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Research Article

DRUG UTILIZATION EVALUATION OF ANTIBIOTICS IN THE DEPARTMENT OF PAEDIATRICS IN COMPLIANCE WITH THE WHO PRESCRIBING INDICATORS

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ABSTRACT

Objective: The objective of this study is to analyze the drug utilization pattern of antibiotics according to the World Health Organization (WHO) prescribing indicators at an outpatient department of pediatrics.

Methods: This is a prospective observational study conducted in an outpatient department of pediatrics in a private hospital located in Telangana, India. Study data were obtained from patient prescriptions and direct interview of the caretaker/patient.

Results: Data have been collected from 295 pediatric patients, out of which 177 were male, the highest number of patients was reported in the age group of 1–4 years. Most of the patients presented with lower respiratory tract infection, acute gastroenteritis, and fever. Most of the prescriptions included ceftriaxone, amoxicillin + clavulanic acid, and quinolones among antibiotics.

Conclusion: Most of the prescriptions were in accordance with the essential list of medicine for children given by the WHO, but the number of drug-drug interactions in the prescriptions were significant, which can be simply prevented by following standard therapeutic guidelines and by establishing a role of clinical pharmacist in the hospitals.

Keywords: Pediatrics, World health organization prescribing indicators, Lower respiratory tract infections, Acute gastroenteritis, Drug-drug interactions.

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INTRODUCTION

Pediatrics is the branch of medicine dealing with the development, diseases and disorders of children. Rapid growth and development occur in the period of infancy and childhood. Drug therapy is considered to be a major component of management among pediatrics [1].

The World Health Organization (WHO) defines drug utilization study as "the prescription, distribution, marketing, and use of the drug in society, with special emphasis on the resulting medical, social and economic consequences [2]. Drug utilization evaluation is an authorized, ongoing systematic quality improvement process, designed to optimize drug use by developing criteria and standards, to educate clinicians and other health-care professionals (HCP), to increase appropriate drug use, to provide feedback of results obtained during study to clinicians and other HCP, and to analyze prescription pattern [3].

Indian population comprises about 40% children. Infants and children frequently suffer from non-serious illnesses. Most of these illnesses are self-limiting and are often treated inappropriately using multiple drug therapies [4,5]. Due to the differences in pharmacokinetics and pharmacodynamics among infants and children, these populations are extremely vulnerable to the harmful effects of drugs [6]. An antibiotic is a type of antimicrobial substance active against bacteria; hence, antibiotic medications are widely used in the treatment and prevention of bacterial infections [7,8]. They might be bactericidal or bacteriostatic. There are a limited number of antibiotics which also possess additional antiprotozoal activity [9,10].

There is a rapid emergence of resistant bacteria worldwide, which endangers the efficacy of antibiotics, which have transmogrified medicine and saved many lives [11-16]. The irrational use of antibiotics causes destruction of microflora and leads to the emergence of multidrug-resistant microorganisms, and clinical symptoms such as toxic megacolon and pseudomembranous colitis. All these account for serious infections in the outpatients [17]. This irrational use has led to the development of "super bugs," which further leads to the use of more combination of antibiotics and causing fear among the experts about future availability of antibiotics; therefore, an effective step must be taken for rational use of antibiotics especially in the pediatric population [18].

As per the research conducted by global antibiotic resistance partnership, India estimates neonatal deaths to be about 190,000 each year due to infections, of which antibiotic resistance is responsible for over 30% [19]. To promote rational use of drugs antibiotic prescription guidelines has to be followed. "Antibiotic guidelines are defined as a set of standard guidelines based on local culture sensitivity data for the treatment of infectious diseases" [20].

According to the WHO, the rational use of drugs is the use of the right drug given at the right dose at the right time at the lowest possible cost. "Rational use of drugs is all about prescribing medications appropriate to meet the clinical needs of patients, in doses that meet their own individual requirements for an adequate period of time, at the lowest possible cost [21]. The assessment of drug utilization is vital for clinical, educational, and economic purposes [22]. Most of the reported drug utilization studies have been carried out in adult patients with only a few being reported from pediatric patients [23].

Aim and objectives

The aim and objective of this study are to analyze the drug utilization pattern of antibiotics according to the WHO prescribing indicators at an outpatient department of pediatrics.

METHODS

Study design
This was a prospective observational study.

Study site
This study has been conducted in 2016 in an outpatient department of pediatrics of a private hospital located in Telangana, India.

Study duration
The study duration was 6 months.

Inclusion criteria
All the pediatric patients under the age of 16 years who visited the pediatric outpatient department of the hospital were included in the study.

Exclusion criteria
All the inpatients and the patients over the age of 16 years were excluded from the study.

