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PRESCRIBING PATTERN OF ANTIBIOTICS IN PEDIATRICS WARD OF HIWOT FANA SPECIALIZED UNIVERSITY HOSPITAL, HARAR, EASTERN ETHIOPIA

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ABSTRACT

Background: Irrational prescribing of drugs is the major health problem in medical practice resulting in ineffective treatment, development of antibiotic-resistant organism, adverse effects and economic burden on patient and society. The aim of the study was to assess prescribing pattern of antibiotics in pediatric ward of Hiwot Fana Specialized University Hospital (HFSUH). **Methods:** A retrospective study of all prescribing records in the pediatric ward of HFSUH from April 1/2012 to April1/2013 was conducted. All prescribing records were evaluated for the appropriate dose, frequency and duration of treatment. The WHO core prescribing indicators were assessed. **Result:** A total of 326 patient's medical cards with at least one antibiotic were reviewed. From this 142(43.6%) were female where as 184(56.4) were male. Crystalline penicillin was the most frequently prescribed antibiotic. Amoxclav was the least prescribed drugs for the pediatric patients. The maximum number of antibiotics concomitantly prescribed was five and the average number of antibiotics per patient was 2.1. **Conclusion:** In this study, irrational prescribing pattern of antibiotics was evaluated. From a total drug prescribed, antibiotics took 68.8%. This showed over prescribing of antibiotics when compared to standard WHO value.

KEYWORDS: Prescribing Pattern, Antibiotics, Pediatrics, Inappropriate Prescription, WHO Core Drug Use Indicators.

INTRODUCTION

Irrational use of drugs is a major health problem of present day medical practice and its consequences include ineffective treatment, unnecessary prescribing of drugs particularly antimicrobials and injections, development of antibiotic resistant strains, adverse effects and economic burden on both patients and society.[1]

Antibiotics were once considered 'miracle drugs' and have been used for decades to effectively treat a variety of bacterial infections. Unfortunately, widespread use and misuse worldwide have led to the emergence of 'super bugs' and other drug-resistant bacteria.[2] Excessive prescription of antibiotics is a common and constitutes a serious public health problem in particular due to increasing antibiotic resistance by common bacteria.[3]

Infants and children are among the most vulnerable population groups to contract illnesses. The use of antimicrobial agents, especially antibiotics has become a routine practice for the treatment of pediatric illnesses. However, there are also reports of an irrational use of antibiotics which may even lead to infections that are worse than the originally diagnosed ones. The pediatricians and other medical personnel who provide health care for infants and children in developing countries confront a number of challenges during the day-to-day practice of medicine due to the shortage of appropriate drugs and other facilities.[4]

Inappropriate prescription increases the cost of medical treatment and increases morbidity and mortality. The rational use of drugs requires the patients to receive medicines appropriate to their clinical needs, in doses that meet their own individual requirements, for an adequate period of time and at the lowest cost.[5]

Quality of life can be improved by enhancing standards of medical treatment at all levels of the health care delivery system. Setting standards and assessing the quality of care through performance review should become part of everyday clinical practice.[6] Primary health care practitioners have been shown to account for the majority of antibiotic prescribing. To prevent overprescribing, detailed data on antibiotic utilization should be obtained.[7]

Prescribing indicators are one of the core drug use indicators developed by WHO in collaboration with INRUD. These indicators can be used efficiently in many setting of drug use study to detect problems in drug prescribing such as polypharmacy, inclination for

branded products, over use of antibiotics or injections and prescribing out of formulary or essential drug list.[8]

Optimal and judicious selection of antibiotics for therapy of infectious disease requires clinical judgment and detailed knowledge of pharmacological and microbial factor. Antibiotics are used for the empirical, definitive and prophylactic therapy. When used as empirical or initial therapy, the antibiotic should cover all the likely pathogen because the infecting organism has not yet been defined. Definitive antimicrobial therapy should be instituted with narrow spectrum and low toxicity agent to complete the course of treatment.[9]

Several key considerations must be incorporated in decisions about the appropriate empirical use of antibacterial agents in infants and children. It is important to know the age appropriate differential diagnosis with respect to likely pathogens. This affects the choice of antimicrobial agents and also dose, dosing interval and route of administration. The pattern of antimicrobial resistance in the community and potential causative pathogen being empirically treated must be considered before choosing antibiotics.[10]

