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Antimicrobial Sensitivity Pattern of Causative Agents of Urinary Tract Infection in Children Between 1 to 15 Years

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ABSTRACT

Introduction

The presence of actively multiplying organisms in the urinary tract implies urinary tract infection. Although it is infrequently associated with mortality, it is still an important cause of morbidity in the pediatric age group. Prompt diagnosis and early initiation of appropriate antibiotics in children reduce the morbidities associated with urinary tract infection. The objective of the study was to find out the causative agents of urinary tract infections and their antibiotic sensitivity pattern in pediatric patients.

Methods

This was a cross-sectional study conducted in the department of pediatrics over a period of 12 months and 80 patients fulfilled the inclusion criteria. The modes of presentation, laboratory investigation reports which included urine routine microscopy, bacterial isolates with colony count from the urine culture, and antibiotic sensitivity pattern were documented. Descriptive statistics were used for analysis of data.

Results

Escherichia coli was the most common organism isolated (55.9%). Most of them were sensitive to amikacin. The highest degree of resistance was noticed with ampicillin.

Conclusions

Aminoglycosides like amikacin can be considered as first-line drugs in urinary tract infection.

Keywords: antibiotics; children; urinary tract infections.

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INTRODUCTION

Urinary tract infection (UTI) is one of the most common bacterial infections seen in children. A syndrome involving dysuria, frequency, urgency, and sometimes suprapubic tenderness is UTI.[1] The prevalence of culture-positive Urinary tract infection is 57%.[2]

Risk factors for Urinary tract infection are female gender, uncircumcised male, vesico-ureteric reflux (VUR), Toilet training, voiding dysfunction, obstructive uropathy, ureteral instrumentation, wiping after defecation from back to front in girls, tight clothing, pinworm infestation, constipation, anatomical abnormalities, neurogenic bladder, sexual activity.[3]

Urinary tract infection is mainly due to the ascending infection from the urethra.[4]

Infection of the urinary tract is one of the most important risk factors in the development of renal failure or end stage renal disease (ESRD).[4] The common cause of Urinary tract infection in children is Escherichia coli followed by organisms like Klebsiella species, Acinetobacter species, Enterococcus species, Pseudomonas species, Staphylococcus aureus, Enterobacter species, Proteus species, coagulase-negative staphylococcus, Streptococcus, and Citrobacter species.[5]

Clinical features of Urinary tract infection include fever, increased frequency, burning micturition, anorexia, vomiting, abdominal pain, dysuria, malodorous urine, failure to thrive, headache, myalgia, diarrhoea, dribbling of urine.[6] .

Usually, 3-15% of the child develops renal parenchymal disease after the first episode of Urinary tract infection. So early diagnosis and starting of treatment are important in preventing renal scarring, resultant hypertension & progressive renal damage.[7]

Visualisation of causative bacterial pathogen by microscopy provides a rapid and reliable means for establishing a diagnosis. Urine culture and sensitivity is considered the gold standard for diagnosing urinary tract infections. Isolation of causative organism in urine culture is considered confirmatory with a colony count of >1,00,000 cfu/ml in midstream urine in females and >10,000 cfu/ml in males respectively. A growth of single species of bacterial pathogen with colony count of ≥100 cfu/ml from a sample obtained by urinary catheterization or any growth of bacterial pathogens in a sample collected by suprapubic aspiration constitutes significant bacteriuria[7, 8, 9, 10]

Over the years there has been an emerging trend of resistance to antibiotics which are used as an antibacterial agent. It is important to know the type of uropathogens in the locality and their resistance pattern to commonly used antimicrobials. This study will therefore give us an insight into the various pathogens that are the cause of Urinary tract infection and evaluating their antibiotic susceptibility.

METHODS

This is a hospital based Cross-sectional descriptive Study conducted at Nobel medical college & Teaching hospital, Biratnagar from October 2021- September 2022 for a period of 1 year on 80 children who includes all patients of age group 1-15yrs with a history of any of two features fever ,pain abdomen ,dysuria/ increased frequency, smelly urine, nausea/ vomiting, loose stool , decreased appetite, irritability and failure to thrive and with WBC count more than 5/hpf in centrifuged freshly voided urine. Children who have already received antibiotics prior to the hospital visit

and who are immune-compromised were excluded from the study.

