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Original Article

Antibiotic Prescribing Pattern in Paediatric Emergency Department at Tertiary Care Teaching Hospital in Nepal

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ABSTRACT

Background and Objectives: The indiscriminate use of antibiotics often results in an increased incidence of adverse drug reactions (ADR), suboptimal therapy, treatment failure, polypharmacy and most importantly, the emergence of antibiotic resistance. Thus, the objective of this study was to assess the paediatric emergency department, antibiotic prescribing pattern at a tertiary care teaching hospital, Universal College of Medical Sciences (UCMS), Bhairahawa, Rupandehi, Nepal.

Material and methods: A prospective, cross-sectional, observational study was carried out on 152 paediatric patients of ages between 2 months to 12 years at the paediatric emergency department of UCMS. The data were collected by reviewing the prescription paper, and the required information was recorded using a structured data collection sheet prepared for study. The prescribing pattern was assessed through the World Health Organization (WHO) prescription indicators using the WHO Children Formulary 1993 AD.

Results: This study revealed that out of 152 patients, average number of drugs prescribed was 5.13 and antibiotic per patient was 2.10±.540. Antibiotics were prescribed at least once for 93.4% of patients. Drugs prescribed from Essential drug list (EDL) was 46.46% and that encountered with injectable was 92.1%. There was a significant difference between the patients age group and the number of drugs prescribed ($\chi 2$ = 21.553, p = 0.010). The mean duration of antibiotic treatment was 6.95±3.145. Cephalosporin's (36.6%) followed by aminoglycosides (28.8%) were most frequently prescribed antibiotics.

Conclusion: Multiple courses of antibiotics are most frequently prescribed, which could increase antibiotic resistance in future. Continuous audits, training and new treatment protocols should be developed for prescribing and using antibiotics in paediatric patients.

Keywords: Antibiotic prescribing pattern, Antibiotic resistance, Paediatric, 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 antimicrobial resistance and the decline in new antimicrobials have impacted public health and the economy greatly. 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].

Information on drug administration has fallen behind in children and infants than that of adults for various reasons, like developmental differences affecting the drug pharmacodynamics and pharmacokinetics, ethical and financial reasons, research capability, and regulatory guidelines and constraints [3]. Worldwide, inappropriate antimicrobial use in paediatrics has been noted as a common practice. A study conducted in paediatric population in the USA and Canada has indicated an inappropriate antibiotic use of 50% and 85%, respectively [4]. The incidence of medication errors in infants and children is higher than in adults. Research reports on children have pointed towards a high mean number of drugs of 5.5 [5].

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 healthcare facilities and effective functioning of healthcare personnel. This evaluation will boost the development of standards for prescribing, signal out the problems associated with the understanding of instructions provided by consultants to the patients, and even minimize the financial burden on patients [6].

Proper information about antibiotic usage patterns and the pressing need to curtail resistance has become an absolute necessity for a constructive approach to the problems arising due to inappropriate use of antibiotics, especially among the paediatric population [7].

Prescription pattern monitoring studies (PPMS) promotes the appropriate use of antibiotics and other drugs. PPMS guides and supports other prescribers, dispensers, and other general public on the proper use of drugs, collaborate and develop working relationships with other organizations to achieve a rational use of drugs.

Paediatric is the branch of science dealing with medical care and treating diseases associated with infants and children [8]. Antibiotics are essential for treating the frequently prescribed infection and are routinely practiced in the paediatric department [9]. Antibiotic are one of the most successful chemotherapies in the history of medicine. They have saved many lives and significantly contributed to control many infectious diseases that were the leading cause of human morbidity and mortality. During the golden era of antibiotic development, most of the antibiotics were isolated by soil-derived actinomycetes. In the 20th century, one of the leading physicians, who bore witness to prebiotic and antibiotic eras, described the discovery and development of antimicrobial drugs as "awesome acquisition power" for physicians and patients [10]. The discovery of antibiotics helped drop the death rates by infectious disease from 797 per hundred thousand in 1900 to 36 percent in the 1980s, bringing 20-fold improvements. Antimicrobial resistance is today's most significant challenge

