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Assessment of Antibiotic Prescribing Pattern in Paediatric Department: An Observational Hospital Based Study

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ABSTRACT

Background: Frequent irrational use of antibiotics has merged out to antimicrobial resistance to a significant proportion globally, which has led to momentous mortality, morbidity and healthcare costs. To overcome this issue there is a need to inculcate institutional protocols based on rational standard guidelines (WHO). **Aim:** To evaluate the quality of prescribing pattern of antibiotics by health care providers and to find out other associated factors in the inpatient department of paediatrics at a tertiary care teaching hospital. **Methods:** An observational and prospective study was carried out in a tertiary care teaching hospital in Coimbatore, India. A total number of selective 200 paediatric inpatients were included in the given study for a period of six months. Patient's demographics were recorded in a prestructured and validated data collection form. These data were then analysed for various drug use parameters using indicators based on standard protocol. **Results:** Around 3.02 drugs were prescribed per encounter which was higher as per WHO standard which is 2.0. The present study shows that the encounters with antibiotics was 57% (n=114), which were also relatively higher than the standards. Among 200 antibiotic prescriptions, 22.5% of the drugs were prescribed using generic names and 96.9% of the drugs were prescribed as per the essential drug formulary list. Respiratory infections (21%) and gastrointestinal infections (18%) were the most common diagnoses. Cephalosporins (38.96%) were the most frequently used antibiotic in our study. **Conclusion**: As per the WHO guidelines, standard surveillance system is required in all hospital setups at all levels. Effective interventions are required to reduce inappropriate antibiotic prescriptions.

INTRODUCTION

Antibiotics were found to be the most prevalent drugs prescribed for children[1]. Antibiotics are double edged sword and can give rise to antimicrobial resistance if used injudiciously and may endanger many patient's lives[2]. Irrational overuse of antibiotic medications have been noted in both developed and developing countries with around 50-85% of them receiving antibiotics. All together about 29% of the children and infants due to immature immune system are mainly susceptible to infections worldwide. Initial moonlight on first antimicrobial resistance was noted during 1948 and today each known pathogen have become resistant to one or more antimicrobials[3]. Arguably the greatest impact of antimicrobial resistance was noted in low income countries due to high rates of infections and fewer choices of antibiotics[4]. Indiscriminate and irrational drug use have become a biological global threat[5].

Need for newer antimicrobial are in great demand as even the reserved category of drugs are also been used in high proportion due to increased resistance to the previous line of drugs. The circumstances have emerged due to limited data availability on profiles of antibiotic usage and proper selection of antibiotics and non-standardised indications for individual antibiotic. There is an increasing need to involve implementation of parent education, public awareness creation and sensitisation of health care professionals as a part of antimicrobial resistance control measures. A proper multi-disciplinary approach through proper navigation will be useful to overcome the present threats of antimicrobial resistance around the globe[6].

The rationality of prescribing pattern is also one of the important factor to be kept under surveillance as improper prescribing habits such as overuse, underuse and misuse can lead to health hazards, unsafe treatments, exacerbation of infections leading to increased economic burden on the patients. The following factors gives a clear portrait on irrational use such as polypharmacy, use of antimicrobials even in non-bacterial infections, inadequate dose or course, self medications and non-compliance to dosage regimen[7].

To combat this global challenges rational prescribing pattern should be revolutionised. But unfortunately, uptake of this concepts has been very slow, as only fewer countries have developed a good antimicrobial stewardship promoting policies[8]. One such antimicrobial stewardship has been developed by the WHO in the form of indicators to detect barriers in prescribing[9]. These indicators are commonly used as standards in drug utilisation studies

and serve as a platform to measure the performance of the health care providers at primary levels in prescribing antibiotics[10]. The purpose of this study was to evaluate the quality of prescribed paediatric antibiotics by continuous monitoring of prescriptions by analysing a selected category of children by comparing with standard indicators at the population level.

