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Original Research Article

Sensitivity of ciprofloxacin and ceftriaxone in children with urinary tract infections

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ABSTRACT

Background: Urinary tract infections (UTIs) are the 2nd commonest bacterial infections, after respiratory tract infections (RTIs), and may go on to progress into chronic kidney disease among paediatric population. The objective of this study was to determine frequency of sensitivity of ciprofloxacin and ceftriaxone in children with urinary tract infections (UTIs).
Methods: This descriptive, cross-sectional study was done at the department of pediatric medicine, Nishtar Hospital, Multan, from 10th August 2019 to 9th January 2020. A total of 165 patients presenting with UTI and aged 2 to 12 years of either gender were included. Urine sample was taken in sterilized container and sent immediately for urine culture and sensitivity tests.
Results: In a total of 165 cases, mean age was 5.15±2.50 years while most cases, 113 (68.48%) were between 2 to 6 years of age. Out of the 165 patients, 112 (67.87%) were female representing female to male ratio of 2.1:1. Sensitivity of ciprofloxacin in 53 (32.12%) and ceftriaxone in 107 (64.85%) patients was found.
Conclusions: This study showed the sensitivity of ciprofloxacin in 32.12% and ceftriaxone in 64.9% children with UTIs.

Keywords: Ciprofloxacin, Sensitivity, Urinary tract infections

INTRODUCTION

Urinary tract infections (UTIs) are the 2nd commonest bacterial infections, after respiratory tract infections (RTIs), and may go on to progress into chronic kidney disease among pediatric population. Timely diagnosis of UTI is considered vital to protect normal renal functioning.[1] UTI is commonly found among children while cumulative incidence among girls and boys in the 1st 6 years of life is noted to be 7% and 2% respectively.[2]

UTI among children is the microbial inflammation of the lower and/or upper urinary tract. Commonest uropathogen remains to be *Escherichia coli* estimated to cause around 70% of the UTI cases followed by *Proteus mirabilis, Klebsiella, Enterobacter, Pseudomonas aeruginosa* and *Enterococcus* which are some of the other common causes of UTI among boys whereas Staphylococcus saprophyticus is noted to cause acute UTIs among adolescent girls.[3]

Understanding pattern of antibiotic resistance is imperative in guiding clinicians finding appropriate empirical antibiotic choice. Right choice of antibiotic treatment can reduce the chances of treatment failure while inappropriate empirical antibiotics can contribute to higher morbidity rates, increased cost because of longer durations of treatment as well as more visits to emergency settings and hospitalizations.[3,4] Antimicrobial resistance of commonest pathogens has been found rising globally while urine culture is most beneficial to those individuals who have risk factors related to antimicrobial

resistance. Variation exist between patterns of sensitivity and resistance regarding different microorganisms and antibiotics in different regions of the world so it is always advisable to keep up to date with the recent trends.[5,6] A study found sensitivity of ceftriaxone as 44.5%, ciprofloxacin 32.7%, gentamycin 45.5% and ofloxacin 24.5% in children with UTIs.[7] While results of urine culture and sensitivity is awaited, treating suspected children with UTI adopting empirical antibiotic treatment is a usual management practice. Younger children are more susceptible to immediate and long-term complications of UTIs and prompt treatment is advised in this age group.[8]

This study was planned to determine the sensitivity of ciprofloxacin and ceftriaxone in children with UTI. The findings of this study are thought to lead us in adopting better treatment option in children with UTI as there is no such study done in our population. Due to readily availability of the drugs on the counter and irrational use of antibiotics, antibiotic resistance is on the rise in developing countries like Pakistan, so it is the need of hour to find out efficacy of drugs to cure these pathogens. This will help us to decrease disease morbidity and disease duration as well. Proper management will also be cost effective for the economically deprived population of our region.

