

Drug Utilization of Antimicrobial drug in Pediatrics Population in a tertiary care hospital in Erode, Tamilnadu, India

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Abstract

Background: Antimicrobial are among the most commonly prescribed drug in Paediatrics. The caution use for AMAs is very important as their unavailability or resistance can be life threatening. Therefore it is important to study the prescribing pattern of antimicrobial drugs in healthcare centers. It is the first step in evaluating the underlying causes and taking suitable remedial actions

Aim: The present study is aimed to determine the prescribing pattern of anti-microbial agents (AMAs) in paediatric patients in a tertiary care hospital in Tamilnadu, India.

Methods: This prospective cross-sectional study was undertaken for 6 months between July 2010 and December 2010. The information was collected from inpatient department. WHO recommended drug use indicators were used for data analysis.

Results: Altogether 273 patients, 147 males (53.8%) and 126 females (46.2%), were enrolled. Highest rate of AMDs prescription was observed for children aged between 1-5 years. Overall 149 (54.58%) patients were treated with a monotherapy and 78 (28.57%), 41 (15.23%) and 5 (1.83%) patients were treated with two, three and four drug therapies respectively. Most of the patients reported with pneumonia (17.22%), bronchitis (14.28%), acute gastro enteritis (AGE-13.92), viral fever (10.62%), enteric fever (6.23%), whooping cough (5.49%) and others. Among 273 patients, culture test was performed in only 14 cases i.e. (5.13%), only 6 specimens showed positive culture result. Sensitivity analysis was done in 6 cases [UTI (2), pneumonia (2), cellulitis (1) and sepsis (1)]. In all cases the patients were found to be resistant to 6-7 antibiotics. Cephalosporins (38.83%), Aminoglycoside (22.78%) and penicillin derivatives (18.87%) were choice of AMAs for paediatric patients. For 80.95% cases only I.V. route, 5.86% cases only oral route and 13.19% cases both oral and I.V. routes of drug administration were used. Significant difference was found between disease encountered and age of the patients (chi square is equal to 102, $P < 0.01$).

Conclusions: Majority of patients were prescribed drugs irrationally without doing any laboratory investigations. Overall extensive poly-pharmacy and poly-pharmacy among antimicrobial agents was noticed.

Keywords: AMAs (Anti-microbial agents), Drug utilization, Prospective, Paediatrics

Introduction:

Infants and children represent a large part of the population in developing countries.¹ Paediatric population is prone to suffer from recurrent infections of the respiratory tract and gastrointestinal system. Lower respiratory tract infections are the leading cause of death in children below 5 five years of age.² Acute respiratory infection, acute watery diarrhea and viral fever are the common childhood illnesses accounting for the major proportion of pediatric visits.³

Several studies focusing on antibiotic prescribing attitudes in hospitalized children indicate that approximately 35% of infants and children admitted to hospitals receive antibiotics and widespread misuse has been reported.⁴ Higher incidence of infections in infants and children as compared to adults leads to higher use of antimicrobials and contribute to an overall increase in healthcare costs as well as potentially severe adverse drug reactions.⁵⁻⁷ Almost 50% of all antibiotic prescriptions are inappropriate, based on clinical and economical criteria.⁸ Inappropriate antimicrobial-prescribing practices have been well described in developed nations.⁹ Irrational prescriptions by the medical practitioners and incentives provided by the drug companies for promotion of the sale of their products, also add to this health hazards by antimicrobials. The National Health Service circular (UK), formulated a drive against over utilization of AMAs, which was based on four elements of strategy, surveillance, prudent antimicrobial use and infection control.¹⁰

Therefore, it is important to study the utilization pattern of antimicrobial drugs. The detection of problems with the use of antimicrobials in healthcare system is the first step in evaluating the underlying causes and taking suitable remedial actions.

Material and Methods:

The present study was conducted in inpatient department of City hospital Erode, which is a tertiary care hospital between the period of July 2010 and December 2010, to determine the antimicrobial drugs prescribing pattern in pediatrics patients. Study is divided in to three phases- Phase I (Pilot study) consists of preliminary study to identify the scope of work and to determine various paediatric diseases, Phase II consists of literature survey, preparation of

data entry format and collection of cases and phase III consists of data analysis and identification of pattern of antibiotic use. The study is approved by Institute Ethical Committee.

