

ANTIBIOTIC STEWARDSHIP IN CHILDREN WITH URINARY TRACT INFECTIONS: PATTERNS AND PITFALLS

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Abstract:

Background: Urinary tract infection was first described by Roger in 1839 and since then considerable clinical experience and research have been done on this entity. UTI is one of the most common infections in pediatrics. Urinary tract infection (UTI) is defined as localization of bacteria in the renal parenchyma, renal pelvis, bladder or the urethra irrespective of the fact whether the child is symptomatic or asymptomatic. It is an infection which affects any part of the urinary system. UTI leads to an inflammatory response in the epithelium of the urinary tract. Urinary tract infection can affect both lower and upper urinary tracts.

Objectives: The objective of the study is to determine the antibiotic pattern of urinary isolates, most effective antibiotics for empirical treatment of UTI and evaluate the safety of the drugs given.

Methods: In this prospective observational study, we analyzed totally 96 subjects with Urinary tract infections in pediatrics department of Santhiram medical college and general hospital, Nandyal from June 2019 to November 2019. The study based on demographic data and prescription pattern, urine culture report, along with the antimicrobial sensitivity test were evaluated.

Results: In this study it was observed that females (56) were more prone to urinary tract infections when compared to males (40). Females and males age of 11 to 12 years were more prone to UTI. Males at age group of 7-8 yrs and females at age group of 5-6 yrs and 11-12 yrs were more prone to the staphylococcus, males of all ages are equally affected and females of age 9-10 and 11-12 years are more prone to *E. coli*, Males of age 9-10 and females of age 1-2 yrs were more prone to *klebsiella Pneumoniae*. It was observed that the females of age 11-12 years were more affected with cystitis when compared to males. It was also observed that organisms were sensitive to Cephalosporins (cefixime) and resistance to penicillin (Piperacillin, Ampicillin) in a greater number of patients and cefixime and amoxiclav are the drugs used for the cystitis. Of all 96 patients treated for UTI Cephalosporins (cefixime and ceftriaxone) were used in 59%, penicillin (Amoxiclav) was used in 29%, Aminoglycosides (Amikacin) were used in 4% and miscellaneous (Imipenem, Vancomycin, Nitrofurantoin) were used in 8%.

Conclusion: In our study, most of the patients were positive for staphylococcus organism followed by *E. coli* and *Klebsiella Pneumoniae* respectively. Among the culture positive patients those with staphylococcus organism were treated with amoxiclav and cefixime mostly, patients with *E. coli* were treated with ceftriaxone and patients with *klebsiella* were treated with Imipenem, Amikacin and ceftriaxone. Cefixime was used mostly for the patients with cystitis. The drugs involved in our study are rational with no drug interactions and other drug related problems.

Keywords: UTI, Organisms, Cystitis and Antibiotics.

1. INTRODUCTION

Urinary tract infection is defined as localization of bacteria in the renal parenchyma, renal pelvis, bladder or the urethra irrespective of the fact whether the child is symptomatic or symptomatic. (Choudhry V.P & Agarwal R, 1973)^[1]. The epidemiology of pediatric UTI varies based on age and gender. (Steven L. Chang, MD & Linda D, Short Life, MD, 2006).^[2] The reported incidence of UTI is 7% among girls and 2% among boys during the first 6 years of life. (Seyed Reza Mirsoleymani, et al., 2014).^[3] Urinary tract infection is caused by any bacterial, viral, or fungal infection affecting any part of the urinary tract. In children, bacteria constitute major etiologic agents, in immunocompromised children and premature babies' fungi are occasionally seen. (Samuel N. Uwaezuoke, 2017).^[5] The common presenting symptoms of UTI include abdominal pain, vomiting, fever with chills, rigors and Suprapubic pain, crying during micturition, burning during micturition. UTI occurs when the bacteria enter into the urinary tract and adherence of bacteria to the urinary tract.

Accurate diagnosis of UTI is important to facilitate appropriate management of acute illness and to ensure appropriate evaluation and follow-up. (Sunil S. Vaidya, & Shahaji Y. Gaikwad, 2018).^[6] Effective medical

treatment of a pediatric patient is based upon accurate diagnosis and optimum course of therapy. (Palikhe N, 2004).^[7]

The use of antimicrobial agents especially antibiotics has become a routine practice for the treatment of pediatric illness. (Palikhe N, 2004).^[7] The choice of treatment therapy depends on numerous factors, including the child's age, underlying medical problems, illness severity, ability to tolerate oral medications and most importantly the local resistance patterns to uropathogens. Importantly, geographic variations in bacterial susceptibility and resistance patterns should be borne in mind when choosing the agent to use before culture and sensitivity. Also, prior recent antibacterial use can affect resistance. The common drugs used in the treatment of childhood UTIs are: (Shammi Ramlakhan, et al., 2014).^[4] Penicillin (Ampicillin), Co-Amoxiclav, Cephalosporins (Cefixime, Ceftriaxone), Aminoglycosides (Gentamicin, Amikacin), Imipenem, Nitrofurantoin, Vancomycin.

