Research Article

Assessment of Prescription Pattern of Antibiotic Drugs in the Hospitalized Pediatric Patients in A Tertiary Care Hospital

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ABSTRACT

The objective of this study is to assess prescription pattern of antibiotics in various diseases in the hospitalized pediatric patients, analyses the various common infectious disease in pediatrics, to identify the most prescribed antibiotics and to identify the common route of administration of antibiotics. A retrospective study of 6months duration was undertaken. A total number of 120 patients case sheets were utilized for study from pediatric in-patient department of SAPTHAGIRI institute of medical sciences & research center. Patients were included in study with age between 1 month to 15 years with diagnosis of respiratory, gastrointestinal, urinary tract and other infections. Randomization was done by selecting alternative case sheets. Majority of patients 55% belonged to age group of 0-5 years. the number of male patients were slightly high by 3.3%. Tendency of polypharmacy with maximum number of prescriptions were having 3 drugs (35%). Out of 120 patients enrolled in the study, it was observed that acute gastroenteritis in 36 (30%) followed by lower respiratory tract infection 23 (19.16%), and Pneumonia in 15 (12.5%). Most common antibiotics were Cefixime in 32.46% and Amikacin 22.51%, and Gentamicin in 14.13%. Out of 191 antibiotics prescribed 68.58% were given as Twice a day. Intravenous injections were the major formulations used for administration of antibiotics in pediatrics patients (86.66%). In this study antibiotic prescription pattern was not rational as there is polypharmacy, overuse and inappropriate use of antibiotics administration. Strict antibiotic prescribing policy significantly overcome the overuse of antibiotics and reduces the development of resistance to antibiotics.

Keywords: Antibiotics, pediatric, cefixime, acute gastroenteritis, respiratory tract infection, resistance.

INTRODUCTION

Antibiotics are molecules that kill, or stop the growth of, microorganisms, including both bacteria and fungi. Antibiotics that kill bacteria are called "bactericidal"; Antibiotics that stop the growth of bacteria are called "bacteriostatic". They are strong and effective medicines, which are used to treat most different bacterial infections. When antibiotics were first introduced, they were strong and efficient treatments for different bacterial infections. They saved the lives of numerous people.[1]

Antibiotics revolutionized medicine in the 20th century.[2] However, their effectiveness and easy access has also led to their overuse, prompting bacteria to develop resistance. This has led to widespread problems, so much as to prompt the World Health Organization to classify antimicrobial resistance as a "serious threat which is no longer a prediction for the future, it is happening right now in every region of the world and has the potential to affect anyone, of any age, in any country".[4]

Strategies should be made to optimize antibiotic use and this will minimize the antibiotic resistance. Following the strategy developed by WHO in a collaborative work with international network for rational use of drug (INRUD) can detect the 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.[33] Worldwide population constitute of about 28% of children and infants who are most susceptible to diseases due to under development of immune system. Several studies reported that 50% to 85% of children receive antibiotics in developed and developing countries prescribed by physicians. The use of antimicrobial agents, especially antibiotics has become a routine practice for the treatment of pediatric illnesses.[8]

Epidemiological evaluation of medicine use in the elderly is now a highly visible topic, but drug utilization studies in pediatric population have been limited. The assessment of medicine utilization is important for clinical, educational and economic purpose.[9] Children represent about 40% of India's population. Most suffer from frequent, usually self-limiting illnesses. Drug use in children has not been as extensively researched as in adults. It has been observed that 18.2% of children take drugs that are not required.[10] International guidelines for the treatment of childhood illnesses recommend antibiotic treatment for diarrhea with bloody stools and for acute lower respiratory tract infections, but not for non-bloody diarrhea and for upper respiratory infections.[11] Interventions to promote rational antibiotic use are critical for preserving the effectiveness of available drugs.[11] Conversely, in low-resource settings, the high burden of bacterial causes of diarrhea in children[12]

has led to proposals for antibiotics to be used more widely for the treatment of diarrhea even in the absence of dysentery.[13] Antibiotics may also be a potential intervention for malnutrition and environmental enteropathy.[14]

