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CEFTRIAXONE USAGE PATTERN IN PEDIATRICS IN-PATIENT DEPARTMENT OF A TERTIARY CARE HOSPITAL

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ABSTRACT

Background: There is evidence of different patterns in drug utilization of ceftriaxone drug in India. The objective of this study is to evaluate the use of ceftriaxone in a tertiary care hospital. **Materials and methods:** A prospective observational study was of 6 months duration from august 2015 to January 2016 was carried out after the institutional ethical committee approval at pediatric in-patient department. Data was collected in a structured documentation form from case sheets and prescriptions. Data was measured in percentages. To summarize and for analysis of the data SAS software was used. **Results:** We collected 105 ceftriaxone contained prescriptions. Of these, males (63.8%) and patients with the age group of 1-5 (33%) years were more exposed. We found (71%) of cases were given the drug for correct indication. We also found that (24%) of diagnosis were central nervous system related. We have seen that the maximum dose given per day was highest in case of children of age group 5-14 years. We also identified that the duration of therapy (79%) was found to be high in the range of 2-7 days. We noticed that (50.5%) received the drug based on clinical symptoms. **Conclusion:** Ceftriaxone was found to be mostly prescribed according to indication. It was found to be highly used in central nervous system diseases followed by gastrointestinal and respiratory diseases.

KEYWORDS: Ceftriaxone, drug utilization, usage pattern, pediatrics.

1. INTRODUCTION

The drug utilization study was defined by WHO as "the marketing, distribution, prescription and use of the drug in society, with special emphasis on the resulting medical, social and economic consequences".[1]

Pediatrics is the speciality of medical sciences concerned with the physical, mental and social health of children from birth to young adulthood. The world which we live in is highly populated by microorganisms of astonishing diversity and the most commonly affected populations are pediatric by various infectious disease.[2] The most commonly prescribed drugs in pediatrics are antibiotics and they are the most susceptible to diseases than adults due to under developed immune system, hormonal imbalance and genetic factors due to environmental changes. These are the drugs used to prevent, inhibit the life of microorganisms.[3] There is evidence that children receive 50% to 85% of antibiotics in developed and developing countries.[4] In infants and children, the knowledge of drug administration lacks behind that of adults for many reasons such as developmental differences which leads to changes in pharmacodynamic and pharmacokinetic profiles of drugs, ethical and financial reasons, capabilities, regulatory agencies and constraints. In pediatric inpatients the drug prescribing errors occur at a rate as high as 4.2%.[5] In order to avoid multiple drug resistance, treatment failure, non- compliance and increase in cost of treatment a rational antibiotic prescription is very important.[4] To promote appropriate use of antibiotic in children, the Centre for disease control and prevention has given some recommendations and treatment guidelines for treatment of various diseases in children.[6]

Ceftriaxone, a parenteral third generation cephalosporin, was introduced in the United States in 1984.[7] Because of its excellent expanded spectrum of activity and half-life of between 4 to 7 hours which may makes the drug to be useful particularly in the treatment of pediatric infections. In addition, it is used in the treatment of bacterial meningitis due to its modest central nervous system penetration. It is used for the prevention or treatment of a variety of infections.[8] The recommended dosage for the treatment of meningitis in children is 100mg/kg/day in once daily dose or divided into two doses and given every 12 hours up to a daily dose of 2 grams per day. For other infections, 50 to 75 mg/kg/day.[7]

2. MATERIALS AND METHODS

2.1 Study site

This drug utilization study was conducted at Tertiary Care Hospital, Secunderabad, India.

2.2 Study period

This was an observational study completed over a period of 6 months from august 2015 to January 2016.

2.3 Study design

Prospective observational study.

2.4 Studied population

105 Inpatients.

2.5 Inclusion criteria

All inpatients prescribed with ceftriaxone drug in pediatric department of age group less than 14 years.

2.6 Exclusion criteria

Patients aged less than 1 month and above 14 years, medications other than ceftriaxone in prescription.

2.7 Study approval

Ethical clearance was obtained from the Institutional Ethical Committee, CMR College of pharmacy, before the study.

2.8 Source of data and materials

Patient data collection form, Patient case notes/ prescription.

2.9 Study procedure

Patients were enrolled into the study based on study criteria. The cases which had found with the ceftriaxone in the case records and the full details of the cases including patient name, age, sex, laboratory investigations and other details brought into the self-designed patient data collection form. All the enrolled patients case records were followed until discharge for any change in the drug therapy. The data was entered into the Microsoft excel sheet for easy reference and analysis of results later. Criteria for evaluation includes appropriateness of drug of choice for indication, dose, frequency of the drug administration, duration of therapy, laboratory tests and drug switch. The entire data were analyzed by using Anova processed by Windostat Version 9.2 from Indostat services.

2.9 Statistical methods

The data were subjected to statistical analysis using Microsoft excel. Microsoft word and excel have been used to generate bar graphs, pie charts and tables.

