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Original Research Article

A prospective study of antimicrobial drug utilization in infective diseases in pediatrics at Navodaya Medical College Hospital of Raichur, Karnataka, India

Md Mohsin Ahmed[1], Momin Mohd Abdul Mujeeb[2]*

[1]Department of Pharmacology, KBN Institute of Medical Sciences, Gulbarga, Karnataka, India
[2]Department of Pharmacology, B.J. Government Medical College, Pune, Maharashtra, India

*Correspondence to:
Dr. Momin Mohd Abdul Mujeeb,
Email: mominmujeeb23@gmail.com

ABSTRACT

Background: There is increased concern regarding the inappropriate use of antimicrobials resulting in emergence of resistant strains, unnecessary adverse effects and poor therapeutic outcome. This present study has been taken up with a view to analyze the use of various antimicrobial agents alone and/or in combination to combat diseases of infective origin in a proposed manner.

Methods: This was a prospective study carried out for a period of 1 year from January 2011 to December 2011. The prescriptions of all eligible patients were reviewed on daily basis and all the relevant data were retrieved to assess the utilization pattern of antimicrobials and also their safety and potential interactions.

Results: A total of 500 patients were selected randomly who satisfied the inclusion criteria. Of the total selected patients with infectious diseases, 493 patients (98.6%) received one or more antimicrobials. Use of antimicrobials was high in the age group of '6 months to 3 years', 'rural patients' constituted 62% and were mostly from 'Lower Socio-economic status' (46%). Respiratory diseases constituted 38% of the patients. Fever was the notable symptom in 68.4%. Cephalosporins (48.6%) were the most frequently prescribed class of antimicrobials. Combination of 'Parenteral therapy followed by oral therapy' was the preferred route in 92%, and a combination of two antimicrobials was seen in 34.4%. Majority of the patients (81%) were discharged on advice and most of the patients (37.6%) had duration of stay of 7-9 days. 25.8% reported 'Adverse Drug Reactions' including predictable and unpredictable reactions.

Conclusions: Antimicrobial prescribing is common in pediatric infectious diseases. As inappropriate usage of systemic antimicrobials was observed, it is essential that appropriate guidelines on the use of systemic antimicrobials are implanted to ensure rational prescribing of antimicrobials.

Keywords: Antimicrobials, Drug utilization evaluation, Prospective study, Rational drug use

INTRODUCTION

Patients' health mainly depends on the medications they receive. At the same time, the prescriber must remember that a scientific approach does not mean 'a patient must be treated as a mere biochemical machine'. It does not mean the exclusion of spiritual, psychological and social dimensions of human beings, but it does mean 'treating all these in a rational manner'.[1]

Today's physician has an imposing arsenal of drugs. The remarkable spurt of potent drugs in the last two decades, has led to concern and perhaps over reaction that prescribing of drug may be unnecessary, inappropriate and even dangerous. Hence, the concept of drug utilization

should be seriously considered. Drug utilization is defined as "the marketing, distribution, prescription and use of drugs in a society, with special emphasis on the resulting medical, social and economic consideration".[2]

The judicious use of antimicrobials in family practice in United States revealed 79% of prescriptions were unnecessary according to the Centre for Disease Control and Prevention (CDC) guidelines.[3]

Since the past few decades more attention is being given to rational prescribing. Drug utilization studies are playing a major role in this regard. These studies not only detect flaws in the therapy but also find out solutions to rectify the same.

World Health Organization (WHO) has already established, "Drug utilization Research Group (DURG)" in 1968 to monitor these studies and to prescribe the guidelines from time to time.[4]

Antimicrobials are the greatest contribution of the 20th century to anti-infective therapies.[5] As a class they are one of the most frequently used, as well as misused drugs.[6] The inevitable consequence of the widespread use of antimicrobial agents has been the emergence of resistant pathogens, fuelling an ever increasing need for new drugs[6]. 'Monitoring of antimicrobial use' and 'knowledge of prescription habits' are some of the strategies recommended to contain resistance to antimicrobials in hospitalized patients. Antimicrobial resistance substantially raises, already-rising health care costs and increases patient morbidity and mortality.[7]

