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A Study on Antibiotic Utilization in Pediatric Hospitalized Patients and Antibiotic Stewardship

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Abstract

Background: There is an increasing trend of use of antibiotics in pediatric ward/intensive care unit has resulted in increasing health care costs and the emergence of resistant bacteria. **Objective:** We evaluated the utilization of antibiotics in a pediatric teaching hospital aiming to identify targets for improvement of prescription. **Methods:** Clinical, laboratory and treatment data of patients hospitalized in patient department (IPD) and a pediatric intensive care unit (PICU) were prospectively collected during a 6-months period. A subsequent review of the collected data by a pediatric infectious disease specialist, taking into consideration existing in-house treatment guidelines, was carried out **.Results:** Most common age group receiving antibiotics are between 1-5 years of age. Ceftriaxone alone and in combination with other antibiotics was most commonly prescribed (71.4%). Average number of antibiotics per patient was 1.2 and 70% of patients were on single antibiotic. **Conclusion:** The most cause of hospitalization in our set up is due to gastrointestinal diseases and the antibiotics used frequently is ceftriaxone. It is high time for continuous education of doctors on judicious antibiotic use and strict implementation of existing guidelines for it. Improvement in the availability of rapid diagnostic methods to discern viral from bacterial infections may help reduce the numbers of empiric therapies in favor of pathogen-targeted therapeutic treatments.

Key Words: *Antimicrobials,Infections, Pediatrics, Stewardship,antibiotic utilization*

Introduction

The goals of antimicrobials chemotherapy may involve the time course events of infection. This may be prophylactic, pre emptive, empiric, definitive or suppressive.[1] The empirical therapy involves in giving antimicrobial agents without confirming infection with evidence of the microorganism from the culture and sensitivity. Standard medical treatment depends upon the accurate diagnosis and optimal use of antibiotics. Antimicrobials agents are potentially toxic and may promote resistance in microorganism, very often, there agents are prescribed irrationally in conditions like common cold, upper respiratory tract infection and surgical prophylaxis.[1] Antibiotics are the most commonly prescribed medicines in children with highest incidences found in preschoolers. It has been documented that the prescribing doctors lack the knowledge about antibiotics which leads to irrational prescribing and adds to the medical expenses.[2,3] However, hospitals are considered to be the centre of antimicrobial resistance owing to the higher use of broad-spectrum agents in both adults and children [2].

According to the results of various antibiotic drug utilization studies, 50% to 85% of children receive antibiotics in developed and developing countries.[4] In European countries and the United States, 23-38% of in-patients are given some kind of systemic antibiotic treatment. Antibiotics take the lead among most commonly used drugs in Turkey and account for

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20% of the drug market.[5] Unfortunately, 20-50% of antibiotic treatment is used irrationally. In India the sale of antibiotics is on the rise with 40-60% increase observed over last five years.[6] The fact that one of the most important causes of acquiring antibiotic resistance is the lack of rational antibiotic use has been reported in many studies and has taken its place in the literature as evidence. Inappropriate use of antibiotics leads to some undesired effects such as an increase in mortality and morbidity, drug toxicity and interactions, extended periods of hospitalization, and an increase in expenditures.[7] This problem has been largely observed in developing countries through inappropriate prescribing habits, over interested desires to treat every infection children are mostly suffering from. The present study was designed to determine the antimicrobial utilization pattern in a tertiary care hospital and to ascertain the resulting treatment consequences in a selected pediatric in patients and also intensive care unit.

Materials and Method

This work was a prospective, observational and cross sectional study conducted in the department of paediatrics in collaboration with department of pharmacology, Kalinga Institute of Medical Sciences (KIMS), Bhubaneswar, a tertiary care hospital of Eastern Odisha, in the duration of March to August 2018. This hospital is a 1750 bedded teaching and super speciality hospital. In this study paediatric patients aged 1month-14 years admitted to IPD & PICU prescribed with antibiotics were included.

All the consecutive cases those were eligible for the study during the study period within 6 months was taken into consideration. Institutional ethical committee approval was obtained from hospital and parents given consent were included in the study.

Properly designed form sheet was used for data collection. It includes socio-demographic and clinical characteristics of pediatric patients as well as patterns of antimicrobial utilization during the study period. The format includes degree of polypharmacy of all drugs and antimicrobials in particular, dosage regimen, route of administration, prevalence of single and combination antimicrobials, and prevalence of disease states to which antimicrobials were prescribed, among others.

The collected data were compiled, tabulated and entered in Microsoft Excel 2014. The statistical analysis of data is done by STATA 15.1(College Station, TX: StataCorp LLC). Descriptive statistics followed by cross tabulation was employed to pro- vide the frequency and percentage distributions of the vari ables included in the study. The result was presented using tables, figures, and pie charts.