3. RESULTS

A total of 105 patient data sheets were enrolled in this study for the desire purpose that is for the evaluation of use of ceftriaxone.

Table 1: Patient details of studied population

Demographic details	Frequency (N)	Percentage (%)
Gender distribution		
Male	67	63.8
Female	38	36.2
Age distribution		
Infants (> 1 month)	21	20.00
Young children (1-5 years)	35	33.33
Children (5-14 years)	49	46.67

Table 1 showed that males were more (63.8%) than female patients (36.2%). Children (age group of 5-14 years) were more than infants and young children (> 1 month – 5 years).

Table 2: Use of ceftriaxone according to indication

Indication	Frequency	Percentage	ODDS Ratio value	95% Confidence Interval	
				Lower Limit	Upper Limit
Yes	75	71	**1.2174**	0.4034	3.1641
No	30	29			

Table 2 showed that (71%) of patients received drug according to the indication and it was found to be significant (ODDS ratio-1.2174).

Table 3: Diagnosis

Indication	Frequency	Percentage
Central Nervous System	24	23
Gastrointestinal Tract	21	20
Respiratory	19	18
Fever	17	16.1
Renal	12	11.4
Hematological	6	5.7
Others	6	5.7

Table 3 shows that ceftriaxone was mostly used in Central Nervous System 24 (23%), followed by Gastrointestinal Tract 21 (20%), Respiratory 19 (18%) and so on as shown in the table above.

Table 4: Dose prescribed for the patients

Dose given per day (mg)	Frequency (N)	Percentage (%)
500	34	32.4
1000	35	33.3
1500	19	18.0
2000	14	13.3
2500	2	2.0
3000	1	2.8

Table 4 showed that the most frequently prescribed doses were 1000 mg (33.3%) and 500 mg (32.4%). Followed by 1500 (18%), 2000mg (13.3%), 2500mg (2.0%) & 3000 mg (2.8%).

Table 5: Mean dose of patients

Age	Mean dose/day	Standard deviation	Anova test
Infant	539.23	222.06	F- value, 28.75
Young children	999.25	372.07	
Children	1703.88	855.12	p-value, 0.001
Dose-Diagnosis			
Renal	1987.50	1061.76	F , value 3.05
Fever	1350.59	588.36	
CNS	1249.17	683.56	
GI Tract	1116.67	825.86	
Others	1050	634.82	
Respiratory	939.68	683.56	
Hematological	860	446.63	P,value 0.008`

Table 5 showed that mean dose was higher in children (1703.88 mg) followed by young children (999.25mg) and infants (539.23 mg) and it was significant with (p value - <0.001). It also shows that the mean dose of ceftriaxone according to diagnosis was found to be highest in Renal cases (1987.50), followed by Fever (1350.59), CNS (1249.17), GI Tract (1116.67), others (1050.00), Respiratory cases (939.68) and Hematological conditions (860.00) and it was significant with (p value - <0.001).

Table 6: Duration of ceftriaxone Use

Duration	Frequency(N)	Percentage
1 day	1	1
2-7 days	83	79
8-14 days	20	19
15-20 days	1	1

Table 6 showed that the duration of therapy was found to be high in the range of 2-7 days (79%) followed by 8-14 (19%),1 day (1%) and 15-20 days (1%).

Table 7: Ceftriaxone prescribed based on lab data and symptoms

Prescribed based on	Frequency (N)	Percentage %
Symptoms	53	50.5
Lab data	5	4.7
Both	47	44.7

Table 7 showed ceftriaxone was prescribed predominantly based on symptoms - (50.5%) followed by both lab data and symptoms for (44.7%) and only lab data for (4.7%).

Table 8: Drug Switch

Drug Switch	Frequency (N)	Percentage %
Ceftriaxone to Cefixime	18	17.1
Ceftriaxone to Cefotaxim	6	7.6
Others	8	5.7
No switch	73	69.5

Table 8 indicates that drug switch was seen primarily from Ceftriaxone to Cefixime in (17.1%) patients, drug switch to other drugs in (5.7%) patients and no switch was seen in (69.5%) patients.

Table 9: Drug prescribed with generic and brand name

Drug name	Frequency	Percentage (%)	ODDS Ratio Value	95% confidence interval	
				Lower	Upper
Generic name	102	97.1	**1.9286**	0.0657	15.628
Brand name	3	2.9			

Table 9 showed that the drugs with generic name were predominantly prescribed in (97.1%) patients followed by brand name in (2.9%) patients and it was significant (ODDS Ratio-1.9286).

4. DISCUSSION

4.1 Demographic details of patients

4.1.2 Gender distribution

Among 105 patients, we seen male patients were predominant (N=67, 63.8%) than female patients (N=38, 36.2%) in this study. The finding of the study is similar to a study conducted by **Reddy NS**[9] et al that showed a male predominance than female patients.

The finding of this study was also similar to the study conducted by **Jyothi k**[10] et al showed that male patients were more than female patients.

