

## INCIDENCE OF INFECTIONS AND ANTIBIOTIC USAGE IN A PEDIATRIC OUTPATIENT DEPARTMENT OF A TERTIARY CARE TEACHING HOSPITAL

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### ABSTRACT

Pediatric population constitutes about 40% of total population in India. Infections remain most common cause of illness and hospitalization in children in spite of the medical advances in infection control and emergence of more potent antibiotics. Rational antibiotic therapy for infectious diseases is very much essential to avoid high level resistance. A prospective study was carried out with the objective of analyzing the spectrum of infectious diseases in children and to study the antibiotic usage and selection of the dosage forms in pediatric population. 863 pediatric patients (54.9% males and 45.1% females; age range of 1 month to 16 years) attending outpatient department (excluding those coming for vaccination, new borne (below 1month) and hospitalized patients) were included in the study and the data including patient demographics (name, age, sex, body weight), past medical history, past medication history, allergy details, diagnosis, drug details which included name of the drug, generic/brand name, dosage form, dose frequency and duration were obtained and analyzed for the prevalence of diseases, the drugs prescribing patterns and the dosage forms preferred. Majority of the patients were in the age range  $>1 - \leq 4$  years (30.1%) and average of 2.07 (Mean  $\pm$  SD 2.07 $\pm$ 0.9) drugs were prescribed per prescription. Incidence of infections was found to be 61% (525 patients), of which respiratory tract infections (48%) were common among 414 patients and penicillins were the commonest antibiotics prescribed (39%), among which amoxicillin was most frequent, followed by a macrolide antibiotic azithromycin in 69 patients (30%). Syrups were the common dosage forms prescribed for all patients in the pediatric age group followed by tablets where as capsules were least preferred.

**Keywords:** Pediatrics, Infections, Antibiotics, Dosage forms

### INTRODUCTION

Children under 15years of age constitute over 40 percent of the population in India and most of the developing countries. In India it forms a population of above 300 million which is more than total population of United States of America. Medical advances in infectious diseases in the 20<sup>th</sup> century have been phenomenal encompassing vaccines, antimicrobial agents, understanding and implementation of infection control, development of powerful new investigative techniques, and identification of infectious causes of clinical syndromes of expected and unexpected microbial etiology<sup>1</sup>.

Medical progress and changing host susceptibility also have altered the face of pediatric infectious diseases and the predominant clinical work of many sub specialists. New morbidities include infections associated with complex surgery, prolonged intravascular catheterization, or insertion of medical devices. New hosts include those with immune defects from disease or treatment of disease. Pathogens and relative nonpathogens have moved into new ecologic niches persisting microbes have developed new antimicrobial resistance<sup>2</sup>.

Nothing threatens the daily treatment of infectious diseases in pediatric practice as pervasively as the development of relative and high level resistance. Examples of emerging resistance to antimicrobial agents are myriad. Microbes of every category and class worldwide, once fully susceptible to available agents have mutated, acquired resistance genes, or bypassed critical antimicrobial-sensitive pathways to escape deleterious effects. Appropriate and inappropriate use of antimicrobial agents in humans as well as in animal feeds has contributed to the calamity<sup>3-5</sup>. Penicillin and methicillin resistant *Staphylococcus aureus* and coagulase negative staphylococci isoniazid and rifampacin resistant *Mycobacterium tuberculosis*, penicillin and multiple drug resistant *Streptococcus pneumoniae*, ampicillin and vancomycin resistant *Enterococcus* species, beta lactum and amino glycoside resistant *Enterobacteriaceae*, zidovudine and didanosine resistant HIV1, acyclovir resistant herpes simplex, ganciclovir resistant cytomegalovirus, fluconazole resistant *Candida krusei* and chloroquine resistant *Plasmodium falciparum* are but a few

examples medical weaponry reverts to the pre antibiotic era for some infections, with no effective therapies. In response to a 34 fold increase (0.4% to 13.6%) in vancomycin resistance of enterococci in intensive care units in United States, the hospital infection control practices advisory committee of the centers for disease control and prevention (CDC) published broad recommendations to curtail use of vancomycin and to contain resistant organism<sup>6</sup>.

A study was carried out with the objective of analyzing the spectrum of infectious diseases in children and to study the prescribing patterns of drugs, thereby to understand the physician's preferences in prescribing drugs for children, especially the antibiotic usage and selection of the dosage forms in pediatric population.

### MATERIALS AND METHODS

A prospective study was conducted in the pediatrics outpatient department of a 1700 bedded a tertiary care teaching hospital in South India, after obtaining approval of the Institutional Ethics Committee. Pediatric patients of either sex attending outpatient department during the period of Nov 2010 - January 2011 were included in the study. Patients coming for vaccination, new borne (below 1month) and patients who were hospitalized were excluded.

A patient data collection form was specially designed for the study and data including patient demographics (name, age, sex, body weight), past medical history, past medication history, allergy details, diagnosis, drug details which included name of the drug, generic/brand name, dosage form, dose frequency and duration were recorded. The data were analyzed for the prevalence of diseases, the drugs prescribing patterns and the results were tabulated statistically using SPSS windows software version 17.

