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Irrational Antibiotic Usage among Pediatric Patients in a Tertiary Care Hospital-A Point Prevalence Cross-Sectional Study

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ABSTRACT

Background: *Irrational practicing of antibiotic prescribing adds up to increased morbidity and mortality of pediatric patients, especially with infections such as pneumonia, meningitis, bronchitis, etc.* ***Objective:*** *To determine the prevalence of irrational usage of antibiotics among pediatric patients and its effect on them.* ***Methods:*** *A cross-sectional observational study was conducted in a tertiary care hospital for a period of 6-months with 250 pediatric patients from various specializations. The exclusion was based on those with malnutrition, syndromes, congenital heart defects and other concomitant diseases including 80 patients. Medical and laboratory records were made use for the analysis.* ***Results:*** *Common age category of patients were from 0-12 months (57(22.8%)). Mean length of stay was about 6.3 (4; 1-40%). Blood culture reported Staphylococcus aureus (36.6%) to be the prominent organism. Cephalosporin (33.7%) was the commonly prescribed antibiotic class, with tetracycline (11.6%) commonly used as the prophylactic broad-spectrum antibiotic. The mortality rate due to irrational antibiotic prescription was about 37 [PR: 7.21 (1.75 to 22.59, p>0.005)].* ***Conclusion:*** *Male gender was more liable to infections and mortality due to irrational antibiotic prescribing had been increased significantly in the population requiring monitoring and appropriate screening.*

Keywords: Pediatrics, Antibiotics, Prophylaxis, Tetracycline

INTRODUCTION

Irrational drug usage, especially in infectious conditions in pediatric patients, has been a major cause of morbidity and mortality worldwide. Developing countries have been facing such situations commonly with pediatric patients below the age group of 5 years [1-3]. Inappropriate therapy with antibiotics leads to antibiotic resistance, adverse drug reactions or side effects, increased cost, superinfections which would be difficult for therapy. Antibiotic resistance could be defined as the resistance of a microorganism to antibiotics which happens when the bacteria modify to protect itself from antibiotics [4-6].

Antimicrobial resistance (AMR) has been increasingly faced due to improper assigning of antibiotics under certain conditions. The common influential factors towards these conditions are lack of prescriber's information, unnecessary prescribing of antibiotics, fear, patient's demands, self-prescribing by patients, etc., proper correction for this requires monitoring from the outpatients setting where more misusing of antibiotics occurs [7,8]. According to a study in Indonesia, all the patients administered antibiotics before surgery for prophylaxis and cefotaxime was the most common antibiotic given after the surgical procedure. Analyzing of prescribing patterns of antibiotics gives better rationality in drug prescribing which is even more effective for the pediatric population [9,10]. Generally, antibiotics are used for a short duration and the newer agents of antibiotics are highly reserved for specific conditions where the normal therapy does not work. Many microorganisms have thus developed resistance to these antibiotics causing ineffectiveness of therapy. Pediatric patients are highly exposed to infectious conditions demanding common use of antibiotics. Among these infections, diarrhea and respiratory tract infections are prominent which most of the time is caused by viruses and unwanted prescribing of antibiotics in which it remains ineffective. In order to avoid the irrationality WHO recommends in making use of the Indian Academy of Pediatrics list of Essential Medicines (IAP-EM) which is safe but not diagnosis-specific [11-14].

MATERIALS AND METHODS

The study was carried out in the pediatric department of a tertiary care hospital in South India, after its approval and permission from the hospital chief and committee. Information's were sought out with the help of SPSS software version 24 and other standard software. The sample size comprised of 250 including both the gender with pediatric patients of age <12 years. The study period was for about 6-months from June 2018-November 2018. Outpatients were excluded from the study and focusing on prophylactic, medical therapy patients were done.

A cross-sectional point prevalence study was carried out with data collection from prescription charts, laboratory records, and medical records. The parents or guardian of the pediatric patients were interviewed in order to get complete demographic details of patients. Details on age, diagnosis, number of antibiotics prescribed, duration of therapy, route of administration, frequency; were all collected with the help of a self-prepared questionnaire attached to the inpatient's record. A statistical study of mean, median, the standard deviation was configured with the help of software. Obtained data were compared with antibiotic guidelines along with cross-reference of Cochrane study and Martindale.

