BACTERIAL PROFILE AND DRUG SUSCEPTIBILITY PATTERN OF URINARY TRACT INFECTION IN INFANTS AND CHILDREN

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ABSTRACT

BACKGROUND

The biggest concern over UTIs in children is that they can cause permanent kidney damage and scarring. Repeated scarring can lead to high blood pressure and reduced kidney function including kidney failure. Infants and young children seem to be at higher risk for this complication.

OBJECTIVES

The aim of this cross-sectional study was to identify bacterial agents and their antibiotic susceptibility pattern isolated from infants and children with UTI attending Paediatric OP in GEMS Medical College, Srikakulam.

METHODS

Nineteen infants (Below 1 yr.) with excessive cry and strain on micturition and eighty one children (Below 12 yrs.) with burning micturition (n=100) were investigated for urinary tract infection from January to March 2015 by standard microbiological techniques.

RESULTS

Infants and children were included in this study. Bacteriological screening of mid-stream urine specimens revealed that 66/100 (66%) had significant bacteriuria in these groups. The bacterial pathogens isolated were predominantly *E. coli* (46.9%) followed by *K. pneumoniae* (25.7%), coagulase-negative staphylococci (10.6%). Others found in small in number included *Pseudomonas aeruginosa* (6.06%), *P. mirabilis* (4.54%), *Enterococcus* spp. (4.54%) and non-Group A beta-haemolytic *Streptococcus* (1.54%). The gram positive and negative bacteria accounted 16.66% and 83.34% respectively. The susceptibility pattern for gram-negative bacteria showed 100% sensitive to meropenem, 96.2% to nitrofurantoin, 94.4% to amikacin, 87.01% to ampicillin plus tazobactam, 81.4% to gentamycin, 79% to ofloxacin, 72.2% to cotrimoxazole, 55.5% to cefotaxime, 11.11% to amoxiclav. Among the gram-positives, 100% of the isolates were sensitive to meropenem, 95.8% to vancomycin, 91.6% to linezolid, 87.5% are sensitive to norfloxacin and amikacin, 83.3% to ofloxacin, 79.1% to piperacillin plus tazobactam, 70.8% to chloramphenicol and nitrofurantoin, 33.3% to cefoperazone, 20.8% to amoxiclav. Multiple drug resistance (Resistance two or more drugs) was observed in 74% of the isolates.

CONCLUSION

Significant bacteriuria (100,000 CFU/mL of Urine) was observed in both infants and children. Periodic studies are recommended to confirm the findings of this study and also monitor any changes in the susceptibility patterns of uropathogens causing urinary tract infection in these groups.

KEYWORDS

UTI, Infants, Children, Drug Susceptibility.

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INTRODUCTION

In a Urinary Tract Infection (UTI), bacteria usually enter the urinary tract through the urethra. They may then travel up the urinary tract and infect the bladder (Cystitis) and the kidneys (Pyelonephritis). Most UTIs in children clear up quickly with proper antibiotic treatment.^[1]

Urinary Tract Infections (UTIs) in children may not cause obvious urinary symptoms. Symptoms of UTI in an infant or young child may include: Fever - This may be the only symptom in infants, irritability, lack of appetite, failure to gain weight or develop normally, foul-smelling urine, crying during urination, vomiting or diarrhoea.^[1,2]

Most Urinary Tract Infections (UTIs) in children are caused by bacteria that enter the urethra and travel up the urinary tract. Bacteria that normally live in the large intestine and are present in stool (Faeces) are the most common cause of infection. Sometimes bacteria traveling through the blood or lymph system to the urinary tract are the cause of kidney or bladder infections.^[1,3]

The ways that bacteria build up can occur include not properly wiping the bottom after a bowel movement, bacteria may get into the urethra and cause an UTI, constipation, not

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completely emptying the bladder. This can cause bacteria to build up in urine.^[1]

Problems with the structure or function of the urinary tract commonly contribute to UTIs in infants and young children. Problems that limit the body's ability to eliminate urine completely include:

A structural problem of the bladder that allows urine to flow backward to the kidneys (vesicoureteral reflux), an obstruction, such as a kidney stone that blocks, slows or disrupts the normal flow of urine through the urinary tract (Obstructions in the Urinary Tract), other abnormalities of the urinary tract.^[4,5]

The biggest concern over UTIs in children is that they can cause permanent kidney damage and scarring. Repeated scarring can lead to high blood pressure and reduced kidney function including kidney failure. Infants and young children seem to be at higher risk for this complication. The risk of irreversible kidney damage makes early medical evaluation and treatment of UTIs in infants and young children very important. Unfortunately, detecting UTIs in infants and young children can be difficult. Unlike symptoms in older children and adults, symptoms in the very young can be vague and inconsistent. Serious short-term complications of UTIs are unusual, but do occur. They include an abscess in the urinary tract, acute kidney failure and widespread infection (sepsis), which can be life-threatening.^[6,7]

The main aim of the study is to determine the prevalence of UTI as well as the effect of gender and age on its prevalence. The etiologic agents and their susceptibility pattern will also be determined.