A total of 273 cases were studied in inpatient ward, which have complete information as per inclusion criteria. Permission for collection of data and to accompany physician in the pediatric ward was taken from Head of pediatric department before starting the study. The relevant data were collected in specially designed Performa, which contained patient demographics (age, sex and outcome of the patients), diagnosis, investigations, drug details and information from the prescriber regarding the indication for prescribing antimicrobial agent, suspecting organism underlying infection, duration of therapy and details of any concomitant medications and drugs were classified into different groups based on WHO-ATC classification¹⁵.

Statistical Analysis: The data was subjected to descriptive analysis using Microsoft Excel. Chi square test was used to assess the correlation between diseases encountered and age group.

Results and Discussions:

The demographic profile in this study showed male (53.8%) to female (46.2%) proportion in this study indicating that males patients was comparatively more than the number of female patients approaching for consultation.

Significant use of antimicrobials was observed for conditions like pneumonia (17.22%), bronchitis (14.28%) and acute gastro enteritis (13.92%). These conditions were most common reason for the hospitalization of the pediatric patients. Pneumonia and AGE were mostly prevalent in infants and children of age up to five years. But bronchitis was mostly found in children of age group 5-12 and infants. Other common illnesses for hospitalization were enteric fever, viral fever, UTI, meningitis, whooping cough, measles, cellulites and sepsis. Hernia (5.13%) and appendicitis (2.2%) were the two conditions in which the antimicrobial drugs were prescribed prophylactically (Table 1).

Table 1: Indications for which antibiotics were prescribed

Sl.No.	Indications	No of Patients.	Percentage(%)
1	Viral fever	29	10.62
2	Enteric fever	17	6.23
3	Bronchitis	39	14.28
4	Pneumonia	47	17.22
5	Sepsis	8	2.93
6	Cellulitis	6	2.2
7	UTI	12	4.4
8	Hernia	14	5.13
9	Appendicitis	6	2.2
10	AGE	38	13.92
11	Utricaria	10	3.66
12	Meningitis	8	2.93
13	Whooping cough	15	5.49
14	Measles	10	3.66
15	Others	14	5.13

UTI - Urinary tract infection**AGE- Acute gastro enteritis**

Cephalosporins (38.83%), Aminoglycoside (22.78%) and penicillin derivatives (18.87%) were choice of AMAs for paediatric patients, which comprised of Cefotaxim (14.97%), Ceftriaxone (11.06%), Cefpodoxime (3.04%), Cefaclor (0.87%) and Ceftazidime (0.22%), Amikacin (22.78%), Benzyl penicillin (7.37%), Amoxicillin/clavulanate(6.29%), Piperacillin/ tazobactum (4.55%) and Ampicillin/cloxacillin (0.4%), respectively. Among

Cephalosporins third generation Cephalosporins like Cefotaxim and Ceftriaxone were AMAs of choice for paediatric patients, which accounts for 20.03%. Among Aminoglycosides Amikacin was the only drug which was prescribed for the paediatric patients in this study. In this study Benzyl penicillin and Amoxicillin/clavulanate were mostly prescribed drugs among penicillin derivatives (Table 2).

Table 2: ANTIBIOTIC DRUGS USAGE PATTERN

Sr. No.	ATC Code	Name of Antibiotics	No. of Patients	Percentage Usage (%)
1	J01DD01	Cefotaxim	69	14.97
2	J01DC04	Cefaclor	4	0.87
3	J01DD04	Ceftriaxone	51	11.06
4	J01DD02	Ceftazidime	1	0.22
5	J01DD13	Cefpodoxime	14	3.04
6	J01GB06	Amikacin	105	22.78
7	J01FA01	Erythromycin	14	3.04
8	J01FA10	Azithromycin	7	1.52
9	J01MA01	Ofloxacin	10	2.17
10	J01CE01	Benzyl penicillin	34	7.37
11	J01CR02	Amoxicillin+clavulanate	29	6.29
12	J01CR05	Piperacillin+tazobactum	21	4.55
13	J01DD01	Cefotaxim+sulbactam	11	2.39
14	J01DD62	Cefoperazone+sulbactam	5	1.08
15	J01CA51	Ampicillin+cloxacillin	2	0.43
16	J01DD54	Ceftriaxone+tazobactum	24	5.21
17	J01XX08	Linezolid	55	11.93
18		Others	5	1.08