Sample size calculation

Considering the prevalence of Urinary tract infection in children between 1-15 years as 57%.[2] the sample size will be 73 patients as per formula, but we have taken sample size as 80:

$$\text{Sample size (n)} = \frac{Z^2\ p\ X\ q}{l^2}$$

$$\text{i.e., n} = \frac{1.96\ X1.96\ X\ 0.57\ X\ 0.43}{0.114\ X\ 0.114} = 72.45$$

Institute Ethics Committee permission was also sought for conducting the study from the Institutional Review Committee of Nobel Medical College and Teaching Hospital. Urine samples were obtained under strict aseptic precautions for urine analysis in wide mouthed container. Urine culture was sent if the WBC count of more than 5/hpf in centrifuged freshly voided urine was observed.

The results were divided into two groups-culture-proven UTI and the sterile culture groups. The clinical profile of the patients of both groups was studied. The initiated therapy by the treating physician was either altered or continued after reviewing the antibiotic sensitivity pattern in the culture-proven UTI cases.

After collecting, the data were verified and coded accordingly and entered in Microsoft excel 2007 and converted into statistical package for social science (SPSS v.20) for statistical analysis.

For the descriptive presentation, frequency and percentage (%) were calculated, and also the graphical and tabular presentation was made.

RESULTS

This cross-sectional hospital-based study was conducted in the Department of Paediatrics and Neonatology in Nobel Medical College Hospital, Biratnagar on 80 patients who fulfilled the inclusion criteria. Urine culture was positive in 42.5% of cases. Urinary tract infection was common among females (62%) with a male to female ratio of 1:1.63. Most common symptoms seen was fever (73.8%) followed by abdominal pain (57.5%). Escherichia coli was the most common organism isolated (55.9%), followed by Klebsiella (14.7%), Pseudomonas aeruginosa, and Enterococcus faecalis was isolated in 8.8%, Acinetobacter Spp in 5.9% and 2.9%. of isolates had Proteus Spp and Staphylococcus aureus each. Among the Aminoglycosides, Amikacin was found to have the highest sensitivity (88%) amongst most bacteria. Nitrofurantoin and Gentamycin had a sensitivity of 85.3% and 82.4% respectively. Favourable sensitivity was seen with Ciprofloxacin (73.5%), Piperacillin-tazobactam(67.6%) and ceftriaxone(50%). The highest degree of resistance was noticed with Ampicillin (97.1%), Cefotaxime (82.4%), cotrimoxazole(67.6%).

Table 1. Age and gender distribution.

	Age		
Gender	1-5 years	6-10 years	11-15 years
Male	21(60%)	9(25.3%)	5(14.2%)
Female	16(35.5%)	17(37.7)	12(26.6%)

Table 1 shows the age and sex distribution of patients with UTI. Total males in the age group of 1-5 years, 5-10 years, and 11-15 years were 21, 9, and 5respectively whereas females were 16, 17, and 12 respectively.

Table 2. Antibiotic Sensitivity Pattern.

ISOLAT-ED PATHO-GEN	Cefotaxime	ofloxacin	norfloxacin	nitrofurantoin	ciprofloxacin	amikacin	ampicillin	cotrimoxazole	Gentamycin	ceftriaxone	Piperacillin-tazobactum	cefixime	vancomycin
E.coli	6 (31.5%)	8 (42.1%)	8 (42.1%)	18 (94.7%)	14 (73.6%)	19 (100%)	1 (0.05%)	8 (42.1%)	18 (94.7%)	12 (63.1%)	10 (52.6%)	6 (31.5%)	ND
Klebsiella pneumonia	0 (0.00%)	4 (80%)	4 (80%)	5 (100%)	5 (100%)	5 (100%)	0 (0.00%)	1 (20%)	5 (100%)	3 (20%)	5 (100%)	3 (60%)	ND
Enterococcus fecalis	0 (0.00%)	2 (66.6%)	2 (66.6%)	2 (66.6%)	2 (66.6%)	1 (33.3%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	2 (66.6%)	0 (0.00%)	ND
Pseudomonas aureginosa	0 (0.00%)	1 (33.3%)	1 (33.3%)	0 (0.00%)	1 (33.3%)	3 (100%)	0 (0.00%)	0 (0.00%)	3 (100%)	0 (0.00%)	3 (100%)	0 (0.00%)	ND
Acinobacter	0 (0.00%)	1 (50%)	1 (50%)	2 (100%)	2 (100%)	1 (50%)	0 (0.00%)	0 (0.00%)	1 (50%)	0 (0.00%)	2 (100%)	0 (0.00%)	ND
proteus	0 (0.00%)	0 (0.00%)	0 (0.00%)	1 (100%)	1 (100%)	1 (100%)	1 (100%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	1 (100%)	ND
staphylococcus	0 (0.00%)	0 (0.00%)	0 (0.00%)	1 (100%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	1 (100%)	0 (0.00%)	0 (0.00%)	1 (100%)

