

Assessment of Antimicrobials' use in Pediatrics in Moradabad city

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Abstract

This study assesses the use of antibiotics in pediatric patients and also rationality & irrationality of prescriptions. The present study was a population based analytical epidemiological design in the settings of an urban population in Moradabad, (UP) India, during Jan 2009 to April 2009. The intended work can be divided into the following steps: by selecting the antibiotics prescribed prescription then divided the prescriptions according to the following criteria; category of antibiotic used, combination of antibiotic used, site of infection diagnosed & rationality and irrationality of prescriptions. It is important to determine and reduce the antibiotic use in children as it can cause resistance to antibiotics in them that can lead to different problems. The most common antibiotics prescribed in pediatric patients belong to the class of Quinolones (43.18%), among which Norfloxacin (28.95%) predominates. Amoxicillin + Clavulanic acid (40.74%) was the most frequently used antibiotic combination. It was concluded that maximum number of prescriptions were found rational based on considering the number of antibiotics per prescription and drug interaction, while irrational prescriptions were found to be less.

Key words: antimicrobial drugs, hypersensitivity reactions, bacterial infection, rationality.

INTRODUCTION

Drugs play an important role in protecting, maintaining and restoring health of a living body. Among these different population groups, infants and children are the most vulnerable groups to contact illnesses.^{1, 2, 3, 4-5} They are mainly prone to infectious diseases. Antimicrobial agents/drugs are used to combat or treat these infectious diseases. The use of antimicrobial agents, especially antibiotics has become a routine practice for treatment of pediatric illnesses. Antibiotics are considered to be the mainstay of treatment for children⁶ and hence it is the second leading drug prescribed according to the National Ambulatory Medical Care Surveys⁷⁻⁸. The choice of antibiotics for infants and children is usually empiric. Although the antibiotics are effective and play an important role in the management of infectious diseases, they can lead to many serious consequences. One of them is the irrational use of antibiotics which can lead to destruction of gastrointestinal micro flora inducing various clinical symptoms like toxic mega colon, pseudomembranous colitis, and etc⁹. It can also lead to emergence of multi-drug resistant micro-organism which is expected to cause more serious infections than

what we have initially encountered. Now days, many pediatric physicians' include antibiotics in their prescribing pattern without considering it to be rational or irrational. Therefore, an effective step should be taken for rational and effective use of antibiotics especially in pediatric patients.

MATERIAL AND METHODS

The study was conducted by randomly collecting the 482 prescriptions of pediatric patients during Jan 2009 to April 2009. Among the collected prescriptions, antibiotic prescribed prescriptions were separated out. The prescriptions containing antibiotics were then evaluated for the category of antibiotic prescribed, most common antibiotic used and their combinations, rationality (rational use of drugs requires that patients receives appropriate medications according to their clinical needs, in doses that meet their own individual requirements for an adequate period of time) and irrationality (irrational use of drugs refers to inappropriate medications received by the patients) of prescriptions based on drug interaction and number of antibiotic prescribed in each prescription. Along with this, the site of infection was also diagnosed which included gastrointestinal infection, respiratory infection and others that included prescription with unidentified site of infection i.e. anti allergic, analgesics, etc. prescribed with antibiotics. The number of

prescriptions was than counted for each type of study and the final result was obtained.

RESULTS

The data analysis showed that among the total number of patients 24% were infants and 45% belong to the age group of 1-5 years. The most common category of antibiotic that was prescribed by maximum pediatricians was quinolones which accounts for 43.18% of the total. Among quinolones, Norfloxacin (28.95%) was the most common drug to be used. Penicillins, which accounts for 23.38% of the total, was the next category of antibiotic that was prescribed, among this category Amoxicillin

(90.5%) was the most commonly used drug. Cephalosporin (14.77%) was also preferred by many of the pediatricians, the most common drug being Cefalexin (46.15%). Macrolides, especially Azithromycin (81.8%), was also used in many of the cases and accounts for 12.5% of the total. Aminoglycosides were also prescribed in 3.41% of the cases, the most common being Gentamycin (66.7%). Tetracycline, especially Doxycyclin, and Chloramphenicol were used in 1.14% cases. The above data analysis has been represented in Table-1.