2. METHODOLOGY

STUDY DESIGN:

It is a prospective observational study.

Inclusion criteria:

- Children with the age between 1-12 years
- Children presenting symptoms of urinary tract infection □ Children undergoing urine culture.
- Patient with informed consent form.

Exclusion criteria:

- Children with the age of < 1 year and ≥ 13 years.

SOURCE OF DATA:

- Data is collected from all the UTI patients who are visiting the pediatrics department of the Santhiram general hospital, Nandyal.
- Data is collected by using specially designed patient data collection forms.

METHODS OF COLLECTION OF DATA:

The necessary information was collected by interviewing the patients using following annexure.

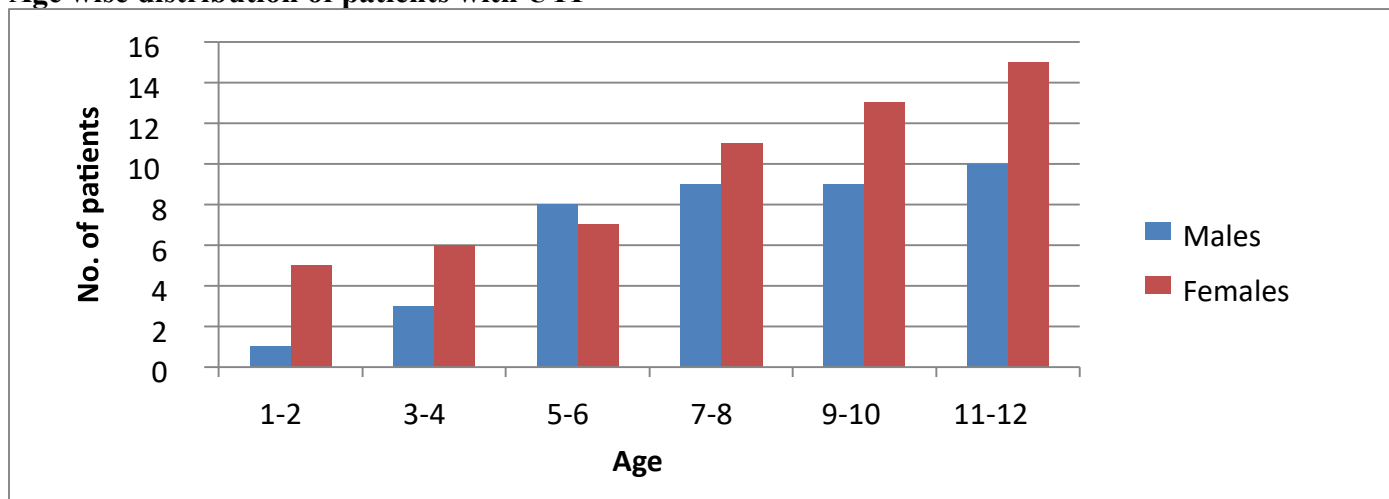
Annexure-I: (patient demographic characteristics proforma)

Annexure-II: (Patient consent form in Telugu)

Annexure- III: (Patient consent form in English)

3. RESULTS

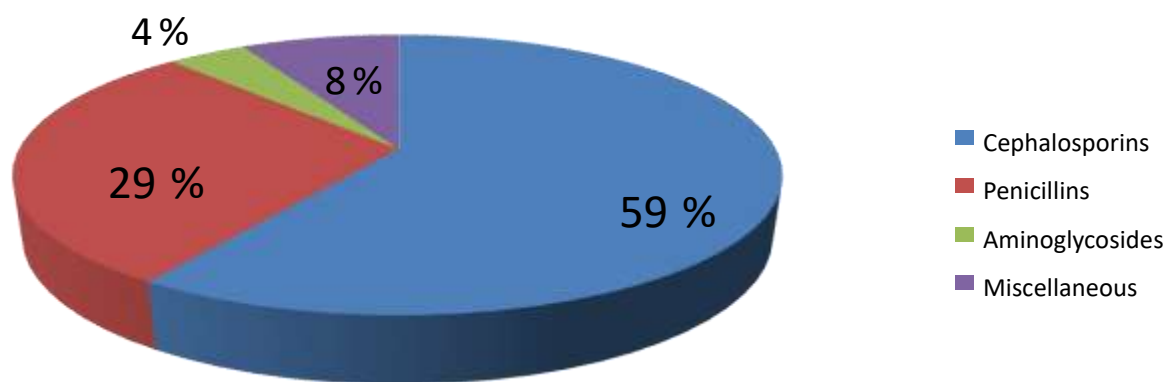
Age wise distribution of patients with UTI