Drug Utilization Evaluation (DUE) is an ongoing, authorized, systematic quality improvement process designed to ensure that drugs are used appropriately, safely and effectively.[8] The primary aim of DUE is to provide patient care through the optimization of therapy, which can be achieved through the ongoing review for use of drugs against standard criteria. The goals of this program include education of health care professionals with rational use of drugs, improve cost effectiveness in drug therapy by selecting the appropriate drug for appropriate period of time and avoiding the exposure of patients to unnecessary drugs.[9] Monitoring reveals the trends in the prescribing pattern and allows comparisons to be made between hospitals.[10]

Since infective diseases are the leading cause of morbidity and mortality among children in developing countries, causing majority of deaths in childhood, hence this present study has been taken up with a view to analyze the use of various antimicrobial agents alone and/or in combination to combat diseases of infective origin in a proposed manner.

The present study was undertaken to analyze the antimicrobial drug utilization in infectious diseases in pediatric age group for various infections at Navodaya Medical College, Raichur.

Objectives

- To assess the prescribing pattern of antimicrobials in pediatric infectious diseases in Navodaya Medical College Hospital and Research Center, Raichur.
- To determine the incidence of use of antimicrobials in pediatric infectious diseases.
- Hospital based studies to carry out a "THERAPEUTIC AUDIT" and to see,
  - What is prescribed?
  - What is the intention and rationale?
- To study the effectiveness of antimicrobials in the prevention and treatment of pediatric infections and time taken for control of infection.
- To assess the appropriateness of the antimicrobials usage.
- To assess the adverse reactions to various antimicrobials.

METHODS

Study site

The Navodaya Medical College Hospital and Research Center, Raichur is an 865 Bed urban tertiary care teaching hospital affiliated with The Rajiv Gandhi University of Health Sciences Karnataka, Bengaluru. The hospital has all major services as per the norms of the Medical Council of India (MCI). The institution covers a population of over 5 lakh inhabitants and has 40000-45000 patients/ admissions / year (an average of 120 admissions/day).

The study was carried out in the pediatric ward, Navodaya Medical College Hospital and Research Center, Raichur. The ward Consists of 110 Beds and has a turnover of 5500-6000 patients /year.

The total duration of the study was over a period of one year starting from 01st January 2011 to 31st December 2011. During this period the prescription data pertaining to 500 inpatients were collected from the day of admission of the patient to the day of discharge from the hospital. No follow up were done thereafter.

The study was approved by the Institute Human Ethical Committee, and permission for collection of data and to accompany physician in the pediatric ward was taken from Head of Pediatric Department, 'Navodaya Medical College Hospital and research center', before starting the study.

Study design

All the patients admitted to pediatric ward were reviewed daily to identify the patients with infective disorders and/or

those prescribed with antimicrobials. Those patients who met the study criteria were enrolled into the study.

The prospective data collection of those who were subjected to infective diseases was done from the pediatric ward of all the units between 2 p.m. to 4 p.m. without disturbing the morning session, so as to facilitate the rounds by the professors, post graduates and interns of pediatric department. Discharge advice of those discharged during any other time was collected from the case sheet sent to Medical Record Department (MRD). In case of doubtful prescriptions, discussions was done with the concerned unit consultants.

Source of data

A written consent was taken from the parents/guardian explaining them about the reason for their interaction. Only upon their satisfactory will the particular data collection was initiated. The sources of data were physicians prescribing records, patient's medication profile and weekly, daily cards. Patient profile (age, sex, weight, height, patient's address), drugs prescribed (generic/brand name), doses and frequency were recorded. Interviews were conducted by using structured questionnaire (open question method).

Inclusive criteria

- Patients of either sex above 06 months of age.
- Evidence of infective disorder such as fever, diarrhea, cough etc.
- Patients prescribed with antimicrobials on inpatient basis.

Exclusion criteria

- Patients less than 06 months of age and more than 15 years of age.
- Patients with immune suppressive disorders.
- Patients on immune suppressive therapies.
- Patients with septal defects, thalassemias, metabolic disorders.
- Patients with chronic disorders such as tuberculosis, leprosy, syphilis, diabetes etc.

Data analysis

Descriptive statistics was used to analyze the results. The data was analyzed and the percentage value was calculated for the use of different class of antimicrobials. The nature and extent of use of each class and individual antimicrobial was also determined. The type of antimicrobial used for a particular disease condition was also determined.