### RESULTS

The study was conducted in 863 patients (474 (54.9%) males and 389 (45.1%) females; age range of one month to 16 years; median age 8.5 years) who visited the pediatrics outpatient department during the study period. Majority of the patients (30.1%) were in the age range of 1-4years (Table 1).

Table 1: Age and sex distribution

Age (yrs)	No. of males	No. of females	Total
≤ 1	146 (30.8%)	68 (17.5%)	150 (17.4%)
>1 - ≤ 4	102 (21.5%)	114 (29.3%)	260 (30.1%)
>4 - ≤ 8	94 (19.8%)	80 (20.5%)	182 (21.1%)
>8 - ≤12	50 (10.6%)	68 (17.5%)	162 (18.8%)
>12 - ≤ 16	474 (54.9%)	59 (15.2%)	109 (12.6%)
Total (N)		389 (45.1%)	N=863

The spectrum of diseases that were diagnosed in the study population were as follows: 364 patients (42.2%) patients had Upper respiratory tract infections; 89 (10.3%) had fever; 50 (5.8%) had lower respiratory tract infections; 73 (8.5%) were diagnosed with helminthiasis; 72 (8.3%) patients had diarrhea and vomiting;

38 (4.4%) had urinary tract infections and 111 (12.8%) had other diagnoses which included minor trauma, allergic symptoms, rheumatic fever, common headache, cellulitis/impetigo, phimosis, general weakness, poor appetite. Infection was the most common cause for illness affecting 61% of the study population (Table 2).

Table 2: Spectrum of diseases in study population

Diseases	No. of patients N=863
Upper respiratory tract infections (URTI)	364 (42.2%)
Lower respiratory tract infections (LRTI)	50 (5.8%)
Helminthiasis	73 (8.5%)
Fever	89 (10.3%)
Seizure Disorder	26 (3.0%)
Urinary tract infections (UTI)	38 (4.4%)
Diarrhoea/ Vomiting	72 (8.3%)
Asthma	16 (1.9%)
Epigastritis	24 (2.8%)
Others	111 (12.8%)
Total	863

Antibiotics were the highest prescribed drug class (12.6%) in the study population which correlated with the diagnosis. Penicillins

were prescribed for 88 (39%) patients followed by macrolides in 69 (30%) patients (Table 3).

Table 3: Antibiotics prescribed in study population

Class of antibiotic	No. of patients
Penicillins	88 (39%)
Cephalosporins	24 (11%)
Fluroquinolones	23 (10.2%)
Macrolides	69 (30.1%)
Others	22 (9.7%)
Total	226 (12.6%)

Table 4 depicts the duration of antibiotic therapy which was 5 days on an average for all the patients.

Table 4: Diagnosis vs. duration of antibiotic therapy

Diseases	Duration of antibiotic therapy (days)	No. of Patients (N = 863)	Total No. of Patient
URTI	5	Penicillin	73
		Macrolide	32
		Sulphonamide	2
LRTI	5	Macrolide	37
		Penicillin	7
Fever	5	Cephalosporin	6
		Sulphonamide	5
		Cephalosporin	3
UTI	7	Fluroquinolone	19
		Nitrofurantoin	10
Others	10	Cephalosporin	9
		Penicillin	8
		Cephalosporin	6
		Fluroquinolone	4
		Aminoglycoside	2
Others	5	Oxyzolidinediones	3
		Fluroquinolone	4
		Aminoglycoside	2

Of the 88 patients prescribed with penicillins, majority of them were prescribed with amoxicillin (54 patients), followed by amoxicillin + clavulanic acid in 28 patients; benzathine penicillin in 6 patients. Azithromycin, a macrolide antibiotic was prescribed in 69 (30%) patients. The cephalosporins prescribed included cefalexin in 7 patients, cefuroxime in 4 patients, cefixime in 8 patients and

cefepodoxime in 5 patients. Of the fluoroquinolone antibiotics, norfloxacin and ofloxacin were prescribed in 19 and patients respectively. Other antibiotics like gentamycin, nitrofurantoin, cotrimoxazole and mupirocin were also prescribed in study population as indicated in Table 5.