Among 96 patients the highest incidence rate is seen in female patients with age group of 11-12 years with 26.78% and in male patients with age group of 11-12 years with 25% respectively.^[12] **Age and gender wise distribution of organisms in patients:**

Age	Staphylococcus		E.coli		Klebsiella Pneumoniae		No. of patients		Percentage (%)	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
1-2	1	1	0	1	0	2	1	4	7.14	18.18
3-4	1	0	1	0	0	0	2	0	14.28	0
5-6	1	3	1	0	0	1	2	4	14.28	18.18
7-8	3	1	1	1	0	0	4	2	28.57	9.09
9-10	0	1	1	3	2	0	3	4	21.42	18.18
11-12	1	4	1	4	0	0	2	8	14.28	36.36
Total	7	10	5	9	2	3	14	22	99.97	99.99

Out of 96 patients, it was found that males at age group of 7-8 yrs and females at age group of 5-6 yrs and 11-12 yrs are more prone to the staphylococcus, males of all ages are equally affected and females of age 9-10 and 11-12 are more prone to E. coli. Males of age 9-10 and females of age 1-2yrs are more prone to klebsiella Pneumonia.^[9] **Category wise distribution of antibiotics:**



From the above table it was observed that the category of Cephalosporins were used mostly.^[12]

Sensitivity and resistance of antibiotics in patients:

Antibiotics		Resistance	Sensitive
Penicillins	Ampicillin (Amp)	20	-
	Methicillin/cloxacillin (M)	-	5
	Amoxicillin +clavulanic acid (AMC)	10	5
	Piperacillin (PI)	21	2
	Piperacillin+tazobactam(PIT)	1	6
Cephalosporins	Ceftotaxime (III)(CTX)	12	1
	Ceftazidime (III)(CAZ)	5	5
	Cefazolin (I)(Cz)	1	-
	Cefixime (III)(Cfx)	-	20
	Ceftriaxone (III)(CTR)	3	7
	Cefoperazone	1	-

	Cefipime (IV)	-	1
	Cefoperazone+ Salbactam(Cfs)	-	3
Amino glycosides	Gentamicin(Gen)	17	11
	Amikacin (Ak)	2	14
	Netilmycin (Nt)	-	8
Quinalones	Ciprofloxacin (CIP)	-	3
	Norfloxacin (Nx)	8	7
	Nalidixic acid (Na)	13	2
	Sparfloxacin (SPX)	3	5
Miscellaneous	Cotrimoxazole (COT)	7	10
	Nitrofurantoin (NIT)	2	10
	Imipenem (IPM)	-	10
	Meropenem (Mr)	-	1
	Linezolid (LZ)	-	3
	Vancomycin (VA)	-	10

From the above table it was observed that Cephalosporins (cefipime) were more sensitive to the organisms and penicillins (Piperacillin, Ampicillin) were found to be resistant in more number of patients. ^[13] **Age and organism wise distribution of antibiotics in male patients:**

Age	Organism	Antibiotics	No. of patients	Percentage (%)
1-2	Staphylococcus	Cefixime	1	7.14
	Klebsiella pneumonia	Nitrofurantoin	1	7.14
3-4	Staphylococcus	Cefixime	1	7.14
	E.coli	Ceftriaxone	1	7.14
5-6	Staphylococcus	Amoxiclav	1	7.14
	E.coli	Imipenem, Amikacin	1	7.14
7-8	Staphylococcus	Amoxiclav	3	21.42
	E.coli	Cefixime	1	7.14
9-10	E.coli	Ceftriaxone	1	7.14
	Klebsiella pneumonia	Imipenem, ceftriaxone	1	7.14
11-12	Staphylococcus	Cefixime	1	7.14
	E.coli	Ceftriaxone	1	7.14
Total			14	99.96

From the above table it was observed that for the staphylococcus organism amoxiclav, cefixime are used, for E. coli ceftriaxone, imipenem, Amikacin and cefixime were used, and for Klebsiella pneumonia Imipenem, Ceftriaxone, and Nitrofurantoin were the drugs used. ^[8]

Age and organism wise distribution of antibiotics in female patients:

From the above table it was observed that for the staphylococcus organism amoxiclav, cefixime, Vancomycin, Amikacin are used, for E. coli ceftriaxone, imipenem, Amikacin and cefixime were used, for Klebsiella pneumonia imipenem, ceftriaxone, cefixime were the drugs used. ^[8]