The rationality of antimicrobials prescription was assessed with respect to various parameters such as indication, dose, frequency and duration of treatment. The prescriptions of all enrolled patients were checked for the appropriateness of use of antimicrobials. The rationality/appropriateness of

antimicrobials with respect to various parameters such as indication, dose, frequency and duration was assessed by analyzing the collected data against standard texts, relevant literatures and available antimicrobial guidelines.

RESULTS

A total of 3697 patients were admitted in pediatrics department from January 2011 to December 2011, out of which 500 patients were selected randomly who satisfied the inclusion criteria. Out of the 500 selected patients 493 patients (98.6%) received one or more antimicrobials.

Out of the 500 patients, 41.6% (n=208) of the patients were in the age group of 6 months to 3 years. 25% (n=125) of the patients were in the age group of 3-6 years. 11% (n=55) were in the age group of 6-9 years. 15.4% (n=77) were in the age group of 9-12 years and 7% (n=25) were in the age group of 12-15 years (Table 1).

Table 1: Age wise distribution of patients.

Age of patients	No. of Patients (%)
6 months to 3 years	208 (41.6%)
3 years to 6 years	125 (25%)
6 years to 9 years	55 (11%)
9 years to 12 years	77 (15.4%)
12 years to 15 years	25 (7%)
Total	500 (100%)

Out of the total (500) pediatric patients, 295 (59%) were males and 205 (41%) were females (Table 2).

Table 2: Distribution of patients based on gender.

Sex of patients	No. of patients (%)
Male	295 (59%)
Female	205 (41%)
Total	500

Out of the total 500 patients, 310 (62%) of the Patients belongs to Rural and 190 (38%) belongs to urban area (Table 3).

Table 3: Rural/urban distribution of patients.

Rural/urban	No. of patients (%)
Rural	310 (62%)
Urban	190 (38%)
Total	500 (100%)

The 'lower class' 231 (46.2%) constituted the majority of the patient in the study followed by 'lower middle' 224 (45.8%), 'Upper middle' 26 (5.2%), 'upper lower 13 (2.6%) and 'Upper class' 6 (1.2%) (Table 4).

Out of the 500 patients, most of them 92.8% (n=464) presented with malnourished state according to 'Indian Academy of Pediatrics (IAP) Classification 1972'. 24.6%

(n=123) were under nourished. 21.2% (n=106) of the children were of Grade-1 malnutrition. 19.4% (n=97) were Grade-2 malnutrition. 14.8% (n=74) were of Grade-3 malnutrition. 13.4% (n=67) were of Grade-4 malnutrition (Table 5).

The relationship of various nutritional state and its association with various infectious diseases is also summarized; out of the 500 patients in the study 190 (38%) were suffering from either of Respiratory infections, while 10 (2%) were suffering from cardiovascular infection, 45 (9%) were suffering from infections of the central nervous system, 33 (6.6%) were diagnosed with typhoid, 125 (22%) were diagnosed with Malaria, 103 (20.6%) were suffering from gastrointestinal infections, 3 (0.6%) were

diagnosed with renal infections while 9 (1.8%) patients were diagnosed with Protein Energy Malnutrition (PEM) with no significant infection (Table 5).

Table 4: Distribution of patients based on Socio-economic status.

Socio-economic status	No. of patients
Lower	231(46.2%)
Lower middle	224(44.8%)
Upper lower	13(2.6%)
Upper middle	26(5.2%)
Upper	6(1.2%)
Total	500 (100%)

Table 5: The relation of 'Nutrition status' to infectious diseases.

Infectious diseases	Nutritional status						Total
	Normal (n=36)	Grade 1 (n=106)	Grade 2 (n=97)	Grade 3 (n=74)	Grade 4 (n=67)	Under nourished (n=123)	
Respiratory	-	62	57	16	17	38	190(38%)
CVS	6	3	-	-	-	1	10(2%)
CNS	13	15	7	3	2	5	45(9%)
Typhoid	-	3	7	6	1	16	33(6.6%)
Malaria	17	23	15	19	-	36	110(22%)
Gastro intestinal	-	-	10	26	44	23	103(20.6%)
Renal	-	-	1	-	-	2	3(0.6%)
PEM only	-	-	-	4	-	2	6(1.2%)

Out of the 500 patients in the study, various patients were suffering from multiple symptoms, fever was the most dominating symptom affecting 342 (68.4%) patients, Cough affecting 195 (39%) patients, vomiting affecting 115 (23%) patients, loose stools affecting 95 (19%) patients, convulsions affecting 35 (7%) patients, pain-abdomen/head ache affecting 30 (6%) patients and yellowish discoloration affecting 15 (3%) patients (Table 6).