Table 3: Frequency of each antimicrobials for particular diagnosis

Diagnosis	Piper+Taz	Cefot+Sal	Cefotaxim	Ceftriaxone	Amikacin	Ben penicillin	Amox+ clavu	Ceftriaxone+ta zobactm	Linezolid	Erythromycin	Cefpodoxime	Ofloxacin	Azithromycin	Cefoperazone+ sulbactum	Cefaclor	Others
Viral fever	3	-	5	21	1	-	1	-	-	-	-	-	-	-	-	-
E fever	-	-	5	11	-	-	1	-	-	-	-	-	-	-	-	-
Bronchitis	3	3	6	9	20	5	8	4	8	-	2	2	-	-	1	-
Pneumonia	7	1	3	-	27	11	17	2	18	-	3	-	1	-	3	-
Sepsis	2	-	-	-	5	4	-	-	5	2	2	-	-	-	-	-
Cellulitis	3	-	5	-	6	1	-	-	1	-	-	-	-	2	-	-
UTI	-	-	-	1	6	-	-	6	-	-	5	3	-	2	-	2
Hernia	1	-	11	2	1	-	2	-	-	-	-	-	-	-	-	1
Appendicitis	-	-	3	2	-	-	-	-	-	-	-	-	-	-	-	1
AGE	-	2	26	3	20	-	-	-	1	-	-	2	-	1	-	3
Urticaria	-	-	-	-	-	-	-	-	6	2	-	-	4	-	-	-
Meningitis	-	-	-	1	-	5	-	7	-	-	-	-	-	-	-	-
Whooping Cough	1	3	-	-	9	3	-	3	9	10	-	1	1	-	-	-
Measles	-	1	-	-	6	1	-	1	3	-	2	2	1	-	-	-
Others	1	1	5	1	4	4	1	1	4	-	-	-	-	-	1	-

Table 4: Specimen taken for organisms isolation (n=273)

Specimen	No of Patients	Percentage (%)
Blood	7	2.56
Urine	4	1.46
Pus	1	0.37
Sputum	2	0.73

Table 5: Pathogenic organisms identified

Organisms	Number of Patients (n=273)	Percentage (%)
<i>S. aureus</i>	1	0.37
<i>E. coli</i>	2	0.73
<i>S. haemolyticus</i>	1	0.37
<i>S. pneumonia</i>	2	0.73

A high percentage of patients 54.58% were prescribed at least one antibiotic, two antibiotics were prescribed in 28.57%, three antibiotics were prescribed in 15.02% and four antibiotics were prescribed in only 1.83% cases. Similar study conducted by **Palikhe et al**¹¹ assessed that two antibiotics were prescribed in more cases (37%), which was differ from that of our study. Similar study conducted by **Shankar et al**¹² assessed

that, of the 687 patients hospitalized, 203 patients were prescribed with antimicrobials and 98% of patients were prescribed a single antimicrobial which was similar to our study. So due to differ in morbidity pattern and economically we cannot make a firm conclusion. In this study multiple antimicrobials usage increased due to elapse of time to diagnose the patient and to select the appropriate treatment.

Table 6: Antimicrobial Sensitivity Studies

Isolated Organisms	Sensitive Antimicrobials											
	No of Patients	Ampicillin/cloxacillin	Amikacin	Cefoperazone/sulbactam	Chloramphenicol	Piperacillin/tazobactam	Linezolid	Cefotaxim	Ceftriaxone	Cefpodoxim	Penicillin	Gentamycin
<i>S. aureus</i>	1	1	-	1	1	1	1	-	-	-	-	-
<i>E. coli</i>	2	-	1	2	2	2	-	-	-	-	1	2
<i>S. haemolyticus</i>	1	-	-	-	-	-	1	-	-	1	-	-
<i>S. pneumonia</i>	2	-	-	-	1	-	2	-	1	1	1	-

Table 7: ADR Reported (n=273)

Drug	ADR	No of Cases
Ceftriaxone	Fever	5
Benzyl penicillin	Rashes	4
Amikacin	Rashes	2
Linezolid	Diarrhoea	6