For infections in infants and children, the successful antibiotic treatment depends primarily on rapid diagnosis of the disease, identification of pathogenic microorganisms, and appropriate application of specialized pharmacokinetic and pharmacodynamics knowledge of antibiotics in children. In infants and children, the absorption, distribution, metabolism, and excretion of drugs may differ considerably in comparison with adults.[15] There are many different routes of administration for antibiotic treatment. Antibiotics are usually taken by mouth. In more severe cases, particularly deep-seated systemic infections, antibiotics can be given intravenously or by injection.[5] Where the site of infection is easily accessed, antibiotics may be given topically in the form of eye drops onto the conjunctiva for conjunctivitis or ear drops for ear infections and acute cases of swimmer's ear. Topical use is also one of the treatment options for some skin conditions including acne and cellulitis.[6] Topical antibiotics applied over certain types of surgical wounds have been reported to reduce the risk of surgical site infections.[7]

Expert recommendations for antibiotic dosing in the essential medicines list for children (EMLC) have been developed to address the lack of harmony in currently available international formularies. In many instances, recommendations are historical practice-based and not strongly evidence-based. Limited evidence is available from studies of effectiveness and safety as well as all age pharmacokinetics for children. National preferences for weight-based (US), age-banded (UK) and weight-banded (WHO) dosing strategies have resulted in quite widely varying recommendations.[16]

Pediatric patients are at a higher risk of experiencing medication errors than adults because of the need for a dose calculation based on a patient's age, weight (mg/kg), body surface area (mg/m^2), and clinical condition.[17,18] Miscalculation of pediatric dosing can lead to a tenfold or greater rate of dosing errors which can have harmful consequences for patients. Another source for dosing errors in children is misplacement of the decimal point after calculating the dose.[18] Antibiotics and sedatives are the medications most widely prescribed in the pediatric population and are the drug classes most commonly reported involved in pediatric medication errors.[19,20]

Antimicrobial side effects present as adverse drug reactions involving one or more organ systems. Although most antibiotics are safe considering their volume of use, some antimicrobials have the potential for life-threatening side effects. In general, β-lactams have the least frequent and least severe side effects. Although any antibiotic is capable of causing side effects, specific agents from each antibiotic class are more likely to do so than others.[21] Side effects from antibiotics are a common reason that children go to the emergency room. These medicines can cause diarrhea or vomiting, and about 5 in 100 children have allergies to them. Some allergic reactions can be serious and life threatening.[22]

Identification of the subset of patients with bacterial infections is key in guiding the best possible management.[23]

In response to worldwide concerns about the excessive use of antibiotics, the rate of oral antibiotic prescribing to children has declined in recent years in Canada, the United States and some other countries.[24,25] Antibiotic resistance is accelerated by the misuse and overuse of antibiotics, as well as poor infection prevention and control. Steps can be taken at all levels of society to reduce the impact and limit the spread of resistance.[26]

The main objective of this study is to evaluate the prescribing patterns of antibiotics in pediatric patients of inpatient. Findings of this study are expected to provide relevant information to pediatricians and general practitioners.

MATERIALS AND METHODS

Study design

This study was a hospital based prospective and observational study conducted at SAPTHAGIRI institute of medical sciences & research center (SIMSRC) (SAPTHAGIRI Hospital), a 1200 bedded multispecialty tertiary care teaching hospital over a period of 6 months.

Study population

The study was done in the Department of pediatric in a tertiary care hospital. The data was collected from the patients admitted to IP pediatric department. The hospital caters to both urban and rural population. Most of the patients belong to middle and upper strata of the society.

Sampling method

All the patients irrespective of diagnosis, and treatment who were on antibiotic prescription and were willing to give consent were included in the study.120 patients were selected based on the criteria. The pediatric wards were visited on all five days of the week and information regarding the patient demographics and drug use were recorded in a suitably designed proforma.

Study criteria

Inclusion criteria

Neonate: newborn up to first 28 days of life.
Infant: comprises neonatal period up to 12 months.
Toddler: 1-3 years.
Pre-school: 3-5 years.
School-age: 6-10 years.
Adolescent: 11-14 years.

All prescriptions containing antibiotics in in-patients.

Exclusion criteria

Patients of either sex aged >15 years of age.

Prescriptions which does not containing antibiotics.

Pediatrics from intensive care unit.

Study materials

Patient Consent Form

Consent of each guardian was taken. Consent was collected by using self-designed Patient Consent Form.

Data Collection Form

Data was collected by using a self-designed data collection form, which contained details like patient demographics, laboratory data, drug therapy and other relevant information.

Data analysis

This was a retrospective and prospective observational study. The patients who satisfied the inclusion criteria was enrolled into the study with the help of patient consent form. The clinical pharmacist reviewed the patient case notes, medication chart, laboratory data and other relevant data. A structured data collection form was used to record all the necessary data including patient demographic details, patient medication history, co morbid conditions, reason for admission, medication details and lab investigation. The pattern of drug dosing was also recorded.