for global public health. Although it has saved millions of lives, poverty, ignorance, poor sanitation, hunger and malnutrition, inadequate access to drugs, poor and inadequate health care systems, civil conflicts, and bad governance in developing countries have limited the benefits of these drugs on controlling infectious diseases [11]. The number of infections caused by antibiotic-resistant bacteria is growing to outpace the new antibiotics rate. The duration of hospitalization and the cost of treatment is increased. When conditions become resistant to first-line antibiotics, more expensive, second-line therapies must be used. Antimicrobial's resistance offers a barrier to control infectious diseases that rely on only antimicrobials as a strategy for control and prevention [12]. Prescription is a general formula for the preparation and administration of the drug. The prescribing pattern study infers monitoring, evaluating, and suggesting medications in the practitioners prescribing habits to make patient care reasonable and effective [13]. A guideline for writing a good prescription involves the patient's name, age, address with or without hospital case number indicating the date and name of the drug-using generic name instead of brand name, specifying dosage form, frequency, duration treatment [14]. Adequate clinical trials in child patients lack, mainly because of cost, responsibility, and regulations that frequently act as obstacles. Only a few clinical trials involving children focused on the drug's efficacy and rarely monitored their safety, making it troublesome to watch medication errors and ADR [15].

It necessitates antibiotic use, monitoring by examining the prescribing trends in clinical settings and the associated ADR, which will serve as baseline data for formulating the standard treatment guidelines to promote rational drug use. Evaluation of antibiotic prescribing patterns will also help minimize ADR as children are more susceptible to them, and it shall also provide cost-effective care [16].

MATERIAL AND METHODS

The prospective, cross-sectional, observational study was conducted in the Paediatric Emergency Department of Universal College of Medical Sciences (UCMS), a tertiary care teaching hospital. In this study, a total of 152 paediatric patients from May 2018 to October 2018 (six months) of age above two months and below 12 years of both male and female, were included to determine the antibiotic prescribing pattern. Data was collected by reviewing the prescription, and required information was recorded using a structured data collection sheet prepared for study. The collected data was checked, verified and then entered into the datasheet. Before starting the study, ethical clearance was taken from the Institutional Review Committee (IRC Registration No. UCMS/IRC/100/18), and ethical permission was taken from individual paediatric guardians/parents. After that, the prescribing information was collected from their prescription slip.

To evaluate the conditions of the services offered to the population concerning medication, we used the World Health Organization (WHO) developed Medication use indicators, including Prescription indicators which are as follows:

a) The average number of drugs per prescription.

b) Percentage of drugs prescribed by generic name.

c) Percentage of antibiotics prescribed.

d) Percentage of drugs prescribed from essential drug list or formulary.

e) Percentage encountered with injectable.

Data analysis: The collected data was filled in MS Excel and was analyzed using SPSS 20. Analysis was based on descriptive statistics (Means and percentages) and the Chi-square test.

RESULTS

Out of the 152 patients, 81 (53.3%) were males, and 71 (46.7%) were females. Patients were classified into four age groups in this study. The patients average age was 5.57±4.41 as depicted in Table 1.

Table 1: Socio-demographic data of paediatric patients.

Demographic	N=152 (%)
Gender	
Males	81 (53.3%)
Females	71 (46.7%)
Age in Years	
<1	36 (23.7%)
1-5	54 (35.5%)
>5-10	28 (18.4%)
>10-12	34 (22.4%)

The different WHO prescribing metrics for opioid trend tracking studies are shown in table 2. The total number of medications prescribed per patient was 5.13 out of 152 prescriptions, which is higher than the WHO standards 2. In contrast to WHO normal rating of 100%, 44.42% and 46.46% of medications were prescribed by generic names and from important drug lists, respectively. Similarly, 93.4% of prescriptions were encountered with antibiotics, and injectable prescribed were 92.1%.

A total of 274 antibiotics were prescribed to the patients, and the average number of antibiotics per prescription was 2.10 ± .540. In this study, 12 (8.4%) patients received one antibiotic, two antibiotics in 106 (74.1%), three antibiotics in 23 (24.1%) and four antibiotics were prescribed to only 2 (1.4%) patients of all cases. Since the null hypothesis was rejected, there exists a significant difference between the age group of patients and the number of antibiotics prescribed ($\chi 2 = 21.553$, $p = 0.010$). The data is expressaed in table 3, but there is no significant relationship between gender and the number of antibiotics prescribed ($\chi 2 = 6.940$, $p = .074$).