Outcomes were categorized into primary (survival/death) and secondary (rational/irrational use of antibiotics, first-line antibiotics, blood cultures, types of microorganisms, types of antibiotics, etc). The dependent variable was primary and secondary outcomes of survival and length of stay respectively and the independent variable was irrational use of antibiotics.

Inclusion Criteria

Patients records with antibiotics (oral and injectable) form either in generic or brand name, patients below or equal to 12 years of age of either sex, who stayed for at least 1 night were included in the study.

Exclusion Criteria

Patients records with antibiotics in the form of semi-solids (creams, ointments, drops), children with congenital heart defects, shock, disease syndromes, central nervous system disorders, malnutrition, sepsis, concomitant infections, etc. were excluded from the study.

Length of the stay indicates the number of days the patient stays at the hospital from admission to the date of discharge and they were grouped into 2 categories with a mean value of 7. Data were obtained and analyzed with p-values, Prevalence ratio (PR), 95% confidence interval, univariate analysis.

RESULTS

Out of the 330 patients who were interviewed for the study, 250 patients were found to fit the inclusion criteria and were selected. Based on the age group of pediatric patients selected, there was a mean and standard deviation of (5.135 ± 3.763), the highest frequency was found among the age group of 0-12 months (57 (22.8%)) and the lowest in patients of 1-4 years (39 (15.6%)) (Table 1).

Table 1 Age group of pediatric patients (n=250)

Range	Frequency	Mean age ± SD
0-12 months	57 (22.8%)	5.135 ± 3.763
1-4 years	39 (15.6%)	
5-7 years	55 (22.0%)	
8-10 years	51 (20.4%)	
11-12 years	48 (19.2%)	
Total	250 (100%)	

On the basis of the literature study, the pediatric patients of age group <1 year were more susceptible to infectious diseases and the results of our study laboratory also in favor of it. Demographic details of the patients were male 150 (60%) and female 100 (400%) with a median age of about 3.7. The length of stay was about 6.3 (4; 1-40%).

Based upon the wards, the pediatric population found in the medical ward was 163 (66.5%) and the surgical ward was 87 (34.59%). Rate of common infections among pediatric patients was highest in bronchopulmonary class (14.8%), upper respiratory tract (14.4%) with the lowest in bone and joints infection (4.0%). The most common antibiotic class made use of was Cephalosporins was 179 (33.7%), next to broad-spectrum penicillin was 116 (21.8%). Trimethoprim+sulfonamide 5 (0.9%) was found to be used rarely. The common combination of antibiotics made use of was ampicillin-gentamicin to about 39%. The single antibiotic regimen was found to be about 42.9%, two antibiotic regimens in about 38% and 3 antibiotic regimens in about 19.1% cases. In the blood culture, sample *Staphylococcus aureus* (56) was found prominent, next to *Pseudomonas aeruginosa* (43). About 97 samples were not cultured for microorganism. A total of about 90 patients were found to have irrational therapy which included spectrum (42), length of treatment (27) and dose (21) (Table 2).

Table 2 Demography and clinical outcomes of children prescribed with antibiotics

Characteristics of patients	Frequency (n=200)
Gender	
Male	150 (60%)
Female	100 (40%)
Age (Years)	
(mean, median, range)	5.135 (3.7; 0-12%)
Length of stay	
(mean, median, range)	6.3 (4; 1-40%)
Specialties	
Medical ward	163 (66.5%)
Surgical ward	87 (34.5%)
Infections in Patients	
Central nervous system	20 (8%)
Gastrointestinal system	35 (14%)
Urogenital tract	15 (6%)
Bone and joints	10 (4%)
Skin and systemic infections	12 (4.8%)
Upper respiratory tract	36 (14.4%)
Surgical/Trauma	55 (22%)
Bronchopulmonary	37 (14.8%)
Others	30 (12%)
Blood Culture	
No culture	97
Culture	
Pseudomonas aeruginosa	43
Staphylococcus aureus	56
Others	54
The Rationality of Antibiotic Use	
Irrational	
Spectrum	42
Dose	21
Length of treatment	27
Rational	160

Most patient were followed with 3 days antibiotic regimen (97 (38.8%), next to 5 days regimen (72 (28.8%)). Common drugs for anaerobes prescribed were metronidazole (31 (29.2%)) next to chloramphenicol (25 (23.5%)) (Figure 1).