Age	Organism	Drugs	No. of patients	Percentage (%)
1-2	Staphylococcus	Vancomycin, Amikacin	1	4.76
	E.coli	Ceftriaxone, Imipenem, Amikacin	1	4.76
	Klebsiella pneumonia	Ceftriaxone, Imipenem	1	4.76
5-6	Staphylococcus	Amoxiclav	2	4.76
		Cefixime	1	4.76
	Klebsiella pneumonia	Ceftriaxone	1	4.76
7-8	Staphylococcus	Amoxiclav	1	4.76
	E.coli	Ceftriaxone	1	4.76
9-10	Staphylococcus	Amoxiclav	1	4.76
	E.coli	Ceftriaxone	2	9.52
		Imipenem ,Amikacin	1	4.76
	Klebsiella pneumonia	Imipenem, cefixime	1	4.76
11-12	Staphylococcus	Cefixime	2	9.52
		Amoxiclav	2	9.52
	E.coli	Cefixime	4	19.07
Total			22	99.99

Age and gender wise distribution of antibiotics in cystitis patients:

Age	Antibiotics	No. of patients		Percentage (%)	
		Males	Females	Males	Females
1-2	Cefixime	0	0	0	0
3-4	Cefixime	0	1	0	5.55
5-6	Cefixime	3	2	21.42	11.11
7-8	Cefixime	4	2	28.57	11.11
	Amoxiclav	0	1	0	5.55
9-10	Cefixime	2	3	14.28	16.66
	Amoxiclav	1	2	7.14	11.11
11-12	Cefixime	2	4	14.28	22.22
	Amoxiclav	2	3	14.28	16.66
Total		14	18	99.97	99.97

From the above table it was observed that cefixime and amoxiclav are the drugs used for the cystitis. ^[8]

4. DISCUSSION

In this prospective observational study, we totally collected 96 patients with UTI. Out of them, 56 members were females and 40 members were males. Among them, 36 patients were positive for the organism, 32 patients had

cystitis. Based on the gender wise distribution the prevalence of UTI is seen more in female patients with 58% and less in male patients with 42% respectively. ^[14]

Our results showed increase in the percentage of UTI in patients with the age group of 11-12yrs were affected equally in both genders. Based on age wise distribution, the highest incidence rate is seen in female patients with age group of 11-12 years with 26.78% and in male patients with age group of 11-12 years with 25% respectively. ^[12]

Out of 96 patients, it was found that males at age group of 7-8 yrs and females at age group of 5-6 yrs and 11-12 yrs were more prone to the staphylococcus, males of all ages were equally affected and females of age 9-10 and 11-12 were more prone to E. coli. Males of age 9-10 and females of age 1-2yrs were more prone to klebsiella Pneumonia. ^[9]

In our study it was observed that the category wise, Cephalosporins category was used mostly. Cephalosporins had the highest level of sensitivity along with co-amoxiclav. ^[12]

In our results it was also observed that organisms were sensitive to Cephalosporins (cefixime) and resistance to penicillins (Piperacillin, Ampicillin) in a greater number of patients. ^[13]

In male patients' antibiotics treated for the staphylococcus organism were amoxiclav and cefixime, for E. coli ceftriaxone, imipenem, Amikacin and cefixime were used, and for Klebsiella pneumonia Imipenem, Ceftriaxone, and Nitrofurantoin were the drugs used.

In female patients, it was observed that antibiotics used in treatment of staphylococcus organism include amoxiclav, cefixime, Vancomycin, Amikacin, for E. coli ceftriaxone, imipenem, Amikacin and cefixime were used, for Klebsiella pneumonia imipenem, ceftriaxone, cefixime were the drugs used.

In our study it was observed that cefixime and amoxiclav were the drugs used for the cystitis. ^[8]

5. CONCLUSION

UTI is a potential cause of fever in children. Urine culture is the gold standard for the diagnosis of UTI in children. Parents should be educated about the importance of UTI and its long-term complications so that they bring their children for regular follow-ups. In our study, the prevalence of UTI is seen more in female patients and less in male patients. In males and females, the occurrence of UTI is most common in the age group of 11-12 yrs. In our study, most of the patients were positive for staphylococcus organism followed by E. coli and Klebsiella Pneumonia respectively. Among the culture positive patients those with staphylococcus organism were treated with amoxiclav and cefixime mostly, patients with E. coli were treated with ceftriaxone and patients with klebsiella were treated with Imipenem, Amikacin and ceftriaxone. Cefixime was used mostly for the patients with cystitis. In this study, third-generation Cephalosporins (cefixime) and Amoxiclav were the antibiotics, which are commonly prescribed for the empirical therapy of UTI. Third generation Cephalosporins were the most commonly used antibiotics as it covers both gram-negative and gram-positive organisms. The drugs involved in our study were rational with no drug interactions and other drug-related problems. As the sample was small, we cannot attribute these results to entire population and hence need further studies.

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