Table 3 Pediatric in- patient exposure to antibiotics

Number of antibiotics per patients	Number of prescriptions (%)	Total number of antibiotics prescribed
1	12 (8.4%)	12
2	106 (74.1%)	212
3	23 (24.1%)	69
4	2 (1.4%)	8
Total antibiotics per patients Mean ± SD	**143 (100%) 2.10±.540**	**301**

Table 4 reveals, that the mean duration of antibiotic therapy was 6.95±3.145 days. The maximum number of antibiotics, 72(23.92%), were given for eight days of duration of treatment, while the minimum number of

Table 2: Prescribing indicators for paediatric patients (n=152)

Prescribing indicators	Value obtained	WHO standards
Average number of drugs prescribed	5.13	2
% of drugs prescribed with generic name	44.42%	100%
% encountered with antibiotics	93.4%	<30%
% of drugs prescribed from EDL	46.46%	100%
% encountered with injectables	92.1%	<10%

antibiotics 1(0.33%) was given for one day of duration for the treatment. Here, it rejected the null hypothesis, and there was a significant difference between the duration of antibiotic prescribed and the number of antibiotics prescribed ($\chi2 = 54.338$, $p = 0.011$).

Table 4 Duration of antibiotic treatment with respect to number of antibiotics prescribed

Duration of antibiotics treatment (days)	No of antibiotics prescribed (%)
1	1 (0.33%)
2	6 (1.99%)
3	6 (1.99%)
4	45 (14.95%)
5	27 (8.97%)
6	45 (14.95%)
7	2 (0.66%)
8	72 (23.92%)
9	13 (4.31%)
10	26 (8.63%)
11	20 (6.64%)
12	38 (12.62%)
Mean ± SD	**6.95± 3.145**

Different drug combinations were prescribed in different paediatric emergency cases. The most common diagnosis for which drugs were prescribed was pneumonia (32.2%), followed by epilepsy (7.9%), enteric fever (7.2%), and meningitis (5.27%), as listed in the table 5. There was a significant difference between the age group and diseases encountered ($\chi2 = 89.061$, $p = .000$).

Figure 1, shows the prescribing pattern of different antibiotics to paediatric patients of this study. Amikacin (27.9%) was the most frequently prescribed antibiotics followed by combination of ceftriaxone and tazobactam (14.1%), vancomycin (12.8%), cefotaxime (12.4%), ceftriaxone (8.1%), combination of piperacillin and tazobactam (7.7%), flucloxacillin (5%), azithromycin (3.4%), ceftriaxone (3%), clindamycin (2%), metronidazole (2%), metronidazole (2%), and tobramycin (0.3%).

Out of 779 prescribed drugs, solution form was found in the highest frequency 349 (44.8%), followed by nebulizers 133 (17.1), tablets 129 (16.5%), syrup/ oral drops 123 (15.8%) and capsules 25 (3.2%), whereas the least prescribed drug dosage form was cream/powder/ointment 20(2.6%) as expressed in figure 2.

Table 5 Distribution of all diagnosis with age group seen in the paediatric emergency department, for which prescriptions were provided (n= 152)

Diagnosis	<1 years	1 – 5 years	>5 – 10 years	> 10 – 12 years	Total (%)
Undiagnosed	2	1	0	4	7 (4.6%)
Pneumonia	21	19	3	6	49 (32.2%)
Dehydration	1	1	2	5	9 (5.9%)
Hepatitis	0	1	0	3	4 (2.6%)
Malaria	0	3	0	2	5 (3.3%)
Encephalopathy	0	2	2	3	7 (4.6%)
Epilepsy	0	6	6	0	12 (7.9%)
Enteric fever	1	6	2	2	11 (7.2%)
Abscess	0	3	1	0	4 (2.63%)
Typhoid	0	1	3	1	5 (3.3%)
Meningitis	2	5	1	0	8 (5.27%)
Sepsis	0	0	1	2	3 (2%)
UTI	0	0	3	1	4 (2.63%)
Combination	4	1	0	3	8 (5.27%)
Others	5	4	4	3	16 (10.5%)