METHODS

This descriptive, cross-sectional study was conducted at "Unit-I of department of pediatric medicine, Nishtar Medical College and Hospital, Multan", from 10th August 2019 to 9th January 2020. Approval from "Institutional Ethical Committee" was sought and informed consent from guardians/parents of all the study participants was also taken.

A total of 165 children, aged 2-12 years of either sex, presenting with UTI were included. Urine samples were inoculated on nutrient agar and McConkey agar after 24 hours of incubation. Any growth observed on plate was deemed as UTI positive. All cases which were already taking ciprofloxacin or ceftriaxone within 48 hours, or having congenital or acquired immunodeficiency or having poor oral intake were not enrolled.

Table 1: Sensitivity measurement of drugs included in the study.[9,10]

Name of drug	Sensitive (In mm)	Intermediate (In mm)	Resistant (In mm)
Ciprofloxacin	≥21	16-20	≤15
Ceftriaxone	≥ 22	20-22	≤ 20

Urine sample was taken in sterilized container and immediately sent to institutional laboratory for urine culture and sensitivity test. Any growth observed, after 24 hours was subjected to drug sensitivity/resistance test using modified Kirby Baur disc diffusion method on a Mueller Hinton agar plates by a qualified microbiologist having more than 10 years' experience after post-graduation. Outcome variable was noted after measuring zone of inhibition of a specific drug. Drug sensitivity was measured as diameter by zone of inhibition of specific drugs as per method described in Table 1.[9,10]

Statistical analysis

SPSS version 21.0 was used for data handling and analysis. Mean and standard deviations were calculated for age while frequency and percentages were calculated for gender, age groups, sensitivity, residential area, family income, mother's education and source of drinking water. Stratification was done to control effect modifiers and post stratification chi square test was applied considering p value <0.05 as statistically significant.

RESULTS

In a total of 165 children, mean age was noted be 5.15±2.50 years while most, 113 (68.48%) were between 2 to 6 years of age. Out of the 165 patients, most 112 (67.87%) were female representing a female to male ratio of 2.1:1. Most, 97 (58.7%) belonged to rural areas, 91 (55.1%) had family income >Rs. 25000, 81 (49.1%) illiterate, and 109 (66.1%) had drinking water source as water supply.

Table 2: Frequency of sensitivity of ciprofloxacin and ceftriaxone in children with urinary tract infections.

Sensitivity	Ciprofloxacin	Ceftriaxone	p-value
Yes	53 (32.12%)	107 (64.85%)	0.0151
No	112 (67.88%)	58 (35.15%)	

Table 3: Sensitivity of ciprofloxacin with respect to study variables.

Study variable		Sensitivity		p-value
		Yes (n=53)	No (n=112)	
Age (years)	2-6	32	71	0.6204
	>6-12	21	41	
Gender	Female	34	77	0.7301
	Male	19	35	
Place of living	Rural	33	61	0.2262
	Urban	20	51	
Family income (PKR)	<25,000	22	51	0.7874
	>25000	31	61	
Literacy	Literate	30	57	0.6408
	Illiterate	27	56	
Drinking water source	Water supply	27	76	0.1214
	Red pump	26	36	

Sensitivity of ciprofloxacin was noted in 53 (32.12%) and ceftriaxone in 107 (64.85%) patients. The difference was noted to be statistically significant (p-value=0.0151) as shown in Table 2.

Table 4: Sensitivity of ceftriaxone with respect to study variables.

Study variable		Sensitivity		p-value
		Yes (n=107)	No (n=58)	
Age (years)	2-6	67	50	0.1218
	>6-12	40	08	
Gender	Female	63	49	0.1287
	Male	44	09	
Place of living	Rural	65	32	0.3612
	Urban	42	26	
Family income (PKR)	<25,000	58	16	0.1134
	>25000	49	42	
Literacy	Literate	57	27	0.8873
	Illiterate	50	31	
Drinking water source	Water supply	70	39	0.3015
	Red pump	37	19	

Stratification of sensitivity of ciprofloxacin and ceftriaxone with respect to study variables is shown in Table 3 and Table 4 respectively which showed that there was no significant difference found (p value > 0.05) for all study variables.