Source of data
Study data were obtained from patient prescriptions and direct interview of the caretaker/patient.

Sample size
Tha sample size was 295 pediatric patients.

Study procedure
Prescriptions of pediatric outpatients were reviewed prospectively for antibiotics.

RESULTS

Description of results
Fig. 1 shows that in the present study of 295 pediatric patients about 177 were male and 118 were female. There is a clear dominance of the male population. Table 1 shows that the highest number of patients was reported in the age group of 1–4 years (156 patients), followed by 5–8 years (65 patients), <1 year (36 patients), 9–12 years (34 patients), and 13–16 years age group reported the least number of patients (4 patients). Fig. 2 shows that most of the patients were diagnosed with lower respiratory tract infection (LRTI), followed by acute gastroenteritis, fever, urinary tract infection (UTI), and upper respiratory tract infection (URTI) (Others include – Common cold, Cough, Dyspepsia, Flatulence, Nausea, and Vomiting) Table 2 suggests about 284 antibiotic prescriptions were made in this study. Among them, cephalosporins were prescribed in 97 patients who are highest, followed by penicillins, macrolides, fluoroquinolones, and aminoglycosides which were given in 82, 48, 44, and 13 patients, respectively. Table 3 reports that among 97 cephalosporin prescriptions, ceftriaxone was prescribed in 60 patients which is highest, followed by cefotaxime and cefpodoxime which were given in 21 and 14 patients, respectively, while cefixime was given in only two patients which is lowest. Table 4 shows among 82 penicillin prescriptions, combination of amoxicillin + clavulanic acid was prescribed in 67 patients which is highest, followed by plain amoxicillin and ampicillin which were given in 9 and 6 patients, respectively. Table 5 reported that among 284 antibiotic prescriptions, LRTI accounts for the highest number of antibiotic prescriptions (66), followed by URTI (65), UTI (32), G.E (20), and fever accounts for least, i.e., 17 antibiotic prescriptions. Table 6 shows in the present study of 295 patients, a total number of 1041 drugs were prescribed; among them 5 prescriptions were prescribed with

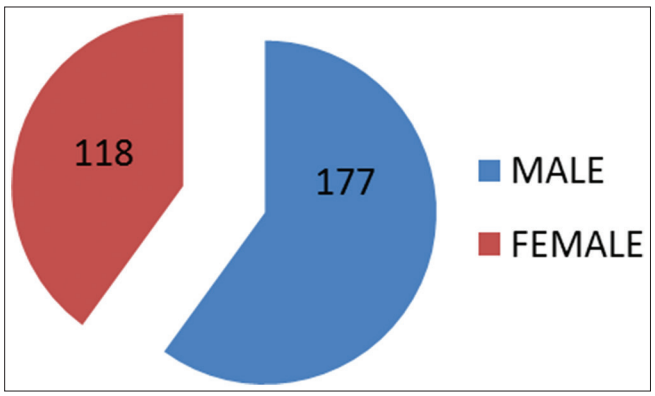

Fig. 1: Gender distribution of the study population

Table 1: Age distribution of study population

Age (years)	No. of patients
<1	36
1–4	156
5–8	65
9–12	34
13–16	4

Table 2: Type of antibiotics prescribed

Antibiotic	No. of prescriptions
Cephalosporins	97
Penicillins	82
Fluoroquinolones	44
Macrolides	48
Aminoglycosides	13
Total	284

Table 3: Break up of cephalosporins

Antibiotic	n (%)
Ceftriaxone	60 (61.85)
Cefotaxime	21 (21.64)
Cefixime	02 (2,06)
Cefpodoxime	14 (14.43)

Table 4: Break up of penicillins

Antibiotic	n (%)
Amoxicillin	09 (10.9)
Ampicillin	06 (7.31)
Amoxicillin+Clavulanic acid	67 (81.70)

Table 5: Distribution of antibiotics based on disease

Disease	Amoxa	Amp	ceftri	Cefot	Cefi	Cefpo	Quin	Macro	AGs	A+C	Total
LRTI			28	02		06	10	8		12	66
URTI	08	05	14		02	08	12	3		13	65
G.E			2				4	6		8	20
UTI							12	11	3	6	32
Fever			6							11	17
Others	01	01	10	19			6	20	10	17	84
Total	09	06	60	21	02	14	44	48	13	67	284

Amox–Amoxicillin, Amp–Ampicillin, Ceftri–Ceftriaxone, Cefot–Cefotaxime, Cefi–Cefixime, Cefpo–Cefpodoxime, Quin–Quinolones, Macro–Macrolides, AGs-Aminoglycosides , A+C–Amoxicillin+Clavulanic acid. LRTI: lower respiratory tract infection, URTI: Upper respiratory tract infection