According to World Health Organization (WHO) rational drug use requires that patients receive medication appropriate to their clinical needs, in doses that meet their individual requirement, for an adequate period of time and at an affordable cost. Inappropriate use of medicine continues to be a wide spread problem in developing and transitional countries.[11]

The core prescribing indicators of the WHO measure the performance of prescribers.[12] The fact that the fate of infants and children is decided by parents or any other third party can have a negative impact on the provision of health care for them. The increasing use of antibiotics empirically and the prescription of unnecessary antibiotics has already been reported. The roles of health workers in the selection of antibiotics for pediatric patients are crucial.[13] This study mainly focused on assessing the prescribing pattern of antibiotics in pediatric ward of HFSUH.

MATERIALS AND METHODS

Retrospective study of prescribing pattern was conducted using patient medical cards based on WHO core drug use indicators. The study was conducted from April 1-30/2013 in HFSUH, Harar, Eastern Ethiopia. Medical cards of all pediatric patients who were taking at least one antibiotics in HFSUH from April 1, 2012 to April 1, 2013 were included in the

study. A total of 326 patients' medical cards were selected by systematic random sampling method to represent the appropriate population.

Before starting data collection and preliminary study, an official and approval letter was obtained from Institutional Research Ethics Review Committee of College of Medical and Health Sciences, Haramaya University and delivered to HFSUH. The confidentiality of the patients on the patient's medical card was secured by not using their names and card number in the data collection tools during data collection.

RESULTS AND DISCUSSIONS

Out of 326 Pediatric patients admitted to HFSUH between April 1, 2012 and April 1, 2013, 86(26.4%) were treated with at least one antibiotics.

Table 1 shows age & sex distribution of patients; and the most age group treated by antibiotics were 1-5 years which accounts 163(50.0%), where 75(23%) were females & 88(27%) were males. While the least age group treated by antibiotics was those of less than 1 month.

Table 1: Age & sex distribution of patients in pediatric ward of HFSUH, Harar, Eastern Ethiopia from April 2012- April 2013.

The ultimate goal of antibiotic therapy is to achieve rational and cost effective medical care particularly in developing countries. In this study, the total of 1008 drugs including antibiotics were prescribed to the total of 326 patients; out of which 693(68.8%) were antibiotics as shown in Table 2.

Table 2: Prescribing indicators among pediatric ward of HFSUH, Harar, Eastern Ethiopia, from April 2012- April 2013.

From the total of antibiotics, crystalline penicillin 117(16.9%) was the most frequently prescribed followed by gentamycin 106 (15.3%). Amoxiclav was prescribed for three patients. The most commonly prescribed antibiotics & their classes are presented in Tables 3 and 4, respectively.

Table 3: Most commonly prescribed antibiotics in pediatric ward of HFSUH, Harar, Eastern Ethiopia, from April 2012- April 2013.

Table 4: Most commonly prescribed classes of antibiotics in pediatric ward of HFSUH, Harar, Eastern Ethiopia, from April 2012- April 2013.

Combination of antibiotic therapy was common practice in HFSUH. Out of the total prescription, 140(42.9%) contains two antibiotics, 81(24.9%) contains three antibiotics, 15(4.6%) contains four antibiotics and 4(1.2%) contains five antibiotics as indicated in Table 5. Only 86(26.4%) patients were prescribed with one antibiotic. The average number of antibiotics per patient was 2.1.

Table 5: Number of antibiotics prescribed per patient in HFSUH, Harar, Eastern Ethiopia, from April 2012- April 2013.

Antibiotics were used for empirical, kinetic and prophylactic therapy in the setting, with the highest proportion (94%) for empirical therapy as shown in Figure 1. When used as empirical therapy, antibiotic should cover all the likely pathogen; because the infecting organism has not yet been identified.

Figure 1: Type of antibiotic treatment at HFSUH, Harar, Eastern Ethiopia, from April 2012-April 2013.

The optimal plasma concentration of antibiotics is crucial to maintain its effectiveness and safety. Frequency by which antibiotics prescribed is therefore very important to pay attention. Most antibiotics were prescribed in the frequency of twice per day (BID) and few antibiotics were prescribed in the frequency of once per day (QD). However, no frequency was indicated for 38(5.5%) antibiotics as indicated in Table 6.