MATERIALS AND METHODS:

a) Study area and study period:

An observational and prospective study was carried out at a tertiary care teaching hospital, India for a period of six months. The institutional ethics committee approval (Ref: SRH/EC.11-16/2017-18) was obtained to conduct the study.

b) Study population

Randomly 200 patients were taken, around 13 years of age of both the genders admitted in the paediatric ward department after obtaining the informed consent from the respective parents. They were briefly explained about the study nature. Children previously diagnosed with severe birth defects or with severe side effects to antibiotics were exempted from the study. Confidentiality was assured and maintained throughout the study.

c) Data collection and diagnostic criteria

Patients were enrolled for the study group from the day of admission till the day of discharge. As it provided the complete details on the antimicrobials used during the stay and also about the final diagnosis. A pre-tested, semi-structured schedule was used for interviewing the study subjects. Data collectors and lead researchers carried out the data collection based on the interviewer-administered questionnaire. All the patient demographic details such as the diagnosis, laboratory values, sensitivity patterns, antibiotics prescribed and clinical conditions were manually extracted and recorded on a structured and piloted form with an individual record number. The quality of the data collected and the extracted information were verified by co-investigators on regular basis. The WHO prescription indicators were used to analyze the prescription such as the number of antibiotics prescribed per patients, types of prescription (polytherapy or monotherapy), percentage of fixed drug combination and commonly prescribed antibiotics. Data were evaluated and tabulated using Microsoft Excel 2007.

RESULTS:

A total of 200 randomly selected paediatric patients were reviewed during the study period. Among these patients group, the highest number of patients were in the age group of 1-3 years (42%) and lowest proportion was found in 8-13 years age group (4%) [Table1]. Gender incidence analysis showed almost equal proportion between males (52%) and females (48%) [Table 1].

On estimating the prescriptions based on the WHO prescribing indicator an average of 3.02 drugs were prescribed per patient encounter which was relatively higher than the WHO standards. One or more antibiotics were prescribed with 57% (n=93) of all patient encounters. 22.5% of the antibiotic prescriptions in our analysis used the drug's generic name. And around forty six percent of prescriptions were given in injection form. The percentage of drugs prescribed from the essential drug formulary list was high in our study [Table 2].

As per the final clinical diagnoses 46.5% of the children were admitted for bacterial cause of their illness like respiratory infections (21%) and gastrointestinal disorders (18%) [Table 3]. Among the other systemic illness, the children were admitted for viral fever (19%) and other non-bacterial causes. As outlined in Table 4, out of 114 drugs prescribed 70.77% were broad spectrum antibiotics followed by 29.33% of narrow spectrum antibiotics. In our study cephalosporins(38.96%), β-lactam (28.53%) and aminoglycosides (26.34%) were the most commonly prescribed antibiotics in the paediatric department. Fixed dose combinations were quantified in around 13.1% of the prescriptions. During the study, antipyretic drugs (30.37%) were the highly encountered drug followed by antibiotics (23.54%), multivitamins (16.96%), anti-emetics (4.8%) and anti-epileptic (3.79%).

In our analyses, we could find that 72% of the prescriptions were with single antibiotics and only a small proportion of the prescription (21%) could be identified with more than one antibiotics. Most of the drugs (n=586) were given in the form of injection (46%) which was relatively high in number when compared with other dosage forms such as syrups and tablets. Sensitivity pattern of antibiotics were carried out in this study and it revealed that *S.aureus* was resistant to cotrimoxazole and *E.coli* was resistant to ceftriaxone and cefotaxime respectively.

During the follow up process around 13 cases of ADR were reported with amikacin, ceftriaxone, amoxicillin-clavulanate and cefixime. Mostly vomiting, diarrhoea and rashes

were the commonly identified ADRs. Few prescriptions (n=38) were also identified with drug interaction accounting with 18.4% major interaction, 73.6% with moderate interaction and 10.7% with minor interactions.

Table No. 1: Baseline demographics of the study sample

Characteristic	No of patients (n=200)	Percentage (%)
Age		
>12 years	36	18
1-3 years	84	42
4-7 years	72	36
8-13 years	8	4
Gender		
Male	104	52
Female	96	48

Table No. 2: World Health Organization (WHO) prescribing indicators estimated from the paediatric department

WHO prescribing indicator	Average percentage	WHO standard(%)
Average number of drugs per encounter	3.02	1.6-1.8
Percentage of an encounter with an antibiotic prescribed	57	20-26.8
Percentage of encounters with an injection prescribed	46	13.4-24.1
Percentage of drugs prescribed by generic name	22.5	100
Percentage of drugs prescribed from essential drug formulary	96.9	100

Table No. 3: Distribution of diagnoses in the paediatric department

Diagnoses	No of patients (n=200)	Percentage(%)
Respiratory infections	42	21
Gastrointestinal infections	36	18
Urinary tract infections	27	13.5
Viral fever	38	19
Seizures	13	6.5
Asthma	21	10.5
Injuries	7	3.5
Others	16	8