Results

Figure 1 shows the use of antimicrobials in pediatric ward and PICU patients. A total of 133 patients were selected in the study period rceived antibiotics during their hospital stay. It shows that ceftriaxone alone and in combination with other antibiotics were most commonly prescribed (71.4%) antibiotics. Piperacillin Tazobactum & Cefpodoxime were prescribed in 9.8% of cases each. Ciprofloxacin (1.5% cases), Co-amoxyclav (3% cases) were used in minimally.

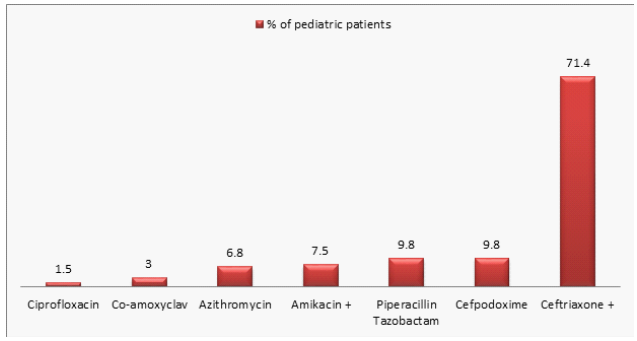

Figure no. 1 : Use of anti-microbials in pediatrics ward and pediatric intensive care unit (n= 133)

(+) denotes in combination with other anti-microbials.

Figure 2 shows the organ system involvement of the pediatric patients. Gastrointestinal system is involved in 27.8% of cases followed by 21% cases where systemic infection prevailed. Less commonly involved systems were respiratory (12.8%) and Cetral Nervous System (11.8%). Skin was least commonly involved in 1.5 % cases.

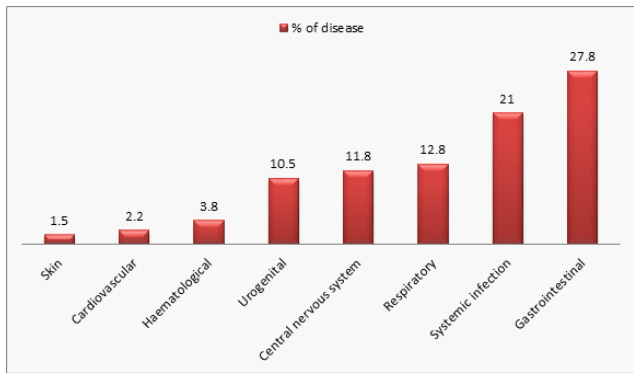

Figure. 2: Morbidity pattern of pediatric inpatients and pediatric intensive care unit (n=133)

As Shown in Figigure 3 maximum number of children belong to 1-5 years age groups (45%) followed by 6-10 years age groups in 23% of cases. Children less than 1 year age group and 11-14 years constitute the lowest (16%) among all cases.

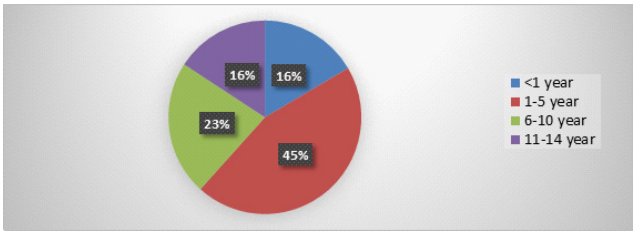

Figure no.3 : Age distribution of patients

Table 1 shows distribution of patient in relation to route of antibiotic administration. Maximum patients (82.7%) were administered intravenous antibiotics whereas only 4.5 % cases administered with oral antibiotics.

Table 1 :Patient distribution regarding route of administration of antibiotic

Route of Antibiotic administration	No. of patient
IV	110 (82.7%)
Oral	06 (4.5%)
Both	17 (12.8%)

Table 2 shows maximum patients (70%) received antbiotic monotherapy, 27% cases received 2 antibiotics and only 3% cases were on 3 or more number of antibiotics.

Table 2: Patient distribution regarding number of antibiotics received

No. of Antibiotic	No. of patient
1	93 (70%)
2	36 (27%)
≥3	04 (3%)

Table 3 shows maximum no of patients i. e. 70.67% were admitted in the hospital for 1-7 days. The duration of hospital stay was 8-15 days in 18.8 % cases. Only 4.5 % of children stayed in the hospital for more than one month.

Table3: Distribution of duration of stay in hospital

Number of days	No. of patient	Percent (%)
1-7	94	70.67
8-15	25	18.79
16-30	8	6.01
≥31	6	4.51

Discussion

Antibiotics are most commonly prescribed and effective drugs which are used to treat microbial infections. The present study was conducted in the department of paediatric IPD (In-Patient Department) & PICU (Paediatric Intensive Care Unit), KIMS, Bhubaneswar between March to August 2018. A total number of 133 patients of 1mo -14 years were included comprising of 120 IPD and 13 PICU patients.. We compared the demographic profile of our patients with that of other studies done in pediatric population in regard to the antibiotic utilization.