RESULTS

Out of 120 patients enrolled in the study from inpatient pediatrics department, majority of patients belonged to age group of 0-5 years (55%) followed by 6-10 (30%) and 11-15(15%). Gender distribution of patients showed that62 (51.6%) patients were males and 58 (48.3%) patients were females. (Table 1)

Table 1: Demographic details

Age / Gender	No. Of Patients	In Percentage
Age distribution of patients observed (n=120)		
0-5	66	55%
6-10	36	30%
11-15	18	15%
Gender Distribution of Patients observed		
Male	62	51.6%
Female	58	48.3%

Tendency of polypharmacy with maximum number of prescriptions were having 3 drugs (35%) followed by four drugs 37 (30.83%), five drugs 16 (13.33%) and six drugs 11 (9.16%). (Figure 1, Table 2)

Table 2: Total number of drugs prescribed per patient (n=120)

Therapy Pattern	No. Of Patients	In Percentage
One Drug	3	2.5%
Two Drugs	7	5.83%
Three Drugs	42	35%
Four Drugs	37	30.83%
Five Drugs	16	13.33%
Six Drugs	11	9.16%
Seven Drugs	3	2.5%
Eight Drugs	1	0.83%

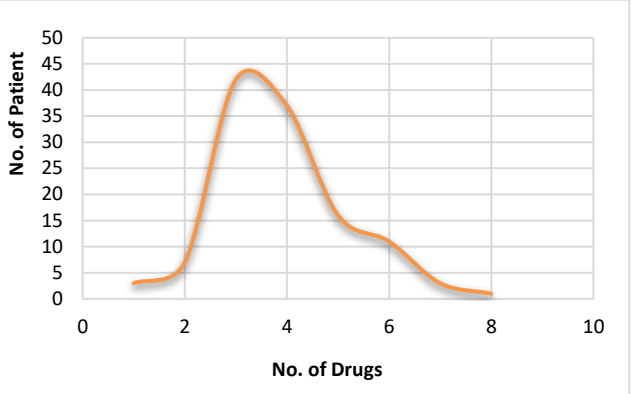

Figure 1: Total number of drugs prescribed per patient

In this study, most of the pediatric patients were prescribed two antibiotics (55%) followed by single antibiotics (35.83%), three antibiotics (6.66%) and four antibiotics (2.5%).Out of 191 antibiotics prescribed, 131 (68.58%) were given as twice a day, followed by 52 (27.22%) were given as three times a day and four times a day in 5 (2.61%) which is represented in Figure 2. Intravenous injections (86.66%) were the major formulations used for administration of antibiotics in pediatrics followed by tablets (9.16%) and syrups (4.16%). (Table 3)

Table 3: Number, frequency and route of administrations of antibiotics

Therapy Pattern / Frequency / Formulations	No. Of Patients	In Percentage
Number of Antibiotics prescribed per patient (n=120)		
One Drug	43	35.83%
Two Drugs	66	55%
Three Drugs	8	6.66%
Four Drugs	3	2.5%
Frequency of treatment observed (n=191)		
Once Daily	3	1.57%
Twice A Day	131	68.58%
Three Times A Day	52	27.22%
Four Times A Day	5	2.61%
Formulation of antibiotics used in pediatrics(n=120)		
Intravenous	104	86.66%
Tablet	11	9.16%
Syrup	5	4.16%

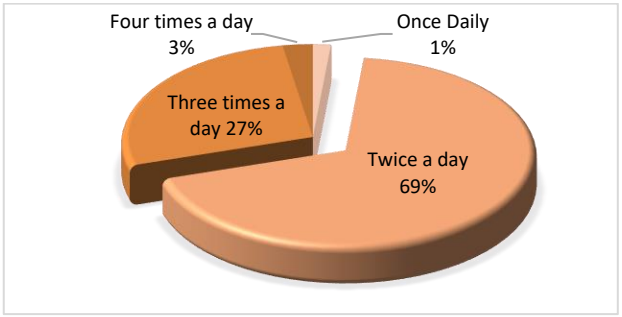

Figure 2: Distribution of frequency of treatment observed

The most diagnosis pattern in different age groups were found acute gastroenteritis in 36 (30%) followed by lower respiratory tract infection 23 (19.16%), and Pneumonia in 15 (12.5%). (Figure 3, Table 4).