Table.1: Most Common Antibiotics Used

SL.NO.	CATEGORY	MOST COMMON DRUG USED	% OF PRESCRIBED PRESCRIPTION n=482
1	Quinolones (Qn)	Norfloxacin (28.95%)	43.18
2	Penicillin (Pn)	Amoxicillin (90.48%)	23.86
3	Cephalosporin (Cp)	Cefalexin (46.15%)	14.77
4	Macrolides (Ma)	Azithromycin (81.8%)	12.5
5	Aminoglycosides(Ag)	Gentamycin (66.7%)	3.41
6	Tetracycline's (Tc)	Doxycycline	1.14
7	Chloramphenicol (Ch)	Chloramphenicol	1.14

In most of the prescriptions which were evaluated, combination of antibiotics was found to be used. The total number of prescriptions prescribed with combination of antibiotics was considered as 100%. Amoxicillin + Clavulanic acid was the most commonly prescribed combination and it accounts for 40.74% of the total. It was than followed by the combination of Ciprofloxacin + Tinidazole in 14.81% of the cases. The combination of Theophylline + Norfloxacin was

prescribed in 11.11% cases. In 7.41% cases, the combination of Betamethasone + Gentamycin, Lomefloxacin + Benzalkonium chloride, and Norfloxacin + Tinidazole were prescribed by the pediatricians. The combination of Cetirizine + Cefalexin, Fluconazole + Azithromycin + Secnidzole, and Ampicillin + Cloxacillin was used in 3.70% cases, the data being represented in Table-2.

Table.2: Combination of Antibiotics Used

Sl No.	COMBINATIONS	% PRESCRIBED n=482
1	Amoxicillin + Clavulanic acid (Am+Ca)	40.74
2	Ciprofloxacin +Tinidazole (Ci+Ti)	14.81
3	Theophylline + Norfloxacin (Th+No)	11.11
4	Betamethasone +Gentamycin (Bm+Ge)	7.41
5	Lomefloxacin + Benzalkonium chloride (Lo+Bc)	7.41
6	Norfloxacin +Tinidazole (No+Ti)	7.41
7	Cetirizine + Cefalexin (Ce+Cf)	3.70
8	Ampicillin +Cloxacillin (Ap+Cl)	3.70
9	Azithromycin + Fluconazole +Secindazole (Az+Fl+Sn)	3.70

Among the various site of infection, gastro-intestinal tract (git) was found to be more affected. The g.i.t. infection was diagnosed in 26.86% of the cases. Respiratory organs were found to be another site of infection and it was diagnosed in 22.40% cases. Rest

50.74% cases were that of antiallergic, analgesic, antipyretic, etc. and does not show any diagnosis related to g.i.t. or respiratory infection. These were included in the category of others, refer to Table-3.

Table.3: Site of Infection Diagnosed

Sl. No.	SITE OF INFECTION	% OF CASES	n=482
1	Gastro-intestinal	26.86	
2	Respiratory	22.39	
3	Others	50.74	

The prescriptions were also evaluated for their rationality and irrationality. Based on the number of antibiotics prescribed in each prescription 71.64% prescriptions were found to be rational, the remaining of 28.36% prescriptions were found irrational with two or three

antibiotics prescribed in each prescription. When prescriptions were evaluated based on the drug interaction 58.21% prescriptions were found to be rational and 41.79% prescriptions were irrational, the data have been represented in Table-4.

Table.4: Rationality and Irrationality of Prescriptions

Sl. No.	PATTERN	RATIONAL (%)	IRRATIONAL (%)
1	Number of antibiotics prescribed	71.64	28.36
2	Drug interaction	58.21	41.79

DISCUSSION

The inappropriate utilization of antibiotics, especially in infants and children, forced many researchers to evaluate the consumption of this class of antimicrobial agent in order to control the risk and its misuse. Studying the antimicrobial prescribing pattern in an Indian tertiary hospital has showed that two antimicrobials per prescription was maximum in pediatrics, while one antimicrobial was maximum in surgery, urology and internal medicine departments. Amikacin, ciprofloxacin, cefotaxime and cloxacillin were the most preferred drugs¹⁰. The result of present study demonstrates that antibiotics are frequently used in infants and children. In

contradict to the previous observation it was found that the most widely used antibiotics belong to class of quinolones and penicillins (Pn). Norfloxacin, ciprofloxacin, ofloxacin and amoxicillin are found to be most frequently used antibiotics in pediatrics. Resistance against quinolones such as norfloxacin, ciprofloxacin, etc. develops quite slowly and hence they are widely used¹¹. Amoxicillin is active against all organisms sensitive to Pn G, in addition it inhibits many gram negative bacilli, its oral absorption is better and is not interfered by food along with this higher and more sustained blood levels are produced¹². Amoxicillin with