Antibiotics are not effective if not used on the basis of specific type of infection in proper dose, frequency and duration. Antibiotic may be harmful and there is merely waste of money if not used properly. The dosage regimens indicated and not indicated for antibiotics prescribed at HFSUH is presented in Table 6.

Table 6: Dosage regimen of antibiotics prescribed in pediatric ward of HFSUH Harar, Eastern Ethiopia from April 2012 – April 2013.

AP - appropriate; IA - inappropriate; NI - not indicated

Drug interactions are some of the most common causes of adverse drug reactions. It may be additive, synergism, potentiation or antagonism. It is always important to note the possible drug interaction prior to concomitant drug administration. In our study setting, it was observed that there were cases of drug-drug interactions as shown in Table 7.

Table 7: Potential drug–drug interactions between some concomitantly prescribed drugs at HFSUH, Harar, Eastern Ethiopia, from April 2012- April 2013.

Table 1: Age & sex distribution of patients in pediatric ward of HFSUH, Harar, Eastern Ethiopia from April 2012- April 2013.

Age	F	M	Total	%
<1month	8	6	14	4.3
1month – 12month	38	71	109	33.4
>12 month - 5	75	88	163	50.0
6-15	21	19	40	12.3
Total	**142**	**184**	**326**	**100**

Table 2: Prescribing indicators among pediatric ward of HFSUH, Harar, Eastern Ethiopia, from April 2012- April 2013.

Prescribing indicators	No	%
Medical record analyzed	326	95%
Total drugs prescribed	1008	100%
Total antibiotics prescribed	693	68.8
Average number of antibiotic/encounter	2.1	-
Antibiotics prescribed by generic name	690	99.6%
Antibiotics with injection prescribed	484	69.8%

Table 3: Most commonly prescribed antibiotics in pediatric ward of HFSUH, Harar, Eastern Ethiopia, from April 2012- April 2013.

Antibiotics	Frequency	%
Crystalline penicillin	117	16.9
Gentamicin	106	15.3
Ampicillin	101	14.6
Amoxacillin	100	14.4
Ceftriaxone	81	11.7
Chlorampenicol	46	6.6
Cotrimoxazole	33	4.8
Metronidazole	28	4.0
Cloxacillin	27	3.9
Cephalexin	18	2.6
Erytromycin	12	1.7
Rifampicin+Ethambutol+ Isoniazid+Prazinamide	6	0.9
Benzanthine penicillin	6	0.9
Doxycicline	5	0.7
Tetracycline	4	0.6
Amoxclav	3	0.4
Total	**693**	**100**

Table 4: Most commonly prescribed classes of antibiotics in pediatric ward of HFSUH, Harar, Eastern Ethiopia, from April 2012- April 2013.

SN	Classes of antibiotics	Frequency	%
1	Penicillins	354	51.1
2	Aminoglycoside	106	15.3
3	Cephalosporins	99	14.3
4	Chlorampenicol	46	6.6
5	Sulfonamides	33	4.8
6	Nitroimidazole	28	4.0
7	Macrolides	12	1.7
8	Tetracyclines	9	1.3
9	AntiTB	6	0.9
Total		**693**	**100%**

Table 5: Number of antibiotics prescribed per patient in HFSUH Harar, Eastern Ethiopia, from April 2012- April 2013.

No of antibiotics	Frequency	%
One	86	26.4
Two	140	42.9
Three	81	24.9
Four	15	4.6
Five	4	1.2
Total	**326**	**100%**

Table 6: Dosage regimen of antibiotics prescribed in pediatric ward of HFSUH Harar, Eastern Ethiopia, April 2012 – April 2013.

SN	Antibiotics	Dose			Frequency			Duration		
		AP	IA	NI	AP	IA	NI	AP	IA	NI
1	Crystalline penicillin	111	6	-	116	1	-	96	17	4
2	Gentamycin	103	3	-	102	4	-	91	13	2
3	Ampicillin	99	1	1	22	75	4	89	10	2
4	Amoxacillin	77	3	20	83	5	12	50	1	49
5	Others	230	6	33	243	4	22	204	30	35
	Total	620	19	54	566	89	38	530	71	92

AP - appropriate; IA - inappropriate; NI - not indicated

Table 7: Potential drug –drug interactions between some concomitantly prescribed drugs at HFSUH, Harar, Eastern Ethiopia, April 2012- April 2013.