The present study shows the percentage of female patients (61.6%) was more than the male patients (38.4%), whereas other previous studies had shown the males majority.[8-11] This may be due to perceived male child bias has grasually changing in the society due to increase female lireracy and education. Also a study by Laya et al had stated that the equal ratio of males and females indicate the current trend equality of both sexes.[12]

As evident from this study , the maximum number of paediatric patients belonged to the age group of 1-5 years followed by the group of <1 year which were 45.11% and 16.54% respectively.This may be due to immature immunity system in the age group of 1-5 years, which made them more prone to infections. Our finding was similar compared to some other studies.[8]

In this study, most frequent clinical indication for which antimicrobials were prescribed was gastro intestinal tract infection i.e. 27.82% followed by systemic infection with fever 21.05% which was similar to the study done by Shivaleela et. Al.[8] Another study had shown that most frequent infection was respiratory tract infections.[12] As our study was conducted during the

months of winter and summer season, GI tract infections were more prevalent.

The study shows the use of antibiotics were accounting 22.32% of prescriptions in IPD and PICU. A study conducted in Nagpur in 2008 which included paediatric outpatient prescription of 500 in a Bombay tertiary care hospital showed antibiotics constituted 79% per prescription.[13] However a study done by Sunil Krande et. al showed the use of antibiotic per prescription to be 39.6%.[14] Its an indication that antibiotic stewardship program in this institute has an impact on antibiotics prescription.

Table 4: Comparision of our study with other studies in regards to number of drugs and antibiotics used

Study	No. of drugs used	No. of antibiotics used
Our study,2018	5.55±2.24	1.24±0.49
Shivaleela et. al, 2014	4.26	2.13
Gizework et. al, 2015	1.70±0.93	1.45±0.59

Table 4 shows the average number of drugs prescribed per patients was 5.5 and average number of antibiotics prescribed per patients was 1.2. But the studies showing result on average number of drugs and antibiotics as per patient was less from our studies.[8,9] The WHO recommends that the average number of drugs per prescription should be less than two.[15] In present study this number is more than two, so it indicates polypharmacy. The average number of drugs per prescription value should be low as possible to prevent the unfavorable outcomes of polypharmacy such as increased risk of drug interactions, increased cost of therapy, non-compliance and emergence of resistance in case of use of antimicrobials. Since these patients were treated in tertiary care hospital & some of them were critically ill, therefore number of drugs used was more. On the other hand our study showed average no of antimicrobial was 1.2. Therfore rational antimicrobial therapy has been followed in the studied institute.

As per the study of Achalu et.al, 22.8 % cases prescribed with single antibiotic, and two antibiotics were prescribed in 51.5% cases.[10] In our study the single antibiotic was prescribed in 70% cases. Multiple antibiotics were prescribed in 28.6% patients according to study of Shivaleela et. al and this was comparable to the study of Choudhury et. al (29%). [8,16]. Out of 30% of cases having more than 2 antibiotics only 3 % cases had three or more antibiotics were used. In present study, most common route of antibiotic administration was found to be I.V route (82.7%) followed by oral route (4.5%). The same study done by Shivaleela et. al and Tadesse et. al.[8,10] This study was conducted on admitted cases, so most common route of administration was I.V route.

According to our study, the mean duration of stay in hospital was 9.5 which was nearby similar to the study of Srivastava et.al (7.3) and Roy et. al (6.3) and also it was compared to Gupta et. al (5.28) and Rasheed et. Al (4.5).[17-20] It may be due to 14 patients who stayed for more than 20 days because of chronic illness like tuberculosis, post encephalitis sequelae and cerebral palsy leading to increase in hospital stay as compared to other studies. But in majority (89%) of children had average duration of hospital stay was around 7 days.

Our study will be of help to develop evidence based medicine with high quality information in the health care facilities. Further, standard treatment guidelines may be developed like in CMC Vellor for antimicrobial uses in adults.[21] Similar guidelines may be developed to treat paediatric patients. This will minimize the off level use of medicines for pediatric use which is very wide spread in India.[22] Research questions relevant to India getting especially on antimicrobial resistant is lacking.Our study will be of help in evidence based guidelines for making for treatment of pediatric patients.

Limitations of the study:

This study was conducted for period of 6 month extending from March to August 2018. As the study was not conducted by full year as a result the seasonal variations in paediatric illness was not documented.

Conclusion

The most cause of hospitalization in our set up is due to gastrointestinal diseases and the antibiotics used frequently is ceftriaxone. Efforts need to be undertaken towards continuous education of doctors on judicious antibiotic use, as well as ensuring compliance with existing guidelines. Improvement in the availability of rapid diagnostic methods to discern viral from bacterial infections may help reduce the numbers of empiric therapies in favor of pathogen-targeted therapeutic treatments.

Conflict of Interest – None

Source of Funding- Self

Ethical Clearance – Yes

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