ORIGINAL ARTICLE

Evaluation of antibiotic prescribing pattern in pediatrics in a tertiary care hospital

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ABSTRACT

Background: The irrational use of antibiotics is a global issue and it can lead to morbidity, mortality, and increased health care costs. Hence, proper use of antibiotics is imperative and should be included in the pharmaceutical care plan. **Objective:** The objective of this study was to evaluate the prescribing pattern of antibiotics for children using WHO core prescribing indicators. **Materials and Methods:** A prospective, observational study was carried for 6 months in the pediatric department at a tertiary care hospital, Pune. The WHO prescribing indicators were used to evaluate the prescriptions, and the ideal WHO range was considered as a determining factor for rational prescription. **Results:** A total of 302 patients were included in the study, with a mean patient age of 4.92 ± 4 years. The average number of drugs per encounter was 6.12 (WHO standard is less than 2). The percentage of antibiotics prescribed was 26.3% with an average of 1.63 antibiotics per prescription. Of the 493 antibiotics, 85.59% were injectable which is higher than the WHO standard of 13.4–24.1%. A near-optimal value of 99.59% antibiotics was prescribed from the hospital formulary which is similar to WHO standards, and the antibiotics prescribed with generic names were 25.76%. The most common class of antibiotics prescribed were cephalosporins and penicillins. **Conclusion:** Polypharmacy, high injectable use, and non-adherence to generic prescription were common in our tertiary care center. Continuous audits, training, and new treatment protocols are recommended.

Key words: Antibiotics, pediatrics, rational prescribing, prescribing pattern, WHO prescribing indicators

INTRODUCTION

Antibiotics play a crucial role in the management of infectious diseases.[1] The inevitable result of the extensive use of antimicrobials gives rise to the development of antimicrobial-resistant pathogens, creating an increase in demand for new drugs. An upward trend in the antimicrobial resistance and, concomitantly, the decline in the development of new antimicrobials have impacted the public health and economy. Judicious selection of antimicrobial agents requires proper clinical judgment and a thorough understanding of microbiological and pharmacological factors.[2] Therefore, rational prescribing practices can resolve the global issue of antibiotic overuse and misuse.[1]

Irrational drug use is a serious global problem and can pilot its course towards morbidity, mortality, and economic burden on the health-care system.[3,4] World Health Organization (WHO) has reported that over half of all drugs are either inappropriately administered, dispensed or sold.[5] India has reported 37% of inappropriate antimicrobial use.[4]

Information on drug administration has fallen behind in children and infants than that of adults for various reasons. These include developmental differences that affect the drugs'

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pharmacodynamic and pharmacokinetic profiles, ethical and financial reasons, research capability, and regulatory guidelines and constraints.[6] Worldwide, inappropriate antimicrobial use in pediatrics has been noted as a common practice. A study conducted in the pediatric population in the USA and Canada has indicated an inappropriate antibiotic use of 50% and 85%, respectively.[7] The incidence of medication errors in infants and children is higher than in adults.[6] Research reports on children have pointed towards a high mean number of drugs of 5.5.[8]

Proper choice of antibiotics is a complex process that needs careful clinical judgment. WHO has composed a set of core drug use indicators, which assess the performance of prescribers, patients' knowledge and experience at health-care facilities and effective functioning of health-care personnel. This evaluation will boost the development of standards for prescribing, single out the problems associated with the understanding of instructions provided by consultants to the patients, and even minimize the financial burden on patients.[9]

Proper information about antibiotic usage pattern and the pressing need to curtail resistance has become an absolute necessity for a constructive approach to the problems arising due to the inappropriate use of antibiotics, especially among the pediatric population.[10]

Presently, with limited local data in the prescribing trends in the pediatric population, our study will provide baseline data about prescribing habits of the physicians and play a role in clinical education and economic purposes.

METHODS AND MATERIALS

Study setting and design
The study was a prospective observational study conducted at a tertiary care hospital in Pune, Maharashtra for a period of 6 months (October 2018 to April 2019). Patients admitted between the age group of 1 month to 18 years receiving one or more than one antibiotic were recruited in the study.

Ethical approval
The study was initiated after the ethical approval of the Institutional Ethics Committee of Bharati Vidyapeeth Deemed University Medical College (REF: BVDUMC/IEC/10). A written consent and assent form was obtained in both English and Marathi before the participation of subjects in the study.

Data collection
The data recorded to assess the prescription pattern included demographic details, clinical diagnosis, and antibiotic prescription data. The antibiotic class, route of administration, and duration of therapy were also noted.