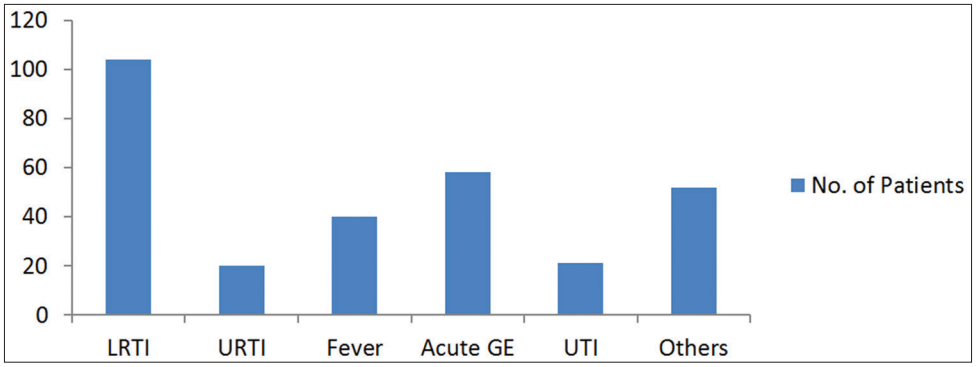

Fig. 2: Distribution pattern of diseases

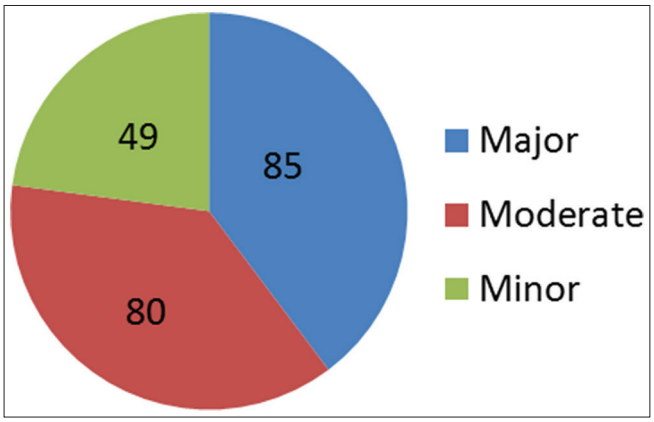

Fig. 3: Categorization of drug-drug interactions

only 1 drug, 56 prescriptions were given with 2 drugs, 106 prescriptions were prescribed with 3 drugs, 62 prescriptions were given with 4 drugs, 38 prescriptions were given with 5 drugs, and 28 prescriptions were prescribed with 6 drugs. As shown in Fig. 3, there were about 214 (72.5%) drug-drug interactions found in this study; among them, 39.7%, 37.3%, and 22.8% were major, moderate, and minor drug-drug interactions, respectively.

DISCUSSION

In the present study of 295 pediatric patients about 177 were male and 118 were female, similarly in a study conducted by Chavda *et al*. indicated among 630 patients, maximum of 391 were male and 239 were female [24], compared to another study conducted by Maheshwari *et al*. reported that the number of male patients (62%) was comparatively more than the number of female patients (38%) [25]. In our study, the highest number of patients was reported in the age group of 1–4 years (156 patients) followed by 5–8 years (65 patients), this is quite similar to a study conducted by Chavda *et al*. which states the maximum patients 253 (40.16%) belonged to age group 1–5 years [24].

In this study, majority of patients were presented with LRTI (104 patients) followed by acute gastroenteritis (58 patients), which complied with a study conducted in Kathmandu valley by Palikhe reported a greater number of children were having Pneumonia, Meningitis [26] and in another study conducted by Chavda *et al.* indicated majority of patients were admitted in the pediatric ward for acute gastroenteritis (31.90%), followed by pneumonia (22.38%) [24]. The reason for this could be the high prevalence of these infectious diseases among children. In the present study of about 284 antibiotic prescriptions; cephalosporins (ceftriaxone – 60, cefotaxime – 21, and cefpodoxime – 14) were prescribed in most of the patients, followed by penicillins (amoxicillin + clavulanic acid – 67), macrolides (48), which is in contrast to a study conducted by Maheshwari *et al*. stated the most common category of antibiotic prescribed is aminoglycosides (48%), cephalosporins (14%),

Table 6: Distribution based on number of drugs per the prescription

No. of prescriptions (n=295)	No. of drugs (n=1041)
5	1
56	2
106	3
62	4
38	5
28	6

fluoroquinolones (7%), and macrolides (2%) [25], whereas in a study conducted by Shankar *et al*. in Western Nepal reported that ampicillin, cefotaxime, and gentamicin were the most commonly prescribed antibiotics [27], compared to another study conducted in Eastern Nepal by Rauniar *et al*. stated that gentamicin, ampicillin, crystalline penicillin, and cefotaxime were the most commonly prescribed antibiotics [28].