Table 6: Incidence of presenting symptoms.

Symptoms	No of patients
Fever	342 (68.4%)
Cough	195 (39%)
Loose stools	95 (19%)
Vomiting	115 (23%)
Convulsions	35 (7%)
Pain - abdominal/headache	30 (6%)
Yellowish discoloration	15 (3%)

Out of the 500 patients in the present study with infections 158 (31.6%) had a past history of similar infections, while 342 (68.4%) had no past history of similar infections (Table 7).

Table 7: Incidence of preceding infections.

Category	No of patients (%)
Patients with Past history of similar infections	158 (31.6%)
Patients with no Past history of similar infections	342 (68.4%)
Total	500 (100%)

In the present study, cephalosporins (n=243) were the most frequently prescribed class of anitmicrobials followed by Penicillines (n=235), aminoglycosides (n=229) antimalarial (n=199) anthelmintic (n=114) and many more (Table 8).

Out of the 500 patients in the present study, most of the patients 460 (92%) received a combination of 'parenteral and oral therapy', followed by 26 (5.2%) patients receiving only oral therapy and 14 (2.8%) patients receiving only parenteral therapy (Table 9).

Out of the 500 patients in the study, 122 (24.4%) patients received single antimicrobial therapy, while 172 (34.4%) patients received a combination of two antimicrobials, 153 (30.6%) patients received a combination of three

antimicrobials and 53 (10.6%) patients received a combination of more than three antimicrobials (Table 10).

Table 8: Prescribing pattern of antimicrobials.

Prescribing pattern	IV	Oral
Ceftriaxone (T1)	33	-
Amoxicillin (T2)	56	52
Gentamicin (T3)	105	-
Azithromycine (T4)	-	15
Ampicilline (T5)	178	-
Ampicilline + Cloxacillin (T6)	60	25
Amoxcilline + Clavulanic acid (T7)	115	72
Amikacin (T8)	102	-
Cefotaxime (T9)	30	-
Cefpodoxime proxetil (T10)	26	-
Cefixime (T11)	128	-
Ciprofloxacin (T12)	10	12
Cefoperazone + Sulbactam (T13)	12	-
Co-trimoxazole (T14)	-	20
Ceftriaxone + Tazobactam (T15)	26	-
Crystalline Penicillin (T16)	11	-
Quinine (T17)	91	69
Chloroquine (T18)	-	30
Arteether (T19)	9	-
Diethyl carbamazine (T20)	14	-
Metronidazole (T21)	13	61
Netilmicine (T22)	22	-
Albendazole (T23)	-	67
Albendazole + Ivermectine (T24)	-	33

Table 9: Distribution of patients based on 'Routes of drug administration'.

Route	No. of patients
Oral only	26 (5.2%)
Parenteral only	14 (2.8%)
Parenteral + Oral	460 (92%)
Total	500 (100%)

Table 10: Number of antimicrobials used.

Antimicrobials	No. of patients (%)
Single	122 (24.4%)
Double	172 (34.4%)
Triple	153 (30.6%)
More than Three	53 (10.6%)
Total	500 (100%)

Out of 500 patients most of the patients 405 (81%) were discharged on advise after complete cure, while 68 (13.6%) were either discharged against medical advice or were found absconded without any information, 27 (5.4%) were referred to higher center (Table 11).

In the Present study, out of the 500 patients 30 (6%) patients stayed for 1-3 days, 180 (36%) patients stayed for

4-6 days, 188 patients (36%) stayed for 1-9 days and 102 (20.4%) stayed for more than nine days. Hence most of the inpatients in this study stayed for a duration of 7-9 days (Table 12).

Table 11: Distribution of patients based on 'Discharge position'.