WHO prescribing indicators
The obtained data were quantitatively analyzed using WHO prescribing indicators:

1. Average number of drugs per patient encounter
2. Percentage of encounters with an antibiotic prescribed
3. Percentage of antibiotics with an injection prescribed
4. Percentage of antibiotics prescribed with generic name
5. Percentage of antibiotics prescribed from the hospital formulary

Statistical analysis
Descriptive statistics, in the form of frequency, percentage, mean and standard deviation were computed.

RESULT

Patient characteristics
A total of 302 pediatric patients receiving antimicrobial therapy were included in the study. Of these, 196 were males (64.56%) and 106 (35.09%) were females with a mean age of 4.92 ± 4 years [Table 1].

The prevalence of respiratory system related infections was the highest, 112 (37%), followed by gastrointestinal infections, 49 (16%) [Table 2]. Cephalosporins were the most common class of antibiotic prescription (45%), followed by penicillins (27%) [Table 3].

Considering the duration of therapy, of the 493 antibiotics, more than half of the patients received antibiotics for 1–6 days (351, 72%) followed by 7–14 days (140, 28%) with a mean duration of 5.90 ± 3 days.

WHO prescribing indicators
A total of 1851 drugs were prescribed with an average of 6.12 drugs per patient. The percentage of antimicrobials prescribed was 26.63 with an average of 1.63 per prescription. Most of the antibiotics were targeted at respiratory tract infections. Of the 493 antibiotics prescribed, 85.59% were injectable, 25.76% were prescribed with generic name and 99.59% of antibiotics were prescribed from the local hospital formulary [Table 4].

DISCUSSION

The findings of our study highlight the crisis of inappropriate prescribing pattern in the country. Given that the costs have to be borne by the patients, the burden of this irrational prescribing falls on the patient.

The average number of drugs per prescription is an important indicator of a prescription audit.[11] An average number of 6.12 drug per patient encounter in this study signifies the presence of polypharmacy. Polypharmacy is prescribing more drugs than that are clinically indicated or necessary.[12] The ideal WHO standard value for average drugs per encounter is 1.6–1.8.[13] Inconclusive diagnosis or pressure on physicians to prescribe drugs for minor symptoms leads to an increased risk of adverse effects, drug interactions, administration errors, development of antimicrobial resistance, and increased cost.[14] In addition, treatment of patients with multiple conditions was also

instrumental in polypharmacy. In contrast to our study, the average number of drugs in Sudan and Nigeria were observed at 2.0 and 2.6, respectively.[15,16] However, a study conducted in India and Nepal reported similar findings.[17,18]

The number of antibiotics prescribed has been within the model WHO range of 20–26.8%.[13] Although there was a higher prevalence of bacterial infections, the study site portrayed the prudent use of antibiotics; a practice which should be acknowledged by other health care centers. The results of our study were similar to the study conducted in Nigeria (28.2%).[16] The numbers were higher in Sudan (81.3%) and UAE (44.6%), and the lowest percentage of antimicrobial use was found in Saudi Arabia (18.5%). A contrasting result obtained from different countries could be owing to the differences in prevalence rates of infectious diseases, socioeconomic and cultural background, understanding of antibiotic resistance patterns, prescriber's knowledge and skill to diagnose diseases.[4]

The use of injectable in our study was much higher than the acceptable range of 13.4–24.1%.[13] An excessive use of injectable may lead to a higher probability of blood-borne diseases, development of complications, and increased costs.[19] But with limited availability of oral formulations in pediatrics, poor compliance towards oral therapy and emergent action in severe conditions are the few reasons associated with the increased prescription of injectable.[20] In contrast to our study, India reported a 2.6%, Nigeria (10.2%), and Sierra Leonne (21.1%).[12,21,22] The findings of our study corresponded with an Ethiopian study (84.33%).[2]

This study identified a male predominance (64.56%), the results of which have corresponded with the studies conducted in India, Sierra Leone, and Ethiopia.[12,23-25] It paints an unclear picture of the reason behind male predominance over the study period, but previously published studies conducted in India have pointed towards the preference of the male child and selective priority over care for children.[23,24] This study also found a higher rate of antibiotic use in the age group of 1 month–12 months (31.78%). It could be a reflection of higher susceptibility of infections below the age of 1 and suggests that infant health should be a health care priority.