Table No. 4: Distribution of all antibiotics prescribed in the paediatric department

Antibiotic class	Proportion prescribed (n=114)	Percentage(%)
Broad spectrum agents		
Cephalosporin	45	38.96
β-lactam	34	28.53
Fluoroquinolones	3	2.19
Sulfonamide	2	1.09
Narrow spectrum agents		
Aminoglycosides	30	26.34
Metronidazole	3	2.19
Macrolides	2	1.09
Glycopeptides	1	0.54

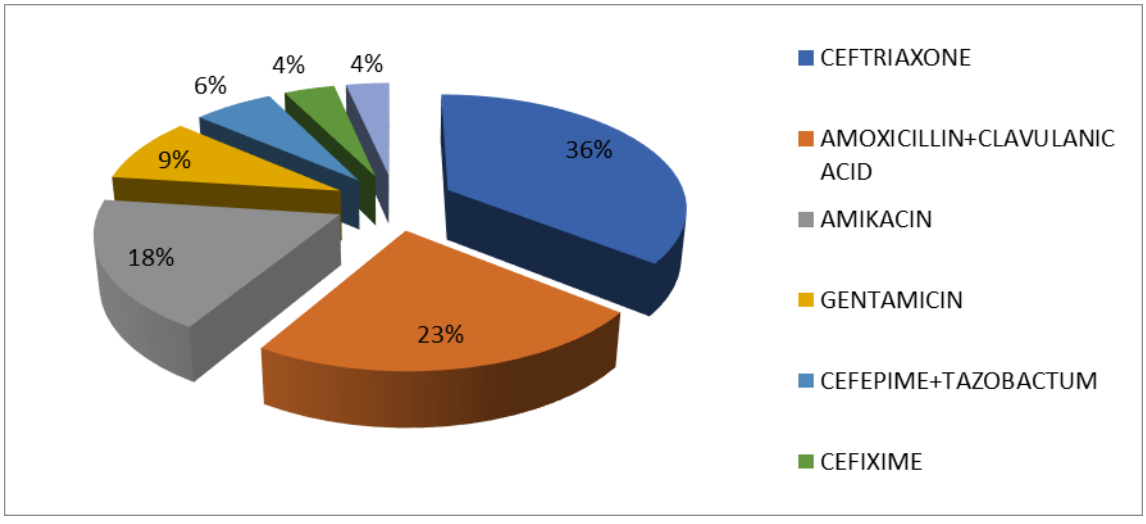

Figure No. 1: Single antibiotics encountered per prescription (n=72)

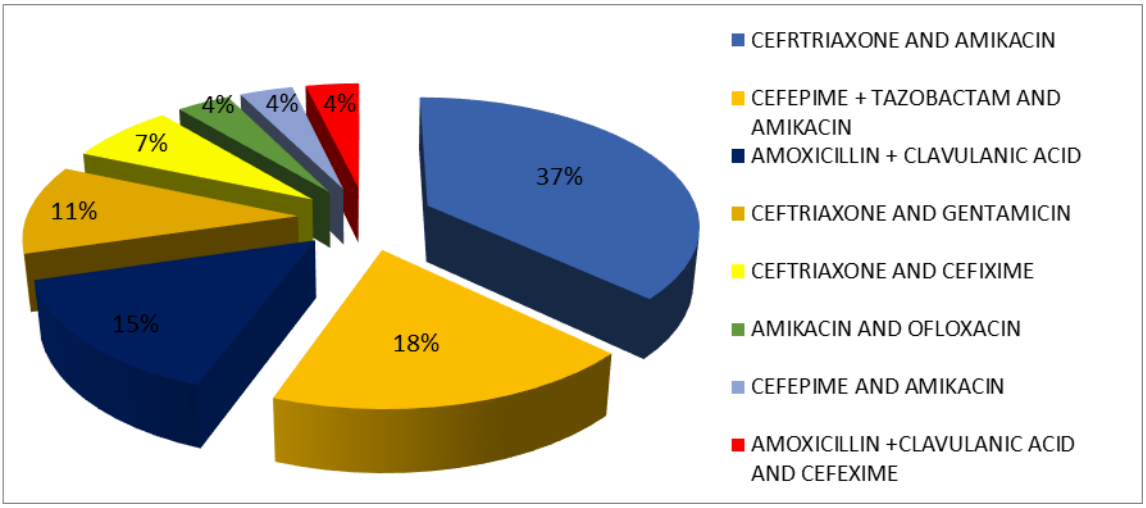

Figure No. 2: Multiple antibiotics encountered per prescription (n=21)

