedman A (2005), found that urinary tract infection is relatively common in children, accounting for many pediatric hospital admissions.

Most growth-positive cases were in the age group of fewer than ten years. It agreed with a previous report from Iran (Moderres*et al*.,1997). It could be because younger children are not well toilet trained. The likelihood of ascending infection with faecal flora is higher at age ten. In this study,76.3% of the UTIs in children were constituted by those aged fewer than ten years (Ibrahim *et al*. (2002). A recent study on prevalence rates of UTIs in children aged 0–19 years of age found UTIs almost four times less frequent in female children aged > 12 months than in children up to 12 months of age (Shaikh *et al*.,2008).

In this study, UTI was more prevalent among female children. The male-to-female ratio was 1:1.3. Other similar studies have reported a male-female ratio of 1:1.9 (Bouskraoui*et al*., 2010) and 1:2 (Malla*et al*., 2008). The tiny female urethra explains this. The most common bacterial pathogen was *E. coli* (86.4%), isolated in this investigation. It was consistent with

previous research in which E. coli was detected in 61.0 to 72.8% of cases (Spahiu *et al*., 2010 and Abedin *et al*., 2020). However, Yüksel and Chakupurakal*et al*. found a very high percentage of E. coli (87.0%) (Chakupurakal *et al*., 2010) and (92.0%) (Abedin *et al*.,2021.). In this investigation, *K. pneumoniae* was isolated in 2 (3.4%) cases. Akram *et al*. conducted a study in Aligarh, India, and found 22.0% of *Klebsiella* species, which was higher than our study (Abedin *et al*., 2021.)

In this analysis, *Proteus mirabilis* was only one isolate out of 1.7% of the total isolates, which was extremely minimal in all these bacterial pathogens. Various studies have shown increased *Proteus* species in urine from 5.8% to 12.4% (Bouskraoui*et al*., 2010; Spahiu*et al*., 2010 and Abedin, *et al*., 2020). In our research, *P. aeruginosa* was isolated in only two cases (3.4%). Outpatients and Pseudomonas are usually a result of nosocomial infection.

In our investigation, the majority of isolated organisms were extremely antibiotic sensitive. *E. coli* shows sensitivity to meropenem at 94.1%, gentamycin (54.9%), and nitrofurantoin at 43.1%. Ceftazidime was resistant in 86.3 percent of cases, Cefixime in 80.4%, and Cefuroxime in 68.6%.Those were similar to GK Rai (GK Rai *et al.*,2008). According to a study conducted in Turkey, high sensitivity to nitrofurantoin (97.8%) against *E. coli* was also reported (Yüksel*et al*., 2006), which did not agree with our findings.

Other bacterial isolates, namely *E. faecalis* (5.1%), *K. pneumoniae* (3.4%), *P. mir*abilis (1.7%), and *P. aeruginosa* (3.4%), were found to be most sensitive to meropenem (100%), and the rest of the bacterial patterns showed resistance at a rate of 100% cefixime, 87.5% cephradine, 87.5% ceftriaxone, 75% cefuroxime, 100% ceftazidime, 75% cefepime, 75% nitrofurantoin, and 62.5% cotrimoxazole (**Fig.3**).

5. Conclusion

According to the results, the most common bacterial isolate was E. coli. Gram-negative bacteria like *E. faecalis, K. pneumoniae, P. mirabilis,* and *P. aeruginous* showed an extremely high percentage of sensitivity to meropenem (100%) among selected antibiotics tested in the study. In contrast, other Gram-negative bacteria like *E. faecalis, K. pneumoniae, P. mirabilis,* and *P. aeruginous* showed an extremely high percentage of sensitivity to meropenem (100%) among selected antibiotics. As a result, when culture and sensitivity are unavailable, these antibiotics might be utilized for empirical treatment of urinary tract infection (UTI). The current study also found that most antimicrobial drugs examined had an effective resistance rate. Multiple medication resistance was also a common occurrence. According to the report, antimicrobial policies in the hospital and the community should be monitored and reviewed regularly.

3. Authors Contributions

Research concept- Mohammad Zakerin Abedin &Samim Mia, Research design- Abdullah Akhtar Ahmed, Supervision- Mohammad Zakerin Abedin, Materials-AyshaAkterLaboni, Sad Al Rezwan Rahman, Data collection-Samim Mia, Data analysis and Interpretation- SheulyAkter, Mohammad Abdullah Taher, Literature search- Mashiur Rahman, Md. Robin Khan & Mariam Rahman, Writing article- NayanKumer Kundu, Md. Iqbal Hossain,, Critical review-Pranab Karmaker&Md.BabulAktar, Article editing-Mohammad Zakerin Abedin & Mala Khan, Final approval- All authors

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7. Disclosure

The authors declare that they have no conflicts of interest in this study.

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