Table 4: Diagnosis pattern in different age groups (n=120)

Diagnosis	1 Month- 5 Years	6-10 Years	11-15 Years	Total	In Percentage
Acute GE	21	10	5	36	30%
LRTI	13	8	2	23	19.16%
Pneumonia	11	3	1	15	12.5%
Enteric Fever	6	2	2	10	8.33%
Dengue Fever	4	4	2	10	8.33%
URTI	2	3	1	6	5%
Febrile Seizure	4	1	2	7	5.83%
UTI	----	2	1	3	4.16%
Nephrotic Syndrome	----	1	1	2	2.5%
Others*	3	1	---	4	3.3%
Combination**	2	1	1	4	3.3%
Total	66	36	18		
In Percentage	55%	30%	15%		

Others*: Poisoning, skin infection, ADEM, viral hepatitis.
Combination**: Skin infection and acute GE, UTI and enteric fever, LRTI and viral hepatitis, acute GE and dengue fever.

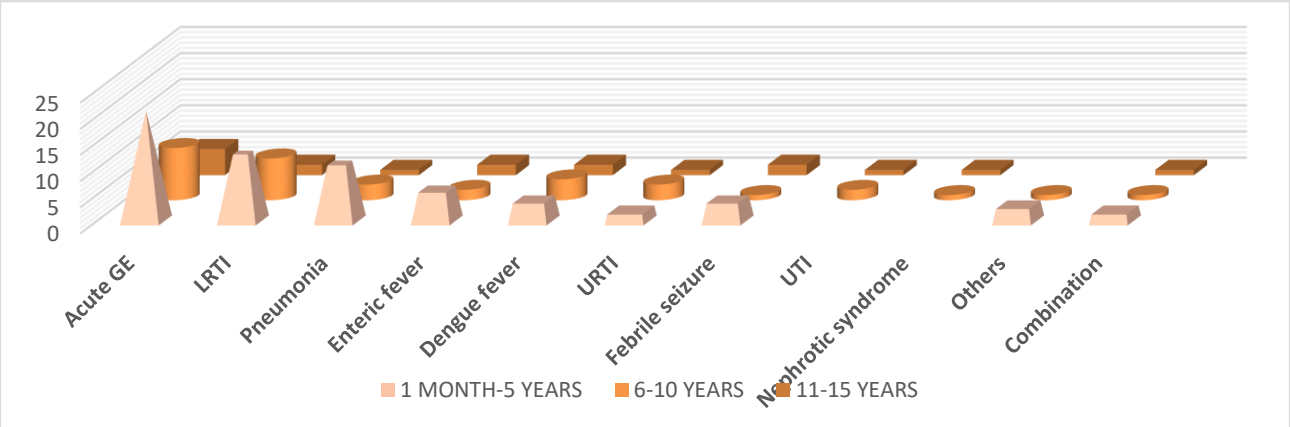

Figure 3: Diagnosis pattern in different age groups

The most common antibiotics received were cefixime in 62 (32.46%) followed by amikacin 43 (22.51%), and gentamicin in 27 (14.13%). (Table 5)

Table 5: Distribution of most common antibiotics received (n=191)

Antibiotics	Number of Prescription	In Percentage
Cefixime	62	32.46%
Amikacin	43	22.51%
Gentamicin	27	14.13%
Ceftriaxone	20	10.47%
Ciprofloxacin	12	6.28%
Amoxycillin + Clavulanate	11	5.75%
Metronidazole	9	4.71%
Other Dugs	7	3.66%

DISCUSSION

Several studies reported that 50% to 85% of children receive antibiotics in developed and developing countries prescribed by physicians. Worldwide population constitute of about 28% of children. The use of antimicrobial agents, especially antibiotics has become a routine practice for the treatment of pediatric illnesses. Their irrational use leads to a number of consequences in terms of cost, drug interactions, hospital stay, increased medication error and bacterial resistance.

In this study, majority of the patients belonged to the age group of less than 5 years (55%), which was similar to the study conducted by, Laya Vahdati Rad, Modupalli

Alekhya, where they observed that the majority of the patients belonged to the age group 0-5 years (55.4%).[29] The main reason is it may be because these group of people have less immunity and are more prone to infections. Males and female population were almost similar in this study; The total percentage of male pediatric patients were 51% comparatively more than of female pediatric patients 48%. Similar findings were seen in other studies done by Tupakula karthik babu, et al and Laya Vahdati Rad, Modupalli Alekhya.[28,29]

The present study was carried out in 120 prescriptions selected in pediatric in-patient case sheets from record section and pediatric ward in Sapthagiri hospital. As the children included in this study had been hospitalized for treatment of infectious diseases, substantial antibiotic usage was expected; however, experts recommend switching from parenteral to oral medication once the child is stable, or even initiating the treatment with oral antibiotics, especially in children with UTI and pneumonia.