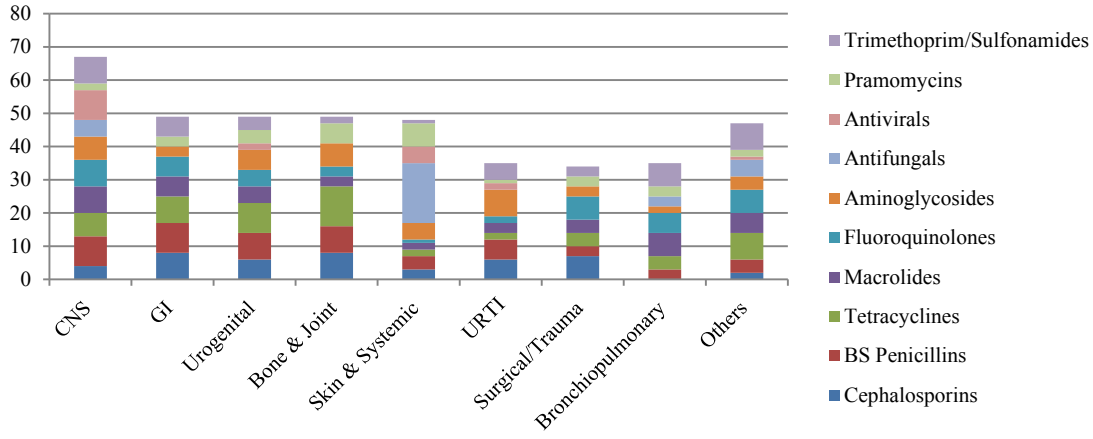

Figure 1 Various antibiotics made use of in infections of different systems

Broad spectrum antibiotics used for prophylaxis included Tetracyclines (29 (11.6%)) next to trimethoprim/ sulfonamides (25 (10.0%) (Table 3).

Table 3 Characteristics of antibiotics given to pediatric patients

Characteristics of Antibiotics Taken	Frequency among the Patients
Drug Distribution among Patients	
Cephalosporins	179 (33.7%)
Broad-spectrum penicillins	116 (21.8%)
Tetracyclines	51 (9.6%)
Macrolides	35 (6.6%)
Fluoroquinolones	27 (5.0%)
Aminoglycosides	15 (2.8%)
Antifungals	21 (3.9%)
Antivirals	72 (13.5%)
Paromomycin	9 (5.0%)
Trimethoprim+sulfonamide	5 (0.9%)
Duration of Antibiotic Course	
3 days	97 (38.8%)
5 days	72 (28.8%)
7 days	41 (16.4%)
14 days	40 (16.0%)
Drugs Commonly Prescribed against Anaerobes	
Chloramphenicol	25 (23.5%)
Metronidazole	31 (29.2%)
Erythromycin	20 (18.8%)
Benzylpenicillin	17 (16.0%)
Carbapenems	22 (20.7%)
Vancomycin	8 (7.5%)
Prophylactic Broad Spectrum Antibiotic Commonly Prescribed	
Tetracyclines	29 (11.6%)
Lincosamides	21 (8.4%)
Macrolides	19 (7.6%)
Trimethoprim/sulfonamides	25 (10.0%)

Based on univariate analysis, the incidence of mortality due to irrational antibiotic usage was about 37 [7.21 (1.75 to 22.59) p>0.005)], and those with a length of stay more than 7 days was about 31 [1.23 (0.89 to 3.09); p>0.019] (Table 4).

Table 4 Univariate analysis of antibiotic use

Primary outcome			PR (95% Cl)	p-value
Antibiotic Use	**Survived**	**Died**		
Rational	157	3	7.21 (1.75 to 22.59)	0.005
Irrational	53	37		
Length of stay			**PR (95% Cl)**	**p-value**
Antibiotic Use	**More than 0-7 days**	**7 days**		
Rational	4	160	1.23 (0.89 to 3.09)	0.019
Irrational	31	55		

Table 5 depicts the antibiotic prescription in the specific group which lead to irrationality.