MATERIALS AND METHODS

Midstream urine was collected from 100 clinically diagnosed cases of urinary tract infection who are attending to paediatric OP of GEMS Medical College, Ragolu, Srikakulam with symptoms of burning in micturition, strain in micturition and excessive cry during micturition.

Inclusion Criteria

Infants below 1 year and children below 12 years with symptoms of UTI.

Exclusion Criteria

Older children and adults with symptoms of UTI. Urinary tract abnormalities, post urethral valve, unstable bladder, etc. were also excluded.

Sample Collection

All the midstream urine samples were inoculated on Nutrient Agar, Blood Agar and MacConkey's Agar and incubated aerobically at 37°C for 18 hours and then examined. All organisms including gram positive and gram negative bacteria were subjected to a battery of tests as follows: Gram staining for morphology, hanging drop for motility, capsular staining using Congo red, for production of enzymes–Oxidase, Catalase, Nitrate reduction, Urease, for substrate utilization–Citrate utilization test, Malonate utilization, for metabolism of proteins and amino acids- Indole production, tests for specific breakdown products-Methyl red test, Voges-Proskauer (Acetoin production), tests for utilisation of carbohydrates of sugar media containing Glucose, Lactose, Xylose, Sucrose, Maltose, Mannitol.

Antibiotic sensitivity testing by Kirby–Bauer's disc diffusion method for the following drugs:

For Gram Positive Bacteria	For Gram Negative Bacteria
Vancomycin (10 µg)	-
Ofloxacin (10 µg)	-
Norfloxacin (30 µg)	Amikacin (30 µg)
Cotrimoxazole (23.75 µg)	Cotrimoxazole (23.75 µg)
Nitrofurantoin	Nitrofurantoin
Amikacin	Amikacin
Chloramphenicol	Gentamicin
Meropenem (10 µg)	Meropenem (10 µg)
Piperacillin plus tazobactam	Ampicillin plus tazobactam
Linezolid	
Cefoperazone (30µg)	Cefotaxime (30 µg)
Amoxiclav	Amoxiclav

RESULTS

Out of 100 kids with symptoms of UTI, 19 (19%) were infants (Below 1 yr.), 81 (81%) were children (Below 12 yrs.); 56 (56%) were boys and 44 (44%) were girls. Culture of mid-stream urine specimens revealed that 66/100 (66%) had significant bacteriuria in these groups (Table 1).

The gram positive and negative bacteria accounted 12% and 54% respectively. The bacterial pathogens isolated were predominantly *E. coli* 31 (46.9%) followed by *K. pneumoniae* 17 (25.7%), *Proteus* spp. 3 (4.54%), coagulase-negative staphylococci, *Pseudomonas aeruginosa* 4 (6.06%). Others found in small number included coagulase negative Staphylococci 7 (10.6%), Enterococci 3 (4.54%) and non-Group A-beta haemolytic *Streptococcus* 1 (1.54%) (Table 1).

The susceptibility pattern for gram-negative bacteria showed 100% sensitivity to meropenem, 96.2% to nitrofurantoin, 94.4% to amikacin, 87.01% to ampicillin plus tazobactam, 81.4% to gentamycin, 79% to ofloxacin, 72.2% to cotrimoxazole, 55.5% to cefotaxime, 11.11% to amoxiclav (Table 3).

Among the gram-positives 100% of the isolates were sensitive to meropenem, 91.6% are sensitive to norfloxacin and amikacin, 75% to vancomycin, 66.6% to piperacillin plus tazobactam, 50% to chloramphenicol, 41.66% to amoxiclav, 33.3% to cefoperazone, 25% to ofloxacin, 16.6% to nitrofurantoin (Table 2).

Multiple drug resistance (Resistance two or more drugs) was observed in 74% of the isolates.