Average number of drugs per person is an important index of prescription audit. The WHO recommends that the average number of drugs per prescription should be less than two.[32] Mean number of drugs per prescription should be kept as low as possible. In this study, results showed tendency of polypharmacy with maximum number of prescriptions were having 3 drugs (35%). It could be due to in-patient nature of the study. In Swapnil Narayan Deshmukh, Manali Mangesh Mahajan study shows average number of drugs per prescription was 4.23 respectively and less than present study (5.25).[30] Higher figures (polypharmacy) always lead to increased risk of drug interaction, adverse effects, development of bacterial resistance, increased hospital cost.

In this study, most of the pediatric patients were prescribed two antibiotics 55%, single antibiotics 36%, three antibiotics 7% and four antibiotics 2%. In Tupakula karthik babu, et al study shows a greater number of patients have received single antibiotics (47%).[28] The WHO recommends that the average number of drugs per prescription should be less than two.[32] The average number of drugs per prescription value should be low as possible to prevent the unfavorable outcomes of polypharmacy such as increased risk of drug interactions, increased cost of therapy, non-compliance and emergence of resistance in case of use of antimicrobials.

Intravenous injections were the major formulations used for administration of antibiotics in pediatrics (87%). The main reason is it may be because of urgent control of infections and to minimize morbidity as compared to oral route. WHO recommends lesser use of injection as it helpful in reducing the cost of treatment and its disadvantages. In oral dosage forms the most commonly used dosage form was tablet. Similar findings were seen in other studies done by Tupakula karthik babu, et al 94% of antibiotics were administered by intravenous route and 6% by oral route. Children are comfortable with the dosage form like syrup and drops compared to tablets and capsules.[28] Most common prevalence of disease among the study was acute GE (30%) and it is treated commonly by cefixime and gentamicin. In this study, most commonly prescribed antibiotic was third generation cephalosporin. In Kailash Thapaliya, et al study shows the most prevalent disease among studied patients was pneumonia followed by acute gastroenteritis, and lower respiratory tract infection.[27] In Swapnil Narayan Deshmukh, Manali Mangesh Mahajan study shows, the most prevalent disease among studied patients was acute GE[30] which is similar to present study.

Cefixime (32%) and Amikacin (23%) were most commonly prescribed antibiotics against diseases like AGE, LRTI and pneumonia. This could be due to their effectiveness in these conditions. Ceftriaxone was commonly used in cases of enteric fever. In one of the studies conducted in tertiary care hospital have found that the commonly used antibiotic combination were amoxycillin with clavulanic acid and cefotaxime with sulbactam (Choudhury DK and Bezbaruah BK).[31] Whereas, in another tertiary care hospital cephalosporin was found to be widely prescribed antibiotic, third generation, ceftriaxone was the leading antibiotic prescribed followed by cefotaxime, cefixime and other antibiotics (Kailash Thapaliya, et al).[27]

Out of 191 antibiotics prescribed 69% were given as Twice a day, followed by 27% were given as Three times a day and Four times a day in 3%. This is based on the choice and course of antibiotics for the therapy.

CONCLUSION

In this study antibiotic prescription pattern was not rational as there is polypharmacy, overuse and inappropriate use of antibiotics and excessive Parenteral use of antibiotics administration. As the resistance of antibiotics is increasing, so they should be selected based on culture report and limited use of antibiotics should be done in patients especially in pediatrics. Though a conclusive inference could only be made after analyzing larger number of cases, this study gives an overview of the pattern of antibiotic used in pediatric patients.

The study showed that majority of patients belonged to age group of 0-5 years. The most common illness for which children were hospitalized involves acute gastroenteritis, respiratory tract infection, pneumonia and enteric fever. Intravenous route is the most common route of administration. Most of the pediatric patients were prescribed two antibiotics. It was observed that most prescribed antibiotics were cefixime, amikacin and gentamicin.

Strict antibiotic prescribing policy significantly overcome the overuse of antibiotics and reduces the development of resistance to antibiotics. Prescription pattern analysis or auditing types of studies are to be conducted on large scale in different health sectors then study will be more effective and help in making local policy for antibiotics prescription in pediatric and also in other specialties.

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