Table 8: Route of administration of AMA

Route	No of cases (n=273)	Percentage (%)
IV	221	80.95
Oral	16	5.86
Both	36	13.19

Table 9: Commonly Prescribed Other Drugs (n=273)

Drug Class	Number Of Cases	Percentage(%)
Intravenous fluids	90	32.97
Antipyretics	52	19.05
Anti asthamatic drugs	61	22.34
Anti emetics	30	10.99
Anti-ulcer drugs	34	12.45
Steroids	18	6.59
Anti diarrheal	36	13.18
Vitamins	40	14.65
Expectorants	52	19.05
Antihistaminics	32	11.72
Mucolytics	29	16.76
Analgesic	27	5.13

Among 273 patients clinically diagnosed with infectious diseases and treated with antibiotics, specimens were taken for culture in only 14 cases (5.13%) for identification of pathogenic organisms (Table 4). Only 6 specimens showed positive culture result, so only in few patients, therapy could be modified after culture results were available (Table 5). Sensitivity analysis was done in 6 cases (two UTI, two pneumonia, one cellulitis and one sepsis). In all cases the patients were found to be resistant to 6-7 antibiotics. In five cases it was found that, third generation Cephalosporins especially Cefotaxim and Ceftriaxone were found to be resistant. The commonly used antibiotic Amikacin was found to be resistant in five cases except in case of UTI. Three antimicrobial especially Penicillin, Gentamycin, Amoxicillin/cloxacillin were found resistant in almost all cases. The organisms isolated were *Staphylococcus aureus*, *Streptococcus pneumonia*, *E coli* and *Staphylococcus haemolyticus* from pus, sputum, urine and blood respectively (Table 6). Similar study was done by Palikhe *et al*¹¹ where specimens were taken for culture in 19.8%. Specimens for culture test were not obtained in most cases or patients were not asked for the culture test in this study. Before the initiation of antimicrobials it is necessary to isolate from the specimen and identify the causative organism for appropriate antimicrobial therapy. Antimicrobial usage mainly depends on various factors like resistance, adverse effects and the cost of health care. So, proper method should be implemented in order to prevent the irrational use of antimicrobials like proper understanding of therapeutic use of antimicrobials, awareness about the prevalence of various pathogens and resistance patterns to advice the proper empirical therapy. For 80.95% cases only I.V. route, 5.86% cases only oral route and 13.19% cases both oral and I.V. routes of drug administration were used (Table 8).

So most of the antibiotics were given in the form of injection in paediatric patients. Similar study was conducted in Ansam swalaha *et al*¹³ and assessed that 61.8% received parenteral antimicrobial therapy, 4.7%

receives both parenteral and oral therapy and 2.1% receives oral therapy alone. So the most preferable route for antimicrobial therapy in paediatric inpatients is parenteral but careful administration of antimicrobials is very essential in pediatric patients. The most commonly prescribed drugs of other classes were assessed and found that intravenous fluids (32.97%) and antiasthmatic drugs (22.34%) were more frequently prescribed classes in this study. Significant difference was found between disease encountered in patients of different ages (chi square is equal to 102, $P < 0.01$).

ADRs like fever, rashes and diarrhoea were reported with ceftriaxone, penicillin and amikacin respectively (Table 7). Nimesulide has been prescribed in the study, but the use of the drug is strictly banned for the children up to the age of 12 by DTAB (Drugs Technical Advisory Board). DCGI (Drug Controller of Government of India) has finally decided to ban the drug based on the recommendation of DTAB¹⁴. The low use of Quinolones (3.05%) indicates that due to the toxic effects of quinolones in childrens they are not prescribed by pediatricians. Ciprofloxacin, one of the most commonly prescribed quinolone, needs proper monitoring.

Conclusion:

The study concludes that the treatment regimen implemented in most of the cases is with out doing any culture sensitivity test which may lead to wide spread of irrational prescription. So physician must be more specific in their diagnosis despite the financial burden of culture test. Empirical therapy and antimicrobial usage for viral infection can be reduced by the availability of rapid diagnostic method to differentiate between viral and bacterial infection. ADR recording habit in health care facilities will promote the rational therapy in future. Proper education program on rational usage of drug and an antimicrobial order form should be implemented in the hospitals to reduce the inappropriate therapy.

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