Discharge position of patient	No. of Patients
On advise	405 (81%)
Against advise	68 (13.6%)
Referred to higher center	27 (5.4%)
Total	500 (100%)

Table 12: Distribution of patients based on 'Duration of stay'.

No. of days	No. of patients
1-3	30 (6%)
4-6	180 (36%)
7-9	188 (37.6%)
>9	102 (20.4%)
Total	500 (100%)

The adverse events experienced by the study patients are presented in Table 6.

Out of the 500 patients in the study, a total of 129 (25.8%) adverse drug reactions were reported during the study period. Of the total ADRs reported 68.2% (n=88) were mild and 29.5% (n=38) of the reactions were moderate in their severity while 2.3% (n=3) were severe. All the adverse drug reactions that occurred were predictable.

Table 13: Adverse effects of antimicrobials.

Type	Adverse effect	No. of patients
Mild (n=88)	Diarrhea	18
	Vomiting	29
	Allergic skin reaction/ Rashes	24
	Erythematous papules	8
	Dizziness	2
	Headache	2
	Abdominal pain	5
Moderate (n=38)	Thrombophlebitis	3
	Hepatitis	5
	Vomiting	8
	Erthematous papules	7
	Jaundice	4
	Diarrhea	8
	Anaphylactic reactions	2
	Thrombocytopenia	1
Severe (n=3)	Steven Johnson's syndrome	1
	Anaphylactic reactions	2

The causality assessment of ADRs reported found that 44.68% (n=63%) were possible, 38.30% (n=54) were probable and 18.44% (n=26) were conditional using three probability scales (WHO's probability scale and Naranjo scale) (Table 13).

Out of the 500 patients in the study, 367 (73.4%) patients received appropriate treatment based on indication of antimicrobial therapeutic use, 409 (81.8%) received appropriate treatment based on dosage of antimicrobial therapeutic use, 442 (88.4%) received appropriate treatment based on frequency of antimicrobial administration and 309 (61.8%) received appropriate treatment based on duration of antimicrobial administration (Table 14).

Table 14: Overall appropriateness of use of antimicrobials.

Category	No. of patients being given appropriate treatment (%)
Based on duration	367(73.4%)
Based on frequency of administration	409(81.8%)
Based on dosage of administration	442(88.4%)
Based on indication	309(61.8%)

Of the 500 (100%) patients reviewed, a total of 85(17%) interactions were identified. Of those 85 (100%) interactions identified, most of the interactions belonged to significance level 5 [44.71% (n=38)] followed by level 1 [25.88% (n=22)] and level 2 [17.65% (n=15)] (Table 15).

Table 15: The level of significance of antimicrobial interaction.

Category	No. of patients (%)
Significance Level 1	22 (25.88%)
Significance Level 2	15 (17.65%)
Significance Level 3	6 (7.06%)
Significance Level 4	4 (4.71%)
Significance Level 5	38 (44.71%)
Total	85 (100%)

DISCUSSION

Drug utilization evaluation (DUE) is an inexpensive, flexible and simple method to assess the utilization pattern of drugs. DUE has defined potential benefits both for patient and clinical practitioners in carrying out a well planned audit of prescribing drugs. Infectious diseases in children less than 15 years of age constitute a common clinical problem encountered in day to day practice.

Therefore, rational use of antimicrobials demands that an appropriate antimicrobial should be prescribed. This study was focused on the evaluation pattern of the antimicrobial use in pediatrics at Navodaya Medical College Hospital and Research Center.

Of the 500 patients reviewed, the incidence of use of antimicrobials was found to be 99.6%. The reason antimicrobials were prescribed to such a large extent is due to the large number of patients who presented to the hospital with infectious diseases. In the present study, majority of the patients presented with conditions like respiratory tract infections (RTI), malaria, typhoid, gastroenteritis (GE), measles etc.

The present study showed variations in the distribution of patients in different age groups. Most of the patients in the present study (41.6%) were in the age group of '6 months to 3 years', while least (7%) patients were in the aged group of 12-15 years. The major reason for the higher number of patients in the age group of '6 months to 3 years' was the higher incidence of co-morbidities seen in this group of patients. Younger children are more liable to develop infectious diseases as compared to the elder. Hence the younger age group constituted the majority of patients in this age group.