clavulanic acid was the commonly and most frequently used antibiotic combination. Clavulanic acid has a high affinity for and binds to certain β -lactamases that generally inactivate amoxicillin by hydrolyzing its β -lactam ring, thus it extends the antimicrobial spectrum of amoxicillin¹³. In case of gastro-intestinal infection, which is the most affected site of infection in pediatrics, the combination of norfloxacin with tinidazole or ciprofloxacin with tinidazole was highly prescribed. The combination of ciprofloxacin with tinidazole has the advantage of being effective against both bacteria and protozoa as ciprofloxacin is bactericidal against enteropathogens while tinidazole is a potent anaerobicicide, for example *Entameba* requires normal faecal flora for its survival; ciprofloxacin kills the pathogenic intestinal bacteria & alters intestinal flora, and tinidazole directly eradicate *Entameba*¹⁴. While the combination of norfloxacin with tinidazole has an extended range of antimicrobial spectrum and thus is effective in mixed gut infection as well. But in case of respiratory tract infection, which is also one of the leading sites of infection in pediatrics, the combination of norfloxacin with theophylline was found to be prescribed in number of cases. This might be because norfloxacin (though not recommended for respiratory infection) increases plasma concentration of theophylline as it exerts inhibitory effect on the cytochrome P-450 system thereby reducing theophylline clearance¹⁵. Other singly prescribed antibiotics also include cefalexin (cephalosporin) and azithromycin (macrolide) which are highly used but the frequency of consumption were bit less of them. Majority of cephalosporins need to be injected and are not metabolized but are excreted rapidly by the kidney and thus have short $t_{1/2s}$, along with this hypersensitivity reactions are most common side effects to the cephalosporins.¹⁶ On the other hand macrolides have narrow antibacterial spectrum, their absorption is incomplete and is delayed by food, along with this resistance against this class of antibiotic develops quite readily. Cephalosporins such as cefixime, cefaclor, cefpodoxime and cefadroxil were also found to be used. Aminoglycosides such as amikacin and gentamycin was also prescribed in some cases. Tetracycline (though contraindicated in infants and children as calcium-tetracycline chelates) gets deposited in developing teeth and bone and thus affect permanent anterior dentition¹⁷. Chloramphenicol, roxithromycin, nalidixic acid and cloxacillin are also rarely used in pediatrics. Besides

gastro-intestinal and respiratory infection antibiotics and their combination were also frequently used in other cases with drugs like analgesics, antiallergic, steroidal drugs and even with antineoplastic drugs. In some cases nimesulide (NSAIDs) is prescribed with amoxicillin and/or its combination with clavulanic acid but the co administration of nimesulide with amoxicillin may show additive hepatotoxic effect¹⁸, this drug interaction can be prevented either by changing the category of NSAIDs used such as replacing nimesulide by ibuprofen which does not show any interaction with amoxicillin/clavulanic acid. In many cases quinolones such as ciprofloxacin was prescribed with nimesulide but any NSAIDs when prescribed with quinolones show an increased CNS stimulation, this can be prevented by changing the category of antibiotic because if multivitamin is prescribed to combat such interaction another effect will occur leading to reduced absorption of antibiotics. In few cases omeprazole (antiulcer drug) is prescribed with Norfloxacin + Tinidazole (an antidiarrhoeal combination) but this can reduce the absorption of antibiotic from gut¹⁹, hence, in such cases antiulcer or antacids should be avoided. The use of two or more antimicrobial agents has a certain rationale and is recommended in specifically defined situation. The combination therapy is used for number of reasons such as to achieve synergism, to reduce severity or incidence of adverse effects, to prevent emergence of resistance and to broaden the spectrum of antimicrobial action. But the use of unnecessary antibiotics in pediatric patients has led to rise in irrational prescribing patterns in pediatrics for example prescribing two or more antibiotics such as azithromycin and ofloxacin or roxithromycin and cefadroxil in the same prescription was found in some cases. Many reasons account for the prescribing of antibiotics in children. Sometimes it is also prescribed in viral infection due to lack of proper diagnosis. Efforts should be employed to reduce the inappropriate use of antibiotics in children. It is well known that pediatricians or physicians may use diagnosis to justify antibiotic prescribing and it may raise estimates of appropriate antibiotic prescribing²⁰. In spite of this, pharmacists should have a role in promoting antibiotic use. They can play a major role through clinician education and focused clinical services as well as through patient counseling²¹. As this study has been performed on less number of prescriptions and is confined to a hospital i.e. the study has been conducted on small scale. Thus, a study should

be conducted on large scale including number of hospitals in different zones to actually determine the trend of antibiotic use in pediatric patients. The study can also include different parameters like age, sex, duration of therapy, route of administration, site of infection, dose of drugs, etc. in detail for actual evaluation of antibiotic prescribing pattern in children. It is important to determine and reduce the antibiotic use in children as it can cause resistance to antibiotics in them that can lead to different problems in this high risk group such as destruction of microbial flora in gut, hypersensitivity reactions, toxicity, superinfection (appearance of new infection as a result of antimicrobial therapy) and nutrition deficiency. Improving availability of diagnostic methods to differentiate between viral and bacterial infections is suggested to reduce empiric therapy numbers by antibiotic agents.

CONCLUSION

The present study concluded that the most common antibiotics prescribed in pediatric patients belongs to the class of quinolones, among which norfloxacin predominates. Amoxicillin + Clavulanic acid was the most frequently used antibiotic combination. Evaluating the prescriptions on the basis of rationality and irrationality, it was concluded that maximum number of prescriptions were found rational based on considering the number of antibiotics per prescription and drug interaction, while irrational prescriptions were found to be less.

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