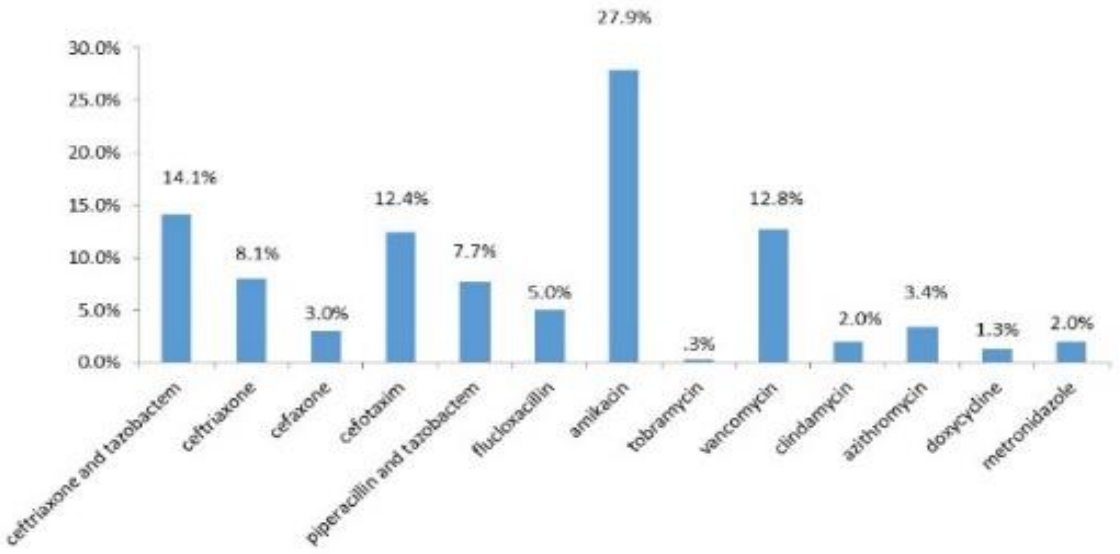

Fig 1: Prescribing pattern of different antibiotics to pediatric patients

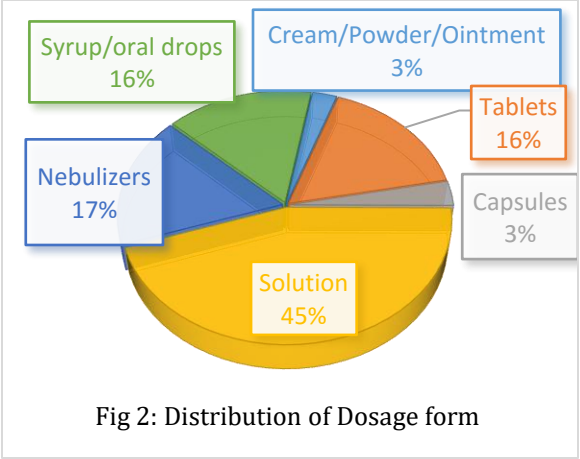

Fig 2: Distribution of Dosage form

DISCUSSION

The average number of drugs per prescription is an important indicator of a prescription audit [17]. An average number of 6.12 drug per patient encountered in this study signifies the presence of polypharmacy. Polypharmacy is prescribing more drugs than that are clinically indicated or necessary [18]. The ideal WHO standard value for average drugs per encounter is 1.6-1.8 [19].

In our study, the total number of male paediatric patients was 53.3%, and the female paediatric patients was 46.7%. Similar findings were found in the study conducted by Chaudhary DK and Bezrahuah BK et al. (2013), where 58.3% were male paediatric patients and 41.7% were female paediatric patients [9]. The dominant age group was 1-12 years paediatric patients, in contrast to the study conducted in a Paediatric hospital in Kathmandu valley by Palikhe et al. (2008) which showed infants less than 1 year received maximum antibiotic therapy [20]. The average number of drugs prescribed was 5.13, higher than the WHO standards 2, and in contrast to the studies conducted by LW Umar et al. (2018), which were 3.7 and 2.1, respectively [19, 21].