Table 5 Antibiotic prescribing within specific diagnosis groups among the pediatric patients which are inappropriate

Each Diagnostic Group	Enteric Fever		Viral Fever		Unspecified Fever		Non-Infectious Respiratory Tract Infections	
	Number	**p-value**	**Number**	**p-value**	**Number**	**p-value**	**Number**	**p-value**
Number of inpatients	23	*	12	*	19	#	9	*
Duration of hospital stay (Mean (SD))	24 (12)	-	10 (7)	#	18 (10)	*	23 (12)	*
Number of antibiotics classes	21	#	16	*	17	*	18	#
Duration of antibiotic therapy (Mean, SD)	20 (19)	*	30 (22)	*	12 (7)	#	10 (6)	*
Antibiotics given by generic name	19	*	18	#	7	*	2	*
*p-value of 0.008; #p-value of ≤ 0.001								

DISCUSSION

Children with enteric fever, unspecified fever, and acute gastroenteritis were found to be commonly prescribed antibiotics. This seemed to pose most of the irrational drug interactions. Antibiotics are not rational therapy for viral infections. They were prescribed for therapy with the intention of rectifying superimposed bacterial infections in some cases. Third-generation cephalosporin is to be prescribed only in multi-drug resistant or complicated conditions, but most of the patients were prescribed with cephalosporin as empirical therapy. Broad-spectrum antibiotics like tetracyclines are indicated only when other antibiotics are found ineffective, ironically most of the cases in our study did not match with this concept of WHO [15-19].

From the results of other studies, the route of administration of antibiotics was increased through parental route in public sectors when compared to the public [20-22]. This strategy matched with our study too. Our study highlights the irrationality of therapy through long stay and antibiotic therapy duration to be high, which coincides well with recent study reports. Unnecessary fixed drug combination for inappropriate diagnosis is a bane which adds to the increased cost of therapy in person and antibiotic resistance. Thus it is always advisable to get access to generic drugs when compared to the trade name of drugs for its easy accessibility and bioavailability. Another prominent cause of irrationality of antibiotics is its increasing demand from the patient's caretakers for prescribing antibiotics for mild conditions [18,19]. This could be changed only with proper understanding and education to the patient on the effects of unnecessary prescribing.

Nowadays the selection of antibiotics in pediatric patients is not being appropriately done. Microbiological examination before the prescribing of antibiotics is to be compulsorily done in order to avoid complications and for precise therapy. Selection and amount of antibiotic are to be accurately done by healthcare professionals, as it is a wide source of irrationality.

CONCLUSION

The rationality of antibiotic usage especially in pediatrics requires its initiation from the patient's and caretakers understandings on its importance, antibiotic resistance, etc. Health care professionals too must encourage its conflicts and make keen use of available drugs. Generic following of therapy makes more reliable practices.

DECLARATIONS

Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

REFERENCES

[1] Thrane, Nana, et al. "Socioeconomic factors and prescription of antibiotics in 0-to 2-year-old Danish children." *Journal of Antimicrobial Chemotherapy,* Vol. 51, No. 3, 2003, pp. 683-89.

[2] Vlahovic-Palcevski, V., M. Morovic, and G. Palcevski. "Antibiotic utilization at the university hospital after introducing an antibiotic policy." *European Journal of Clinical Pharmacology,* Vol. 56, No. 1, 2000, pp. 97-101.

[3] Al-Zakwani, Ibrahim, et al. "Drug utilization pattern in an Intensive Care Unit at a tertiary care teaching hospital in Oman." *Asian Journal of Pharmaceutical and Clinical Research,* Vol. 10, No. 2, 2017, pp. 194-97.

[4] Rokhmah, Nisa Najwa, Retnosari Andrajati, and M. A. K. S. U. M. Radji. "Cross-sectional study of surgical prophylactic antibiotic administration in Marzoeki Mahdi Hospital, Bogor, Indonesia." *Asian Journal of Pharmaceutical and Clinical Research,* Vol. 10, No. 11, 2017, pp. 87-89.