Of the 500 patients treated with antimicrobials, 59% (n=295) were males and 41% (n=205) were females. Majority of the patients admitted with infectious diseases belonged to rural area 62% (n=310) while patients from urban area constituted only 38% (n=190). This high number of cases admitted from rural areas was due to the fact that the prevalence of infectious diseases is high in the rural areas due to lack of sanitation and lack of awareness of people towards health.

The socio-economic status of the patients was classified according to modified Kuppuswamy scale into 5 groups.[11] In this study, greater majority of the patients belonged to 'lower' (46.2%) as well as 'lower middle class' (44.8%).

Out of the 500 patients in the study 190 (38%) were infected with either of 'Respiratory infections', while 10 (2%) were infected with 'cardiovascular infection', 45 (9%) were suffering from infections of the 'central nervous system', 33 (6.6%) were diagnosed with 'typhoid', 125 (22%) were diagnosed with 'Malaria', 103 (20.6%) were suffering from 'gastrointestinal infections', 3 (0.6%) were diagnosed with 'renal infections' while 9 (1.8%) patients were diagnosed with 'Protein Energy Malnutrition'(PEM) with no significant infection. As far as the nutritional status in the patients with infectious disease in this study is concerned, 92.8% (n=464) of the patients were malnourished according to 'Indian Academy of Pediatrics (IAP) Classification 1972'. 24.6% (n=123) were under nourished. 21.2% (n=106) of the children were of Grade-1 malnutrition. 19.4% (n=97) were Grade-2 malnutrition. 14.8% (n=74) were of Grade-3 malnutrition. 13.4% (n=67) were of Grade-4 malnutrition.

Out of the 500 patients in the study, Various patients were suffering from multiple symptoms, Fever was the most

dominating symptom affecting 342 patients, followed by cough 195 patients, vomiting affecting 115 patients, loose stools affecting 95 patients, convulsions affecting 35 patients, pain (abdominal/head ache) affecting 30 patients and yellowish discoloration affecting 15 patients.

Out of the 500 patients in the present study with infectious diseases, 158 (31.6%) had a 'past history of similar infections', while 342 (68.4%) has 'no past history of similar infections'.

Amongst the blood indices 'Raised ESR' was notable in most of the cases of infectious diseases while alternation in other blood indices such as 'Total WBC count', 'Neutrophile count' 'Lymphocyte count' were minimal. 'Monocytes' and 'Basophils' were not raised in any of the case of infectious diseases recruited in this study.

In the present study, Cephalosporins (n=243) were the most frequently prescribed class of antimicrobials followed by Penicillines (n=235), Aminoglycosides (n=229), Antimalarials (n=199), Anthelmintics (n=114) and many more.

Out of the 500 patients in the present study, most of the patients 460 (92%) received a combination of oral and parenteral therapy (parenteral antimicrobial therapy followed by oral therapy), 26 (5.2%) patients received only oral antimicrobial therapy and 14 (2.8%) patients received only parenteral antimicrobial therapy. This is irrespective of the other medicines (non antimicrobials) used concurrently as adjuvant or for symptomatic relief. Those patients who had severe infections were prescribed with 'parenteral therapy'. The patients were administered with 'parenteral therapy' for their severe conditions, as the patients condition improved, the 'parenteral route' was changed to 'oral'. Patients with less severe infections were started with 'oral therapy'. 'Oral therapy' was used because it was 'easy to administer', would cause 'minimum discomfort' to the patient, it would 'cost less' and ensure 'better compliance' to the treatment. Parenteral therapy was used alone when a particular antimicrobial prescribed against a particular disease was available only in the parenteral form or the age of the pediatric patient was such that exact calculation of the dose in oral form was unreliable. The selection of proper route of antimicrobial depends on severity of infection and bioavailability. The use of parenteral route was preferred for faster onset of action and for the management of severely disabled and non co-operative pediatric patients.

In the Present study, out of the 500 patients 30 (6%) patients stayed for 1-3 days, 180 (36%) patients stayed for 4-6 days, 188 patients (37.6%) stayed for 1-9 days and 102 (20.4%) stayed for more than nine days. Hence most of the inpatients in this study stayed for 7-9 days.