Table 2 shows antibiotic sensitivity pattern by organism isolated. The maximum isolated organism E.coli was mostly sensitive to frequently used antimicrobials for UTI like Amikacin (100%), nitrofurantoin ceftriaxone (63.1%). But highly resistant to ampicillin (99.5%).

Table 3. Distribution of organisms

Isolated pathoen	Frequency	%
Acinobacter	2	5.9%
E.Coli	19	55.9%
Enterococcus faecalis	3	8.8%
Klebsiella pneumonia	5	14.7%
Proteusspp	1	2.9%
Pseudomonas aeruginosa	3	8.8%
Staphylococcus aureus	1	2.9%
Total	34	100%

DISCUSSION

In our study of the 80 children, UTI was more common in female children. Male: female ratio was 1:1.63. Other such studies also showed the male: female ratio of 1:1.7,[7] 1:1.8[4] and 1:2[2]. This can be attributed to the short urethra and close proximity to the anus in the female.

E. coli was the most common organism isolated (55.9%) in our study. This was in accordance with other studies in which E. coli was isolated in 61.0%,[1] 50%,[2] 67.5%,[4] and 62%.[7] However, some of the studies reported a very high percentage of 81.2%9 and 82.0%6 of E. coli in their study. This may be attributed to ascending infection caused by faecal organisms.

Klebsiella was isolated in 14.7% of cases in our study. A study done in Aligarh, India by Akram et al showed similar data (22.0%).[1] Similar finding was also noted by different authors in studies done in various parts of the world where Klebsiella was isolated in 16.66%,[2] 20%,[4] and 12%.[6]

In our study, most of the organisms isolated were highly sensitive to nitrofurantoin, amikacin, gentamicin, and ciprofloxacin. A study done in Nepal also reported the highest sensitivity of nitrofurantoin (97.8%) and amikacin (94.7%) against E. coli.[4]

In our study, only one case of Proteus and staphylococcus aureus (2.9%) was isolated and was 100% sensitive to vancomycin, ceftriaxone and nitrofurantoin, whereas 100% resistant to ampicillin, cefixime, and cefotaxime. This finding was comparable to the study done in India where Proteus was 100% sensitive to nitrofurantoin but staph aureus was 100% resistant to ceftriaxone[2]

LIMITATION

Hospital based study, so the actual antibiogram and sensitivity in the community level cannot be determined. Urine collection related issues. Delay in transportation of urine after collection might increase the chances of culture coming negative for organism.

CONCLUSION

From this study e can conclude that E. coli was the most common organism responsible for UTI in children and aminoglycosides were found to be most effective in treating UTI except for Enterococcus sps. It is very concerning to note that three or more antibiotics were found resistant to most of the isolates included in this report. Antibiotic resistance is becoming a major public health issue that threatens both the life of the hospitalized person and those with chronic illnesses and adds dramatically to the cost of health care. Therefore, formulating a strict antibiotic prescribing policy in our country is an important topic to be discussed by policymakers. In contrast, this study concludes that, relative to the other antibiotics tested, E. coli and other isolates were more susceptible to amikacin, so these may be the drugs of choice in our area for the treatment of UTIs.

Conflict of Interest: None

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