DISCUSSION

As per the WHO recommendations, there is need for standard monitoring system to access antibiotic use at local as well as at national levels. There has been a growing incidence in the level of antibiotic resistance and data's are found to be reportingly high in the developing countries. Hospital guidelines or any standard organization guidelines are necessary for effective monitoring of antibiotic use and identification of resistant strains in every hospital. In our study out of 200 children, 46.5% of the paediatric patients have received antimicrobial therapy. Mostly children between the age of 1-3 years received antibiotics more frequently than other age group children and our results could be correlated with studies carried out in Guyana where these similar age groups were found to receive antibiotics more frequently than other age category[(1)].

The prescribing patterns of the antibiotics were compared with WHO prescribing indicators which suggested high number of drugs were prescribed per patient. The WHO standard for the average number of drugs encountered per patient is 2.0 and rates higher than this suggests polypharmacy. As our observed value was higher than the WHO standards but our results showed similar values to the previously published drug utilization studies from Jordan and Saudi Arabia[(11,12)]. 57% of the encounters with one or more antibiotic prescribed were identified and was above the value of mentioned standards indicating a need for measure to control the antibiotic overuse. But our value remains much better when compared with other developing countries such as Sudan (81.3%) and Nigeria (71.1%)[(13,14)]. Adherence to the use of generic drugs was slightly low in our studies, this was due to practice of writing branded

drugs in the prescription. Prescribing generic medicine was suggestive as they were cheaper and equally potential. As outlined in table.2, 46% of the prescribed drugs were given in the form of injections, which was double the value of the specified WHO standards. This can lead to non-compliance in paediatric population. Use of the formulary list encourages the prescribers to select cost effective antibiotics and drug appropriate for local resistance and disease prevalence patterns. In our study, 96.9% of the drugs were used from the formulary list. Not in all countries, this standards are maintained, it varies from Nigeria[14] (60.4%) to 100% in the United Arab Emirates[11].

The most common diagnoses, for which the antibiotics were prescribed were respiratory infections (21%) and gastrointestinal infections (18%) which was in par with results from Guyana[1]. In a study done by Bharathiraja et al, nearly 80% of children with acute respiratory infections and acute diarrhoeal disorders received antibiotic therapy in Chennai[15]. Most of the antibiotic prescriptions were based on the clinical observation rather than the culture and sensitivity test. Ceftriaxone, amoxicillin-clavulanate and amoxicillin were the most frequent drugs used against LRTI, AGE and URTI as these agents could have been effective in these conditions and also may be due to the availability of the drugs. These results were supported with other studies carried out by Choudhhury DK and Gupta et al, which also showed similar category of antibiotic use in India[16,17]. It is important to select antibiotics based on the proper specimen examination and culture sensitivity test as these can prevent antibiotic resistance and minimize the cost of therapy.

System wise analyses have shown that 46% of the drugs are in injectable forms which needs to be reduced as per WHO recommendations, so as to reduce the complications related to injectables. In our study, we identified 13 cases of ADRs associated with amikacin, ceftriaxone, amoxicillin-clavulanate and cefixime, which can uniquely be found in this study. Mostly vomiting, diarrhoea and rashes were the commonly identified ADRs. Our study also screened all the drugs for interactions and mostly drugs of cephalosporins and aminoglycosides class showed increased interactions with other category drugs, which specifies that while using antibiotics close monitoring and skin patch test should be done before administration. The use of antibiotics should be cautiously used in epilepsy patients as most of the antibiotics can aggravate the seizure activity.

However keeping in context the results of this study, we recommend that broad spectrum antibiotics should be used limitedly and narrow spectrum antibiotics use should be increased

in paediatric population. Culture and sensitivity test practice should be followed which would benefit in lowering the antibiotic resistance pattern. Use of essential drug formulary should be strengthened and proper indications should be specified for use of various antibiotics.

CONCLUSION

As per the WHO guidelines, standard surveillance system is required in all hospital setups at all levels. Effective interventions are required to reduce inappropriate antibiotic prescriptions. The professional organizations should carry out timely survey and projects to analyse and provide awareness to the physicians and health care providers through systemic approach.

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Ethical approval: *The study was approved by the Institutional Ethics Committee (SRH/EC.11-16/2017-18).*

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