Out of the 500 patients in the study, 122 (24.4%) patients received single antimicrobial therapy, while 172 (34.4%) patients received a combination of two antimicrobials, 153 (30.6%) patients received a combination of three antimicrobial and 53 (10.6%) patients received a combination of more than three antimicrobials.

Out of 500 patients most of the patients 405 (81%) were discharged on advice after complete cure, while 68 (13.6%) were either discharged against medical advice or were found absconded without any information, 27 (5.4%) were referred to higher center.

Out of the 500 patients in the study, a total of 129 (25.8%) adverse drug reactions were reported during the study period.

Of these reported ADR's 68.2% (n=88) were mild and 29.5% (n=38) of the reactions were moderate in their severity, while 2.3% (n=3) were severe. All the adverse drug reactions that occurred were predictable.

The causality assessment of ADR's was done using standard Naranjo ADR probability scale.[12] As per the scales we found that 44.68% (n=63) were possible, 38.30% (n=54) were probable and 18.44% (n=26) were conditiona/doubtful ADR.

CONCLUSION

Antimicrobials prescribing among pediatric age group is common in this hospital set up. However, the use of antimicrobials as a definite therapy was low. Our study revealed, although not to a greater extent, inappropriate use of antimicrobials. There is a great need for the adoption of various strategies to prevent/minimize the inappropriate use of systemic antimicrobials in order to improve the quality use of medicines. As many number of significant interactions and ADR's were found, designing and implementation of mechanisms which constantly monitor the potential interactions and adverse drug events is needed.

There is a need for implementation of appropriate antimicrobial guidelines to promote the rational use of antimicrobials.

Various strategies need to be developed and implemented to minimize the drug interactions and adverse drug reactions associated with the use of antimicrobials in pediatrics.

REFERENCES

1. Powell JR, Cali TJ, Linkwich JA. Inadequately written prescription: As directed' Prescription Analysed. Journal of American Medical Association. JAMA. 1973; 226(8):999-1000.
2. Uppal R. Vijaya Rajendran. Drug Utilization Studies, PGI. Bulletin. 1996;20:1-5.
3. Mohan S, Dharamraj K, Dindial R, Mathur D, Parmasad V, Ramdhanie J, et al. Physician behaviour for antimicrobial prescribing for paediatric upper respiratory tract infections: a survey in general practice in Trinidad, West Indies. Annals of Clinical Microbiology and Antimicrobials. 2004 Dec;3(1):11.
4. Traub R, Wisseman CL. Bulletin of the World Health Organization, Ecological Considerations in Scrub Typhus 2. Vector Species. 1968;39(2):219-30.
5. Triparthi KD. Antimicrobial Drugs General Consideration. In: K.D Triparthi's, Essentials of Medical Pharmacology, Jaypee Brothers Medical Publications, 7th Ed.; 2013:688-689.
6. Gumbo T. Chemotherapy of Infectious Diseases. In: Laurence L. Brunton, Bruce A. Chabner, Bjorn C. Knollmann, Goodman and Gilman's, The Pharmacological Basis of Therapeutics; 13th Ed; McGraw Hill; 2010:955-968.
7. Krivoy N, El-Ahal WA, Bar-Lavie Y, Haddad S. Antibiotic prescription and cost patterns in a general intensive care unit. Pharmacy Practice. 2007;5(2):67-73.
8. Sathwik BS. Drug utilization Evaluation. In G. Parthasarathi, Karin Nyfort-Hansen, Milap C Nahata. A textbook of clinical pharmacy practice: Essential concepts and skills. 2nd Ed. Orient Blackswan Private Limited; 2012;362-375.
9. Misan GMH. The members of society of hospital pharmacists of Australia. SHPA standards of practice for drug usage evaluation in Australian hospitals. Australia. 1998;2:15.1-15.7.
10. Müller-Pebody B, Muscat M, Pelle B, Klein BM, Brandt CT, Monnet DL. Increase and change in pattern of hospital antimicrobial use, Denmark, 1997-2001. J Antimicr Chemother. 2004 Dec 1;54(6):1122-6.
11. Saleem SM. Modified Kuppuswamy scale updated for Year 2018, Paripex. Ind J Resear. March-2018;7(3):1.
12. Zaki SA. Adverse drug reaction and causality assessment scales. Lung India. Official Organ of Indian Chest Society. 2011;28(2):152-3.