Out of 152 prescriptions, 93.4% and 92.1% were encountered with antibiotics and injectables, respectively, which were quite similar to the study conducted by Kanish et al. (2014) in which 91.6% prescriptions were encountered with antibiotics, and 92 % were encountered with injectables, respectively [16]. There was significant difference between

the age group and the number of antibiotics prescribed (p = 0.010), which is similar to the study conducted by Palikhe et al. (p = 0.0256). Generic prescribing was only 44.42% less than the WHO standard value of 100% and was also less than the study conducted at Northern Nigerian Teaching Hospital by Umar et al. (2018), which was 66.8% higher than the study conducted by K A Oshikayo, which was only 7.3% [14,21]. Only 46.46% of drugs are available in EDL, which contrasts the study conducted Northern Nigerian Teaching Hospital where the same value was 95.5 % [12].

The average duration of antibiotic therapy was 6.95 days, similar to 6.05 days of antibiotic therapy obtained by Chaudhary DK and Bezbaruah BK et al. (2013). The average number of antibiotics prescribed was 2.1, which is almost the same value of 1.9 obtained by Kanish R et al. [16].

In our study, among the various groups of antibiotics, cephalosporins (36.6%) were most frequently prescribed antibiotics followed by aminoglycosides (28.8%), and penicillins (12.3%). Whereas the study conducted at a tertiary care medical college hospital in Northern India had shown cephalosporins (39%), aminoglycosides (23%), flouroquinolones (11%) and penicillina (9.9%). Similarly, another study conducted in Gauhati Medical College and Hospital revealed cephalosporins (41.5%) were the most frequently prescribed antibiotics and other categories of antibiotics included penicillins (35.5%), and aminiglycosides (20%). Likewise, the study conducted in paediatric hospital of Kathmandu valley found the antibiotic prescribing pattern as cephalosporins (31.19%), penicillins (30.27%) and aminoglycosides (14.67%) [9, 16, 20].

For individual antibiotics, amikacin (27.9%) was the mostly prescribed, followed by a combination of ceftriaxone and tazobactem (14.1%), vancomycin (12.8%), cefotaxim (12.4%), ceftriaxone (8.1%), and a combination of piperacillin and tazobactem (7.7%). In another study, amikacin (87.7%) was mostly prescribed, followed by a combination of amoxicillin and clavulanic acid (20%) and ofloxacillin (52.5%). Similarly, it was found that amoxicillin and ceftriaxone (35%), ceftriaxone (29%), and amikacin (17%) were prescribed in the study conducted in Gauhati Medical College and Hospital [9,16].

Pneumonia was the most frequently found disease among paediatric patients, which comprises 32.2%. Similar findings were found in Gauhati Medical College and Hospital and Paediatric Hospital of Kathmandu Valley, where the most frequently diagnosed disease was pneumonia comprising of 15.15% and 24%, respectively [9,16]. Amikacin/cefotaxim were the most frequently used antibiotics for pneumonia, amikacin /ceftriaxone and tazobactem for epilepsy, enteric fever, and vancomycin for meningitis and typhoid. Whereas the study conducted by Palikhe et al. in Paediatric Hospital of Kathmandu Valley found that benzylpenicillin and gentamycin/cefotaxime combination was most frequently prescribed antibiotics for pneumonia, ceftriaxone for enteric fever, and ceftriaxone in combination with chloramphenicol for meningitis [20]. There was a significant difference between the age group and disease encountered ($\chi 2 = 89.061$, p = .000) similar to the study done in Kathmandu valley hospital by Palikhe et al. ($\chi 2 = 42.95$, P=0.000).

CONCLUSION

Based on results obtained here, the antibiotic prescribing rate in the paediatric patient may

not always be appropriate in UCMS paediatric in-patient department. The rate of antibiotic prescribing was substantially higher. Since the null hypothesis was rejected, there is a significant difference between the age group of patients and the number of antibiotics prescribed ($\chi2 = 21.553$, $p = 0.010$), which concludes that neither of them is an independent one, they are associated with each other. But there are no significant relationships between gender and the number of antibiotics prescribed ($\chi2 = 6.940$, $p = 0.074$), concluding that they are independent of each other. It was found that the average number of drugs used exceeded, too higher than the WHO prescribing indicator value declaring extensive polypharmacy. Generic prescribing is the key indicator for cost-effective and rational use of drugs. Yet, most of the medicines were prescribed in brand names. Since excessive injectables were observed, consideration should be taken care of the syringes used to administer different antibiotics.

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