**Table 5: Drugs used in each class of antibiotics**

Antibiotic class	Name	No. of patients (n=863)	Total (n=863)
Penicillins	Amoxicillin+Clavulanic acid	28	88 (10.2%)
	Amoxicillin	54	
	Benzathine Penicillin	6	
	Cefalexin	7	
Cephalosporins	Cefuroxime	4	24 (2.8%)
	Cefixime	8	
	Cepodoxime	5	
Fluroquinolone	Norfloxacin	19	23(2.6%)
	Ofloxacin	4	
Macrolide	Azithromycin	69	69 (7.99%)
Aminoglycoside	Gentamycin	2	
Urinary antiseptics	Nitrofurantoin	10	22 (2.5%)
Sulphonamides	Cotrimoxazole	7	
Oxyolidinediones	Mupirocin	3	

Table 6 depicts the different dosage forms used in the study population at different age groups. Majority of the patients in the age group of less  $\leq 1$  year were prescribed with oral drops, followed by syrups and nasal drops. Syrups were the most preferred dosage forms for patients in the age range of  $>1 - \leq 4$  years (262 patients) and  $>4 - \leq 8$  years (135 patients). Suspensions were the next preferred dosage form in patients in the age range of  $>1 - \leq 4$  years

(104 patients) where as tablets were the second preferred dosage form in patients in the age range of  $>4 - \leq 8$  years (122 patients). Patients in the age range of  $>8$  years to  $\leq 16$  were mostly prescribed with tablets (200 patients in the age range of  $>8 - \leq 12$  years and 165 patients in the age range of  $>12 - \leq 16$  years). Capsules were the least preferred dosage form in all age groups.

**Table 6: Age vs. dosage forms used**

Dosage Forms	Age (yrs)					Total (n=863)
	$\leq 1$	$>1 - \leq 4$	$>4 - \leq 8$	$>8 - \leq 12$	$>12 - \leq 16$	
Oral drop	93	21	0	0	0	114 (6.4%)
Suspension	25	104	46	2	1	178 (9.9%)
Syrup	79	262	135	67	21	564 (31.6%)
Nasal drops	72	47	12	6	3	140 (7.8%)
Liquids	11	19	26	16	11	83 (4.7%)
Tablets	2	41	122	200	165	530 (29.7%)
Capsules	0	1	10	13	18	42 (2.3%)
Others	43	49	13	19	13	137 (7.6%)

## DISCUSSION

Out of 863 patients included in the study, 54.9% were males and 45.1% were females with age range of 1 month to 16 years. Majority of the patients were in the age range  $>1 - \leq 4$  years (30.1%), followed by  $>4 - \leq 8$  years (21.1%),  $>8 - \leq 12$  years (18.8%),  $\leq 1$  (17.4%) and  $>12 - \leq 16$  years (12.6%). On an average 2.07 (Mean  $\pm$  SD of 2.07 $\pm$ 0.9) drugs were prescribed per prescription. The results of this study confirmed to WHO prescribing standards<sup>7</sup> recommending a limit of 2.0 drugs per prescription.

The diagnostic patterns of outpatients enrolled in the study showed that upper respiratory tract illness was the most common problem affecting 364 patients (42.2%), followed by fever (10.3%), helmenthiasis (8.5%), diarrhoea and vomiting (8.3%), lower respiratory tract infection (5.8%), UTI (4.4%), seizure disorder (3.0%), epigastritis (2.8%), asthma (1.9%) and others (12.8%). This correlates well with other studies. Recent estimates indicate that 1.9 million children Worldwide die each year from acute respiratory illness, many of which are lower respiratory infections (LRIs)<sup>8</sup>. Pneumonia is one of the serious LRI. It is known that viruses are the most common cause of pneumonia in preschool children while Streptococcus pneumoniae is the most common bacterial pathogen

among pre and school-aged children and adolescents with community acquired pneumonia<sup>9</sup>. Mycoplasma pneumoniae and Chlamydia pneumoniae can also cause pneumonia in older children.

A total of 1788 drugs were prescribed for the study population of which, 226 (12.6%) drugs were antibiotics. Among the antibiotics, the penicillin group (39%) was most commonly prescribed followed by macrolides (30.1%) and cephalosporins (11%). This shows that the prescription volume of antibiotics is high which was statistically significant ( $p=0.000$ ). It must also be emphasized that the antibiotics are prescribed empirically and not through culture sensitivity reports.

The emerging problem of antibiotic resistance has become a major threat to the medical field. Excessive and inappropriate use of antibiotics has been a major contributor to this ever-growing problem. The majority of common childhood illnesses are caused by viruses which do not require antibiotics<sup>10</sup>.

Various dosage forms were prescribed for the children. The study showed that 60.4% of medicines were prescribed as syrup/suspension/oral drops/liquids/nasal drops and 32% was prescribed as tablets/capsules. All other dosage forms comprised

about 7.6%. The age at which children can swallow conventional tablets is of great importance for their safety. Liquid medicines are usually recommended for infants and younger children so the ability to mask unpleasant taste with sweeteners and flavours is crucial<sup>11</sup>.

The traditional cough suppressants and medicines against the common cold are the drugs most commonly given as syrups. Though these drugs have been licensed for use, more studies are required to label them as safe as they are not up to the current scientific standards<sup>12</sup>.

In the present study, incidence of infections was found to be 60.8% (525 patients) of which respiratory tract infections (48%) were common among 414 patients and penicillins were the commonest antibiotic prescribed (39%), among which amoxicillin was the most frequently prescribed. Syrups and tablets were the common dosage forms prescribed for all patients in the pediatric age group and capsules were least preferred.

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