4.1.3 Age distribution

In our study we observed that children of age group 5-14 years were hospitalized more when compare to young children and infants. According to the literatures, the most commonly affected populations are pediatric by various infectious disease.[2] and our result is in accordance with them.

4.2 Use of ceftriaxone

The study showed that, (71%) of patients were given the drug for correct indication and (21%) not according to the indication. The finding of the study was similar to the previously conducted study by **Bantie L**.[11]

4.3 Diagnosis

In my study ceftriaxone was mostly used in central nervous system diseases 24(23%), followed by gastrointestinal tract (20%), respiratory diseases (18%) and so on as shown in above table. The finding of this study was in contrast to the result revealed from the study, Drug Use Evaluation of ceftriaxone in Medical Ward of Ayder Referral Hospital, Ethiopia in which ceftriaxone was mainly used for pre-operative prophylaxis. The contrast was because, in my study only pediatric ward was included where as in their study different wards such as surgical ward, medical ward, pediatric ward, ICU, and emergency wards were studied.[7]

4.4 Dose prescribed

In the study mostly prescribed doses were 1000 mg and 500mg. Out of 105 patients included in the study 35 patients (33.3%) were prescribed with 1000mg of drug and 34 patients (32.4%) were prescribed with 500mg of the drug. The finding of my study was similar to the previously conducted study by **Gyawali S**[12], which revealed that most commonly prescribed dose was 1000mg followed by 2000mg (25.0%) and 1500mg (2.2%). In our study the second

highest dose commonly given was 500mg which is different from the same study because in that study the second most commonly given dose was 2000mg.[12]

4.5 Mean dose of patients

From a total of 105 cases, the mean dose of ceftriaxone was found to be highest in children (1703.88) followed by young children (999.25) and infants (539.23). We observed that there is an increase in dose from infants to the children, because the dose has to be given according to age and for ceftriaxone the dose should be given in accordance with the body weight of the patient.

In our study we also observed that, there is a difference in doses administered for various diagnosis. Renal diseases have received the highest dose (1987.50) followed by fever (1350), central nervous system (1249.17), gastro intestinal tract (1116.67), respiratory (939.68) and hematological diseases (860).

4.6 Duration of ceftriaxone use

In our study the duration of ceftriaxone was higher in the range of 2-7 days (79.0%) followed by 8-14 days (19.0%), 1 day (1.0%) and 15-20 days(1.0%). The duration of therapy was high in the range of 2-7 days which is the appropriate duration of ceftriaxone use. The finding of the study was similar to the cross sectional descriptive study conducted by **Gyawali S.**[12] But the second highest duration of ceftriaxone therapy was found to be in the range of 8-14 days which is different from the same study because in that study second highest duration was found to be stat (13.33%). This is an important factor as the number of days in which an antibiotic is used correlates with the disease prevalence.[2] The finding of my study was also similar to the study conducted by **Berhe FD**[13], in which duration of ceftriaxone was found to be high in the range 2-7 days (51.69%) as in my study.

4.7 Ceftriaxone prescribed based on symptoms and lab data

In our study we observed that ceftriaxone was mostly prescribed on the basis of clinical data. We had seen that (50.55%) of cases were prescribed ceftriaxone only based on symptoms and (44.7%) were based on both lab data and symptoms and (4.7%) cases were given the drug only based on lab data. The finding of the study was found to be similar with the study conducted by **Ahmed S**[14], in which the antibiotics were used mostly on the basis of clinical condition rather than the result of blood culture, as the yield of blood culture was quite low. Third generation Cephalosporins are the most commonly prescribed broad spectrum

antibiotic even before the culture sensitivity result arrives. The finding of the study was found to be similar with the study conducted by **Kaliamoorthy K.**[15]

4.8 Drug switch

In our study we found that out of 105 cases, drug switch was seen in 32 (30.5%) and in remaining cases there is no drug switch. Drug switch from Ceftriaxone to Cefixime 18 (17.1%), ceftriaxone to Cefotaxime 6 (7.6%), and others (5.7%). As studies showed that switching from intravenous route to oral route, is usually practiced in conditions where, patients are clinically stable and the selected oral medication will produce serum levels comparable to those achieved through intravenous form and also to reduce the length of stay.

4.9 Drug prescribed with generic and brand name

Our study revealed that ceftriaxone was prescribed predominantly with the generic name in (97.1%) and with brand name in (2.9%) of cases. It is prescribed mostly in generic name rather than brand name because it is a well-known drug. Prescribing by generic name is a good practice by the physicians as it reduces confusion among the pharmacist while dispensing. It also helps the hospital formulary to have a better inventory control. Moreover, generic drugs are more cost effective than the branded ones. The finding of the study was found to be similar with the study conducted by **Kaliamoorthy K.**[15]

5. CONCLUSION

The study concludes that Pediatrics of age group 5-14years was given the higher percentage of ceftriaxone and the dose was given according to the body weight.

The treatment regimen application in majority of cases is done without doing any culture sensitivity test which may lead to widespread of irrational prescription.so the physicians must be more specific in the diagnosis criteria.

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