[5] Sözen, Hamdi, et al. "Application of ATC/DDD methodology to evaluate antibiotic use in a general hospital in Turkey." *Annals of Clinical Microbiology and Antimicrobials,* Vol. 12, No. 1, 2013, p. 23.

[6] Akalin, Serife. *Antimicrobial consumption at a university hospital in Turkey*. Diss. Universitas Mataram, 2015.

[7] Vaccheri, Alberto, et al. "A 3-year survey on the use of antibacterial agents in five Italian hospitals." *Journal of Antimicrobial Chemotherapy,* Vol. 61, No. 4, 2008, pp. 953-58.

[8] Jasso-Gutiérrez, Luis, and José I. Santos-Preciado. "Use of defined-daily-doses per 100 bed-days for measuring the consumption of anti-infective in a pediatric hospital." *American Journal of Health-System Pharmacy,* Vol. 67, No. 1, 2010, pp. 14-15.

[9] Kuster, S. P., et al. "Quantitative antibiotic use in hospitals: comparison of measurements, literature review, and recommendations for a standard of reporting." *Infection,* Vol. 36, No. 6, 2008, pp. 549-59.

[10] Gyssens, Inge C. "Audits for monitoring the quality of antimicrobial prescriptions." *Antibiotic Policies*. Springer, Boston, MA, 2005, pp. 197-226.

[11] Watt, James P., et al. "Burden of disease caused by *Haemophilus influenzae* type b in children younger than 5 years: global estimates." *The Lancet,* Vol. 374, No. 9693, 2009, pp. 903-11.

[12] Nair, Harish, et al. "Global burden of acute lower respiratory infections due to the respiratory syncytial virus in young children: a systematic review and meta-analysis." *The Lancet,* Vol. 375, No. 9725, 2010, pp. 1545-55.

[13] Athale, U. H., R. C. Brown, and W. L. Furman. "Immunomodulation." *Clinical management of infections in immunocompromised infants and children. 1st ed. Philadelphia: Lippincott Williams and Wilkins*, 2001, pp. 584-615.

[14] Bhatnagar, Shinjini, et al. "IAP Guidelines 2006 on the management of acute diarrhea." *Indian Pediatrics,* Vol. 44, No. 5, 2007, pp. 380-89.

[15] Kotwani, Anita, and Kathleen Holloway. "Antibiotic prescribing practice for acute, uncomplicated respiratory tract infections in primary care settings in New Delhi, India." *Tropical Medicine and International Health,* Vol. 19, No. 7, 2014, pp. 761-68.

[16] Kundu, Ritabrata, et al. "IAP Task Force Report: management of enteric fever in children." *Indian Pediatrics,* Vol. 43, No. 10, 2006, p. 884.

[17] Björkman, Ingeborg, et al. "Infectious disease management in primary care: perceptions of GPs." *BMC Family Practice,* Vol. 12, No. 1, 2011, p. 1.

[18] Cabral, Christie, et al. "They just say everything's a virus-Parent's judgment of the credibility of clinician communication in primary care consultations for respiratory tract infections in children: A qualitative study." *Patient Education and Counseling,* Vol. 95, No. 2, 2014, pp. 248-53.

[19] Kotwani, Anita, et al. "Factors influencing primary care physicians to prescribe antibiotics in Delhi India." *Family Practice,* Vol. 27, No. 6, 2010, pp. 684-90.

[20] Pitaknetinan, Kitti, et al. "Profit, payment and pharmaceutical practices: perspectives from hospitals in Bangkok." *Health Policy,* Vol. 46, No. 3, 1999, pp. 179-94.

[21] Austad, Kirsten E., et al. "Association of marketing interactions with medical trainees' knowledge about evidence-based prescribing: results from a national survey." *JAMA Internal Medicine,* Vol. 174, No. 8, 2014, pp. 1283-90.

[22] Rajan, Asha K., et al. "Assessment of antibiotic sensitivity patterns in a primary care hospital." *Research Journal of Pharmacy and Technology,* Vol. 11, No. 8, 2018, pp. 3411-14.