DISCUSSION

Delay in attaining bladder and bowel control, troubles in neuromotor controls of posture, less cognition, restricted ability in communication of need to void, constipation as well as bladder dysfunctions are some of the factors contributing to chances of acquiring UTIs.[11-14]

Commonest uropathogens among children are noted to be *Escherichia coli, Proteus spp, Enterococcus faecalis, Klebsiella spp,* and *Staphylococcus spp*.[15,16] Co-amoxiclav and co-trimoxazole are the recommended antimicrobial agents against commonest causative agents of UTIs but increase in resistance against these 1st line agents is reported to increase in the recent years.[16] Authors did this study to determine frequency of sensitivity of ciprofloxacin and ceftriaxone in children with UTIs.

Authors noted most patients, 113 (68.48%) were between 2-6 years of age while 112 (67.87%) were female representing a female to male ratio of 2.1:1. In this study, it was found that the sensitivity of ciprofloxacin was noted in 53 (32.12%) and ceftriaxone in 107 (64.85%) patients. In a study, ceftriaxone is 44.5% sensitive, ciprofloxacin 32.7%, gentamycin 45.5%, ofloxacin 24.5% sensitive in children with UTIs.[7] Ravi KC et al, found a high sensitivity to gentamycin (94.7%), ciprofloxacin (92.1%), ceftriaxone (89.4%), cefixime (89.2%), cefuroxime (73.6%), nalidixic acid (73.6%) and nitrofurantoin (68.4%).[16] Commonly used antibiotics like ampicillin (13.1%), co-amoxiclav (18.4%) and co-trimoxazole (26.3%) were noted to have high rates of resistance.[16]

Ali and Osman from Iran reported gentamicin (96%), ciprofloxacin (94%), and ceftriaxone (90%) to have good susceptibility against all isolates found while co-amoxiclav (19%) and ampicillin (14%) were noted to have lowest susceptibility findings.[17] From US hospitals, *E. coli* was noted to have highest rates of resistance for trimethoprim-sulfamethoxazole (24%) but while lowest for nitrofurantoin (<1%).[18] Highest rates of susceptibility are recorded for amikacin (79.7%), ofloxacin (78.3%), and gentamicin (71.6%) among commonly found causative agents while ampicillin (83.5%) and co-trimoxazol (75.4%)are found to have highest rates of resistance.[19]

In a study in Iran in 2008, among urine isolates of 438 children, resistance rates of *E. coli* were noted to be 13% for ciprofloxacin and 13% to ceftriaxone which is quite different to what was seen in the present study.[20] It is again emphasizing the fact that there has been a shift in this region regarding antimicrobial resistance patterns against commonly found causative agents. A recent finding from Iran reported rise in the resistance of ceftriaxone amongst commonly found uropathogens involved in UTI.[21] Unnecessary and incomplete usage of commonly practiced antibiotics is responsible for disseminating multidrug resistance against most commonly found microbes.[22]

Gul Z et al, noted ceftriaxone to have high resistance of 77.6% while this was noted for ciprofloxacin as 80.6% among urinary isolates which correlates well with the findings of currents study that resistance for commonly used antibiotics like ceftriaxone and ciprofloxacin have increased significantly in our local population.[23] This findings are also similar to what has been found by researchers from Kenya.[24]

As resistance among commonly used antibiotics is increasing globally because of excessive and unrequired usage of antibiotics, it is the need of the hour that guidelines and recommendations must be formed after regular intervals to provide guidance and perspective to help clinicians.

CONCLUSION

Among children having UTI, sensitivity of ciprofloxacin and ceftriaxone was found to be 32.1% and 64.9% respectively. Public awareness programs should be arranged to enhance our public for early consultation to

the pediatrician in order to avoid antibiotic abuse and practicing incomplete antibiotic regimen.

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