Sl. No.	Organisms	No. of Cases	Percentage (%)
1	<i>Escherichia coli</i>	31	46.9%
2	<i>Klebsiella</i> spp.	17	25.7%
3	<i>Proteus</i> spp.	3	4.54%
4	<i>Pseudomonas</i> spp.	4	6.06%
5	Coagulase negative Staphylococci spp.	7	10.6%
6	Enterococci	3	4.54%
7	Streptococci spp.	1	1.51%
	Total	66	

Table 1: Distribution of Organisms in 66 cases of Urinary Tract Infections

Sl. No.	Organisms	Total No.	Ofloxacin		Piperacillin plus tazobactam		Vancomycin		Chloramphenicol		Cefoperazone		Meropenem		Norfloxacin		Amikacin	
			S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R
1	Gram positive bacteria	23	79 %	75 %	66.6 %	33.4 %	75 %	25 %	50 %	50 %	33.3 %	66.7 %	100 %	0 %	91.6 %	8.4 %	91.6 %	8.4 %

Table 2: Antibigram of Gram Positive Cocci

S - Sensitive, R - Resistance

Sl. No.	Organisms	Total No.	Ofloxacin		Piperacillin plus tazobactam		Amoxiclav		Chloramphenicol		Cefoperazone		Meropenem		Norfloxacin		Amikacin	
			S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R
1	Gram negative bacteria	77	79 %	21 %	87. %	13 %	11.1 %	88.9 %	81.4 %	18.6 %	55.5 %	44.5 %	100 %	0 %	72.2 %	27.8 %	94.4 %	5.6 %

Table 3: Antibigram of Gram Negative Bacilli

S - Sensitive, R - Resistance

DISCUSSION

This work demonstrated that significant bacteriuria (100,000 CFU/mL of urine) was observed in both infants and children. Sixty six out of 100 patients developed UTI.

The percentage of infection in infants (19%) in the present study is same as in the study of H. Solanki et al. (20%).^[8] and the percentage of infection in children (81%) in the present study is same as in the study of H. Solanki et al.^[8] (Turkey) (80%) and Abuhandan et al.^[9] (India) (100%).

However, the percentage of infection in infants is higher in studies of Seyed Reza Mirsoleymani et al.^[10] (67.3%) and Ramiro J Madden-Fuentes et al.^[11] (86.04%) and the percentage of infection in children is lower accounting for 32.7% and 13.95% respectively.

The ratio of male:female is similar in almost 3 studies. They are present study (3.5:2.75), H. Solanki.^[8] P. Patra et al. (3:2) and Seyed Reza Mirsoleymani et al.^[10] (3:2).

Organism Isolated	Present Study	H. Solanki, P. Patra et al.	M. Barton, Y. Bell et al.	Seyed Reza Mirsoleymani et al.
Escherichia coli	46.9%	43%	31%	65.2%
Klebsiella spp.	25.7%	36%	29%	26%
Proteus spp.	4.54%	22%	6%	3.6%
Pseudomonas spp.	6.06%	-	2%	-
Coagulase negative Staphylococci spp.	10.6%	16%	4%	Staphylococcus aureus-3.7%
Enterococci	4.54%	-	-	-
Streptococci spp.	1.54%	-	-	-

Comparison of Percentage of Organisms Isolated in different Studies

The percentage of isolation of E. coli and Klebsiella spp. are same in all studies.

The percentage of isolation of proteus is same in three studies except H. Solanki et al.^[8] study.

Pseudomonas aeruginosa isolated only in two studies. They are present study and M. Barton Y Bell et al.^[12] study.

The percentage of isolation of coagulase negative staphylococci of present study coincides with H. Solanki.^[8] et al. study. Enterococci and Streptococci are isolated in present study only.

Antibiotics	Present Study	Sayed Reza Mirsoleymani et al.	Abuhan dam et al.
Ceftriaxone	-	41.8%	39.5%
Nitrofurantoin	96.2%	-	19.7%
Ampicillin – sulbactam	87.01%	-	64.1%
Cotrimoxazole	72.2%	-	41.5%
Amoxiclav	11.11%	-	51.7%
Cefuroxime	-	-	38.1%
Amikacin	94.4%	79.7%	-
Ofloxacin	79%	78.3%	-
Gentamycin	81.4%	71.6%	-
Cefotaxime	55.5%	41.4%	-
Meropenem	100%	-	100%
Comparison of Percentage of Sensitivity Pattern of Gram Negative Organisms			

All the isolates are resistant to Cefotaxime, Amoxiclav. The most effective drugs are Meropenem, Amikacin and Gentamycin.

CONCLUSION

Significant bacteriuria (100,000 CFU/mL of urine) was observed in both infants and children. Periodic studies are recommended to confirm the findings of this study and also monitor any changes in the susceptibility patterns of uropathogens causing urinary tract infection in these groups.

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