SN	Drugs combined	Frequency	Potential interaction
1	Chlorampenicol + phenytoin	2	Prolong half life of phenytoin
2	Chloramphenicol + phenobarbitone	3	Increased metabolism of Chloramphenicol
3	Gentamycin + furosemide	1	Potentiate ototoxic effect of gentamycin

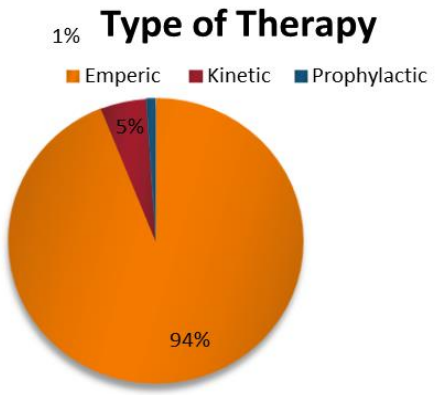

Figure 1: Type of antibiotic treatment at HFSUH, Harar, Eastern Ethiopia, from April 2012- April 2013.

DISCUSSIONS

WHO core drug use indicators can be used efficiently in many setting of drug use study to detect problems in drug prescribing such as polypharmacy, inclination for branded products, over use of antibiotics or injections and prescribing out of formulary or essential drug list (table 2). In this study, 1008 of the total drugs prescribed, 693(68.8%) were antibiotics but WHO recommends 15%-25%. Our study showed there was over prescribing pattern of antibiotics in the setting.

One of the factors that should be considered in antibiotic selection is the cost of antibiotics. Switching from intravenous to oral route is the most important cost saving therapy in hospitalized patients. Selection of proper route of drug administration therefore plays an important role. In this study, parentally administered antibiotics contributed to the highest proportion of all drugs prescribed 484(69.8%). Among antibiotics administered, crystalline penicillin was the most leading parentrally prescribed antibiotic 117(16.9%), followed by gentamycin 106(15.3). The former one was mostly indicated for the treatment of pneumonia,

meningitis and tetanus. This also by far exceeds the WHO indicator of percentage of prescription with an injection (13.4%-24.1%). This might be because of two reasons: the first major reason is that children especially neonates and infants are not volunteer to take oral medication. The second reason may be because of the fact that admitted patients are mostly administered with IV medications and inability of unconscious patients to take oral drugs. The study conducted in North West Ethiopia by Desta et al (2002) showed that the most frequently prescribed drugs were antibiotics from which Ampicillin and Cotrimoxazole were the top two leading drugs prescribed in Gondar hospital.[14]

A study done by Dong et al (2008) on antibiotic prescribing patterns in Western China showed that the percentage of prescriptions with antibiotics was 48.43. In detail, prescriptions with one antibiotic comprised 40.64% of all prescription; those with two antibiotics represented 7.08% of the total and 0.72% were for prescriptions with more than two antibiotics. The most frequently prescribed five antibiotics, which represented 53.45% of all antibiotic prescriptions, were amoxicillin, benzyl penicillin, norfloxacin, cefalexin and cotrimoxazole.[2]

According to the study of drug prescribing practice in pediatric ward in Ethiopia conducted in Jimma university hospital antibiotic is the most commonly prescribed category of drugs. Cotrimoxazole 15.5% and amoxicillin 10.39% were the most frequently prescribed drugs. Generally there was irrational prescribing practice of drugs in the pediatric patients of the study hospital.[15]

Study of Pediatric drug prescribing in a regional hospital of Trinidad the (Orrett FA, Changoor E, Maharaj N. 2010) indicated that the rate of antibiotic use in children less than 15 years of age was three times higher than any other age group, which clearly demonstrated that antimicrobial drug use was highest among children. This study showed almost 36.4% of all hospitalized children were prescribed antibiotics. More than 50% of all prescribed antibiotics had started empirically and almost half of all were found to be inappropriate based on clinical and financial criteria.[16]

Use of a combination of antimicrobial agents may be justified for empirical therapy of an infection in which the cause is unknown, for treatment of polymicrobial infection, to enhance antimicrobial activity or to prevent emergence of resistance. However, it can be disadvantageous due to the risk of toxicity from two or more agents and the increased cost to

the patient. Vancomycin for instance increases the toxicity of amino glycosides when administered together. In addition, antagonism may also result when bacteriostatic and bactericidal agents are given concurrently.[9]

Several studies focusing on antibiotic prescribing attitudes in hospitalized children indicated that approximately 35% of infants and children admitted to hospitals receive antibiotics and widespread misuse has been reported. Almost 50% of all antibiotics prescriptions are inappropriate.[17]

Increasing generic prescribing would rationalize the use and reduce the cost of drug therapy. The percentage of drugs prescribed by generic names was 99.6% which approach the standard WHO value (100%).