In the present study, there were 284 antibiotic prescriptions; among them, LRTI accounts for the highest number of antibiotic prescriptions (66), followed by URTI (65), UTI (32), G.E (20), and fever (17). In our study, ceftriaxone (cephalosporin) is the most prescribed antibiotic for respiratory tract infections which is followed by amoxicillin + clavulanic acid, and quinolones are given for UTIs. In this aspect, our study is in quite a resemblance with a multi-centered study conducted by Malpani *et al.* indicated that amoxicillin + clavulanic acid was commonly prescribed for respiratory tract infections, and fever in both the hospitals followed by cephalosporins and azithromycin was prescribed for few respiratory tract infections and for fever whereas quinolones are prescribed for UTIs and other infections in both the hospitals [18]. Compared to another study conducted by Ashraf *et al*. suggested that the use of a combination of amoxicillin + clavulanic acid was 40.74% [29]. The reason for most antibiotic prescriptions of cephalosporin and amoxicillin + clavulanic acid could be their broad spectrum of coverage against microbes as recommended by Centre for disease control [18].

In our study, there were about 214 (72.5%) drug-drug interactions; among them, 39.7% were major, 37.3% were moderate, and 22.8% were minor. In a study conducted by Malpani *et al*. stated 84.61% moderate and 15.38% minor drug interactions [18]. In another study conducted by Gopal *et al*., there were about 12.07% possible drug-drug interactions [30]. Most of the antibiotic prescriptions in our study were in accordance with the 4th List of WHO Model of Essential Medicines for Children [31].

To ascertain the degree of poly-pharmacy, the average number of drugs prescribed per prescription was calculated using the WHO prescribing indicators. In the present study of 295 patients, a majority of pediatric patients were prescribed with 3–4 drugs per prescription, this is quite similar to a multi-centered study conducted by Malpani *et al*. which states that majority of prescriptions contained 2–3 drugs in both the hospitals [18], whereas another study by Chavda *et al*. reported that the majority of children were prescribed 5–6 drugs [24]. According to the WHO prescribing indicators, the average number of drugs per prescription was

found to be 3.5 in our study. In contrast as per the study conducted by Senthilselvi *et al.* (2019), an average number of drugs per prescription was 4.29 [32]. Similarly, a study conducted in Kathmandu valley by Palikhe indicated that 5.01±1.36 drugs were given to children on an average [26]. Similarly, another study conducted by Chavda *et al.* reported that the average number of drugs per encounter was 5.58 in their study [24]. Our study complies with a study conducted by Ashraf *et al.* which reported the average number of drugs per prescription was 3.46 [29] and another study by Sunil *et al.* reported that the average number of drugs per prescription was found to be 3.59 in their study [33].

CONCLUSION

Antibiotics play a key role in the treatment of infectious diseases especially those caused by bacteria. In the modern world, antibiotic resistance is the major cause of concern in the treatment of bacterial infectious diseases. The emergence of resistant bacterial strains or simply antibiotic resistance can happen due to irrational use of antibiotics which includes poly-pharmacy, inappropriate dosing, and selection of antibiotics with an insufficient spectrum of activity.

In the present study, majority of antibiotics prescribed were ceftriaxone, amoxicillin + clavulanic acid and quinolones and as per the WHO prescribing indicators, the average number of drugs per prescription was 3.5 in this study. Although most of the prescriptions were in compliance with the Essential List of Medicine for Children given by WHO, there were about 214 drug-drug interactions found in this study. This shows that there is a need for every hospital to follow standard therapeutic guidelines and to establish Pharmacy and Therapeutic Committee and an Infection Control Committee to work efficiently and to prevent medication-related problems. In addition, there is a strong need for the development of a working clinical pharmacy department in hospitals, which could not only bring a drastic change in the treatment pattern but also prevent medication errors to a great extent.

AUTHORS CONTRIBUTIONS

None.

CONFLICTS OF INTEREST

None declared by all the authors.

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ACRONYMS:

WHO – World Health Organization
DUE – Drug Utilization Evaluation
OPD – Out Patient Department
HCP – Health Care Professional
GARP - Global Antibiotic Resistance Partnership
LRTI – Lower Respiratory Tract Infection
URTI - Upper Respiratory Tract Infection
GE – Gastro-Enteritis
UTI – Urinary Tract Infection
PTC – Pharmacy and Therapeutics Committee
MRPs – Medication Related Problems.