Table 1: Demographic characteristics of pediatrics

Variables		n (%)
Sex	Male	196 (65%)
	Female	106 (35%)
Age groups (years)	1 month—12 months	96 (32%)
	13 months—2 years	42 (14%)
	2 years—5 years	73 (24%)
	6 years—11 years	62 (21%)
	12 years—18 years	29 (10%)

Table 2: Distribution of illness in pediatrics

Cases	n (%)
Respiratory system	112 (37%)
Gastrointestinal infection	49 (16%)
Urinary tract infection	31 (10%)
Blood infection	24 (8%)
Skin and soft-tissue infection	15 (5%)
Surgical cases	16 (5%)
CNS infection	12 (4%)
Bone infection	6 (2%)
Other condition	37 (12%)

Table 3: Distribution of antibiotic class in pediatrics

Antibiotics	n (%)
Cephalosporins	224 (45%)
Penicillins	133 (27%)
Macrolides	36 (7%)
Nitroimidazoles	28 (6%)
Glycopeptides	21 (4%)
Aminoglycosides	15 (3%)
Tetracyclines	12 (2%)
Carbapenem	8 (2%)
Quinolones	6 (1%)
Lincosamides	4 (0.81%)
Oxazolidinones	2 (0.40%)
Folate inhibitor	2 (0.40%)
Carboxylic acid	2 (0.40%)

Table 4: WHO core prescribing indicators

Indicators	Percentage (n)	Standard (%)
Average number of drugs per encounter	6.12 % (1851)	<2
Percentage of antibiotics prescribed	26.63 % (493)	20–26.8
Percentage of antibiotics with an injectable	85.59 % (422)	13.4–24.1
Percentage of antibiotics with generic names	25.76 % (127)	100
Percentage of antibiotics prescribed from hospital formulary	99.59 % (491)	100

The prevalence of respiratory tract infections was higher and previously established Indian studies conducted by Pradeepkumar *et al.*[3] and Mukherjee *et al.*[10] displayed a similar pattern of diagnosis. The probable cause could be poverty, unhygienic sanitation practices, and environmental exposure and children living in poorly developed areas.

Cephalosporins and penicillins were the leading classes of antibiotics prescription. Our findings appeared similar with Pradeepkumar *et al.*[3] Cephalosporins and Penicillins are the mainstay therapy of infectious diseases, and higher prescription rate could attribute to its broad spectrum of activity, clinical efficacy, and tolerance across all age groups.[26]

This study revealed the mean duration of antibiotic therapy as 5.90 days ± 3 days with similarities observed with Mali *et al.*[27] (6.08 days±6.27 days).

WHO recommends an optimal value of 100% in prescribing drugs by generic name, while our study presented with only 25.76%.[13] Physicians have grown accustomed to the practice of prescribing branded drugs. Generic prescribing has been recognized to be much simpler, minimize dispensing errors, facilitates coordination and transparency between health-care providers and clients, as well as being comparatively cheaper than branded drugs.[19] In contrast to our study, the finding was as low as 2.6% in India, to a value as high as 71% in Sierra Leone and an optimal 100% in UAE.[1,12,28] Inconsistency in the findings of various studies could relate to prescribers' faith on branded products, extensive promotional activities by the pharmaceutical companies, or a lack of strict regulation to prescribe generics.[20]

The percentage of antimicrobials prescribed from the hospital formulary was 99.41%, and the proposed optimal value by the WHO is 100%. A stark similarity was found in a study performed in UAE (100%), and a distinct result was seen in a Nigerian study (60.4%).[22,28] Rational prescribing means prescribing drugs from the essential drug list (EDL) or hospital formulary provided by WHO because the medicines in the EDL are older, less expensive than the newer drugs and have already been tested with proven clinical use. However, an insufficient supply of EDL drugs allows the physicians to prescribe non-EDL drugs.[26]

The limitation of this study includes that it is purely an observational study. There were no qualitative components added to determine the appropriateness of the prescribed drugs. The justification of the prescribed drug with regard to laboratory evaluation and the specific diagnosis was not considered. Therefore, these lacunas should be addressed in further studies.

CONCLUSION

This study gives an overview of prescribing pattern of antibiotics in children in our tertiary care center. The prescribing pattern of antibiotics shows deviation from WHO standards suggesting that the use of antimicrobial therapy be closely monitored as the use of injectable medications were higher. However, the percentage of antibiotics were rational and the prescription adhered with the drug formulary. It is recommended that continuous education and training programs for physicians about rational prescribing with injectable and generic prescription be conducted. Further, we recommend that clinical pharmacists should be appointed at all wards to oversee the prescribing pattern and make necessary valid suggestions when the need arises.

Conflicts of interest
There are no conflicts of interest.

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