Despite the ability of antimicrobial therapy to prevent or control infection, prescribing errors are common. Inadequate consideration of antibiotic resistance potential, drug interaction, side effects and contra indications limit the effectiveness of antimicrobial therapy. Prolonged treatment with amino glycosides increases risk of nephrotoxicity and ototoxicity. In this study, gentamycin was prescribed for an 8 years child for 21 days. Cotrimoxazole was prescribed for one neonate and one infant of 1 month old even though it is contra indicated for neonates and infants of less than six weeks according to Ethiopian standard treatment guideline. Doxycycline was also contra indicated for the children of less than 8 years of age. However, it was indicated for a child of 6 years in this study.

Although the simultaneous use of two or more antibiotics has a certain rational, indiscriminate or routine use of antibiotic combination may have several negative consequences primarily to the patient. Risk of toxicity from two or more antibiotics, increased cost and the emergence of drug resistance are some of inappropriate combination of the antibiotics. The uses of combination of antibiotics were commonly observed in this study that the maximum number of antibiotics prescribed simultaneously per patient was five. The most commonly combined antibiotics were ampicillin+gentamycin 190(27.4%), followed by crystalline penicillin+ Amoxicillin 166(24%) and crystalline penicillin+chloramphenicol 88(12.7%). The average number of drugs per encounter was 3.1 and that of antibiotics was 2.1. Still, it is higher than that of WHO indicator which is 2 & 0.47 for average number of drugs and average number of antibiotics per patient respectively. In addition, three concomitantly prescribed drugs were expected to cause drug-drug interaction (Table 7).

Inappropriate prescribing involves over prescribing & under prescribing including dose, frequency & duration. In this study, inappropriate dose, frequency & duration was commonly observed and it were not indicated in most medical cards reviewed (Table 6). Such inappropriate prescribing might be because majority of drugs (83%) were prescribed by students and inappropriate duration (short duration of treatment) might be due to some patients discharge by themselves or expired before completing their treatment.

CONCLUSIONS

From the total of 1008 drugs prescribed to the total of 326 patients, 693(68.8%) were antibiotics. The most leading class of antibiotics prescribed was penicillins 354(51.1%). Eighty six (26.4%) patients were prescribed with one antibiotics and the average number of antibiotics per patient was 2.1. There were inappropriate dose 19(2.7%), frequency 89(12.8%) and duration 71(10.2%). From 326 pediatric patients, 121(37.1%) had normal body weight while 71(21.8%) were severely malnourished.

Six concomitantly prescribed drugs had the potential drug-drug interactions. Cotrimoxazole and doxycycline were indicated against contra-indication. 484(69.8%) antibiotics were parenterally administered and crystalline penicillin was the most leading 117(16.9 %).

The study showed that children between the ages of 1 and 5 years were admitted more frequently than other age groups. The most common illness for which children were hospitalized involves pneumonia, severe acute malnutrition and acute gastroenteritis.

Irrational prescribing of antibiotics was evaluated in this study. From a total drug prescribed antibiotics took 68.8%. This showed over prescribing of antibiotics when compared to standard WHO value.

Prescribers have to document all necessary information on patient's medical card, minimize empiric antibiotic prescribing habit, always note contra-indications, and possible drug-drug interactions prior to concomitant drug administration. The study initiated to improve prescribing pattern of antibiotics using WHO drug use indicators to reduce over prescribing and prescribing errors.

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COMPETING INTERESTS

The authors declare that they have no competing interests.

AUTHORS' CONTRIBUTIONS

TG involved in conception of the original idea, helped to draft the proposal, participated in all implementation stages of the project, and write up; LA reviewed it critically and involved in all implementation stages of the project and write up. Both authors read and approved the final version of the manuscript.

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